Toward a USAF Arctic Strategy

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The United States Air Force is no newcomer to the Arctic. It has a long history of aerial operations in the High North from fighting the "thousand mile war" in the Aleutians during World War II to expanding its Arctic operations throughout the Cold War and beyond. Today, it maintains a significant presence with missions, bases, personnel, and aircraft in Alaska and at Thule Air Base, Greenland, 750 miles north of the Arctic Circle. It conducts an Arctic Survival School at Eielson AFB, AK, has maintained a radar early-warning system in the High North for over sixty years, and has flying units (Active, Guard, and Reserve) stationed at Eielson and Elmendorf Air Force Bases. The Air Force also operates satellites over the top of the world, launches them into polar orbit, and is responsible for overwatch of the region from space.[1]

During World War II the Army Air Corps used the experience of seasoned Arctic flyers to establish several air bases in Greenland as way stations for ferry flights to England and to conduct search and rescue missions for downed flyers in the Arctic. To thwart the German U- boat menace, it also performed sea surveillance missions in the North Atlantic from these same Greenland bases Seeing the necessity for a permanent base in the High North, Thule AB, Greenland was constructed in the 1950s in near secrecy; an engineering project that rivaled the construction of the Panama Canal in its size and complexity.During the Cold War, SAC bombers dispersed to remote runways in Greenland using "floating shelf" ice islands as part of a "live aboard" concept during times of nuclear tension.[2] By 1957 the "DEW Line" of more than 30 radar stations was manned from Point Barrow, Alaska to the east coast of Greenland to provide early-warning of Russian bomber and missile attacks.[3] The Air Force even had a specialized research organization, "The Arctic, Desert and Tropic Information Center," (ATDIC) at Maxwell AFB, AL from 1952 well into the 1960s, whose personnel conducted mukluks-on-the-ground Arctic research, contracted Arctic studies, and published their findings in in widely-read newsletters, monographs, and survival manuals.[4]

But despite its long Arctic history, the Air Force has no formal Arctic Strategy to date, although it has ample precedence to do so. Following publication of the White House's *National Strategy* for the Arctic in 2012, the Department of Defense (DOD) published its own Arctic Strategy in 2013. A Coast Guard Arctic Strategy was published that same year and the second iteration of the Navy's *Arctic Roadmap* was published in 2014. However, no complementary Air Force Arctic Strategy has ever emerged.

A Lack of "Air Mindedness"

Simply put, the application of airpower to any emergency in the High North provides the quickest response, but there appears to be no DOD-led planning to do so. DOD's Arctic Strategy lacks a sense of urgency and thus is a weak foundation from which to build a complementary Air Force one. For example, DOD views its role in the Arctic as "support-only;" part of a "whole of government" approach to the region. This reflects its general reluctance to engage in near- term Arctic planning, proposing instead "low cost, innovative" solutions (not further identified)to some Arctic issues and waiting on solutions to others until "operational requirements" are defined.5 This is not exactly "if we ignore it, it will go away," but more "we'll wait until we're asked." DOD further observes that future projections of Arctic activity may be inaccurate, cautions that there may be fiscal constraints to new Arctic support initiatives, and feels that Not surprisingly, its

two Objectives, "Ensure security, support safety and promote defense cooperation" and "Prepare for a wide range of challenges and contingencies," are very broad, almost to the point of ambiguity. Being "too aggressive" in addressing future security risks may create "conditions of mistrust."[6] Not surprisingly, its two Objectives, "Ensure security, support safety and promote defense cooperation" and "Prepare for a wide range of challenges and contingencies," are very broad, almost to the point of ambiguity.[7]

Air Force silence also may be the result of a lack any Air Force specificity (i.e. "air mindedness") in DOD's *Strategy* which would prompt USAF to create a "Strategy" of its own. Given the tyranny of time and distance in the Arctic, current lack of air-mindedness is not only wrong, but dangerous: the only way to quickly get to any crisis above the Arctic Circle is by air.

A June 2015 Government Accountability Office (GAO) report seemed to justify DOD's position of a supporting role in the Arctic and observes that "… since the Arctic is primarily a maritime domain, the Coast Guard plays a significant role in Arctic Policy implementation and enforcement."[8] GAO acknowledges the Navy's continuing role in support of other federal agencies and international partners, but it fails to identify a role for the Air Force or even mention the Air Force by name. Thus, an area (i.e. the High North) that is impassable for ships at least part of the year does not have an alternate solution when a maritime one is unworkable due to time, ice, distance, or all three.

This lack of air-mindedness also is reflected in the supporting Arctic strategies of both the Navy and the Coast Guard. The Navy's 2014-2030 *Arctic Roadmap* is rich with objectives, ideas, and goals for the High North, but they apparently aren't objectives, ideas, and goals for the Air Force. Instead, the Navy follows DOD's long lead-time strategy, using near-term (present to 2020), mid-term (2020 to 2030), and far-term (beyond 2030) descriptors, and echoing DOD's assessment that "… with the low potential for armed conflict in the region in the foreseeable future, the existing defense infrastructure (e.g., bases, ports, and airfields) is adequate to meet near-to-mid-term U.S. national security needs."[9] Post 2030, the Navy believes it will have the "…necessary training, and personnel" to respond to Arctic contingencies and emergencies.[10] After reading the Navy Roadmap, one observer pointed out that even in the out-years, the Navy plans to operate only in "open waters" and is not planning for any major fleet enhancements (e.g. double hulls, organic ice breakers, major shore infrastructure) based on a perceived lack of any substantive threat.[11]

Even though "aviation" and "space" are mentioned several times in the Navy's *Roadmap*, it doesn't acknowledge the need for Air Force support except for Intelligence, Surveillance, and Reconnaissance (ISR) "interoperability." Interestingly, several references to the Air Force and Air Force-related milestones in the *Roadmap*'s previous iteration (October, 2009) are absent in the new one. Does this mean that they have been satisfied or just ignored? Perhaps the answer lies in a precursor document to the latest Roadmap, the "Fleet Arctic Operations Game, September 13 -16, 2011" Game Report. It refers to Air Force assets at Elmendorf AFB as "sister service Air transport."[12] In its Arctic Strategy, the Coast Guard discusses aviation in general terms, focusing instead on its maritime needs (read: a glaring lack of icebreakers in sufficient numbers) in the High North. It should be noted that the Coast Guard has taken possession of previously Air Force-owned C-27 aircraft, but it is unclear if any of them will see duty in the Arctic when they enter Coast Guard service later in this decade. Aviation requirements in general - and those in partnership with the Air Force in particular - are missing from the Coast Guard's Arctic planning just as they are from the Navy's. Instead, a report prepared for the Coast Guard in 2010 laments the difficulties in basing aircraft in the High North, even in the summer season. ABS Consulting's "United States Coast Guard High Latitude Region Mission Analysis Capstone Summary" observed that "No suitable facilitates currently exist on the North Slope or near the Bering Strait" that are sufficient for extended aircraft servicing and maintenance. The Mission Analysis' "force mix evaluation" only includes surface vessels and helicopters. No fixed wing aircraft appear in the

accompanying table, but aircraft are mentioned in its "Concluding Remarks" almost as an afterthought.[13]

The overall effect of this benign neglect reduces Air Force motivation to plan for additional Arctic missions because there is no clearly stated need to do so by National Command Authority, DOD, or our sister Services. And there is one other possible reason for the lack of an Air Force Arctic Strategy: there is no war in the Arctic. Although the USAF has been at war for the last twenty-five years, it hasn't fired a shot in anger in the High North since the end of World War II. It still escorts Russian Tu-95 Bears away from Alaska and the US West Coast but in truth, that is a decades-old Cold War mission that continues today. The Air Force'swarfighting focus is elsewhere because, well, there's no war in the High North nor is one foreseen.

Figure 1. The Northwest Passage(s) and the Northern Sea Route. (Reprinted from "Arctic Ocean," in Central Intelligence Agency, The World Factbook, accessed 3 September 2013, https://www.cia.gov/library/publications/the-world-factbook/geos/xq.html .)

Some observers feel that territorial disputes will inevitably spill over into the Arctic and the region will become another arena of conflict. Strategically, to enter or exit the Northern Sea Route or the Northwest Passage from the Pacific side of the globe requires transit of the Bering Strait (itself subject to ice blockage in winter) which is a natural maritime chokepoint dividing US and Russia territory. This, some feel, will be a flash point in the future. To date, territorial issues have all been peacefully resolved and freedom of navigation has not been a vexingproblem. Transit of Russia's Northern Sea Route requires Russian icebreaker "escort" (and a fee)

and there is a lingering dispute between the US and Canada regarding the Northwest Passage status as an inland waterway vice an international transit route. Nevertheless, the specter of war in the High North – either ground combat or naval engagement – is low. Thus, the pressing issue is a response to a High North human or environmental crisis, not a shoot-out at the (frozen) OK Corral.

Crystal Serenity –Chrystal cruises

Beat Goes on in the High North

Meanwhile, the beat goes on. While Royal Dutch Shell has withdrawn its oil exploration plans in the Chukchi Sea, plans for drilling efforts in the region by others continue in hopes of tapping possibly the world's last large deposits. Fishing, "eco-tourism," and commercial tourism in the form of cruise ships of increasing size and frequency on both sides of the Northwest Passage grow each year, but this human activity does not come without risks to both persons and the environment. The consequences of one bad decision may require immediate response to mitigate loss of life and damage to a delicate ecosystem.

A major cruise ship plans a transit of the Northwest Passage in August 2016 and other commercial cruise lines and shipping concerns who wish to exploit the Northwest Passage are watching this event carefully.[14] While there have been a number of successful transits in this decade, waterways of the Northwest Passage are less than ice-free, navigational aids are sorely lacking, and nautical charts of the region are highly suspect. Experts point to poor navigational aids as a major contributor to Northwest Passage safety concerns, prompting a Wall Street Journal article to observe: "Overall, maps of Mars are about 250 times better than maps of theearth's ocean floor." Another report warns that at its current rate, completely charting Canadian Arctic waters will take three centuries.[15]

Figure 2. Arctic SAR agreement, areas of application. (Based on geographic coordinates in the annex to the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic, 12 May 2011, http://www.ifrc.org/docs/idrl/N813EN.pdf.

The United States one of the signatories to the Arctic Council's Nuuk Agreement on Search and Rescue, the "Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic," in which each of the parties will establish and maintain an "adequate and effective search and rescue capability" within its designated area (fig. 2). Further, the Nuuk Agreement binds member nations to coordinate its SAR efforts with other members in case of a plane crash, cruise ship sinking, oil spill, or other disaster across the High North.[16] This means that the United States is responsible for SAR operations in Alaska and a large swath of the approaches to the Bering Strait, but also must respond to any other emergency in the region; most notably, potential oil spills. The US area of responsibility includes the western approaches to the Northwest Passage; the eastern approaches to the Northern Sea Route paralleling Russia's Kamchatka Peninsula; and the Beaufort, Chukchi, and Arctic Seas extending to the North Pole.

A key point in the Nuuk Agreement is that any party may request the assistance of other party/parties if necessary, ensuring that "assistance be provided to any person in distress."[17] Given the current physical disposition of Canadian Search and Rescue forces - actually closer to the northern coast of South America than to Alert, Nunavut – it is highly likely that the United States will be asked to help her in any emergency as well. An article on Canadian Search and Rescue woes calculates flight time from Winnipeg to Resolute Bay in the heart of the Northwest Passage via a Canadian C- 130H at over five hours; helicopters to the same area from Comox would take more than 11.[18] In contrast, US Air Force bases in Alaska and at Thule AB, Greenland are much closer and would be a logical alternative in times of need. Sea distances to the heart of the Northwest Passage, also portrayed in the map below, give an idea of how long a surface response would take.

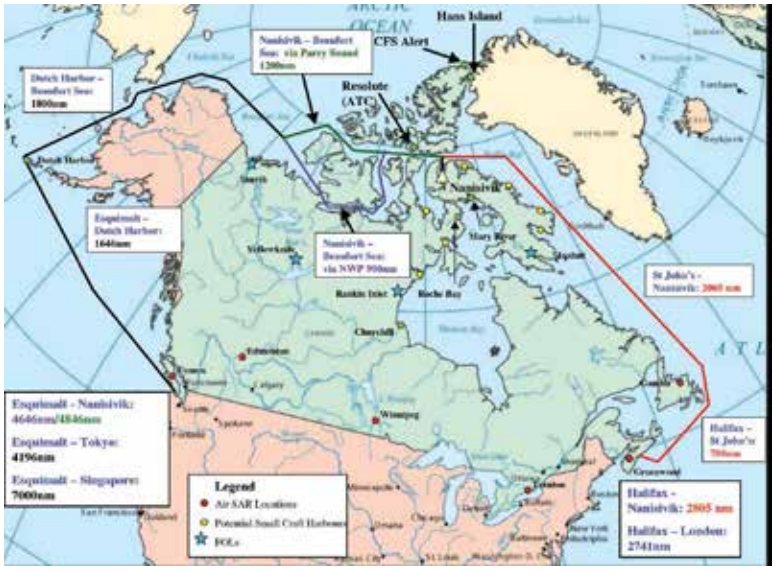

Figure 3. Operational Arctic patrol distances. (Reprinted from Michael Byers and Stewart Webb, Titanic Blunder: Arctic/Offshore Patrol Ships on Course for Disaster [Ottawa: Rideau Institute, Canadian Centre for Policy Alternatives, April 2013], 37, http://www.policyalternatives.ca/sites/default/files/uploads/publications/National%20 Office/2013/04/Titanic_Blunder.pdf.)

Who Ya Gonna Call?

The combination of increased maritime traffic in the High North and shrinking Arctic ice, combined with the unreliability of High North navigation charts, pose a near-term naval problem with only a long-term naval solution. Neither Navy nor the Coast Guard has the current capability to quickly reach any environmental disaster or respond to a Search and Rescue event above the Arctic Circle and neither will have such assets for the foreseeable future, if (in the Navy's case) ever.

According to the prevailing US Strategies, the United States Coast Guard is the logical service of choice for any rescue in the Arctic. But even though it has several bases in Alaska, all are located below the Arctic Circle. Coast Guard aircraft are permanently based in Kodiak, about 800 miles south of Point Barrow but they must transit the 9,000-feet-high Brooks Range just to get to the North Slope. Dutch Harbor in the Aleutian Islands, the northernmost major deep water port in Alaska, is well over 1200 nautical miles south of Point Barrow, the most northern point in the United States. The Coast Guard has announced that it had no plans to build any additional shoreside infrastructure in the coming decade, so its force structure is essentially static for the next ten years.[19]

What hampers DOD's Arctic Strategy (and that of the Coast Guard and the Navy) and deters the Air Force is not lack of manpower, equipment, or facilities, but a lack of imagination and inclusion. Current DOD strategy resides solely in the maritime domain: the slowest, the most expensive ($1B and ten years construction time per icebreaker), and the least flexible method of response to any High North situation.[20] The domains of air, space, and cyberspace are faster and more agile. These three are primarily, but not exclusively, Air Force domains and, ignoring them limits DOD's Arctic options to a single choice. It's time to supplement Arctic DOD's propo-

sed "low cost, innovative" programs, with the Air Force's "virtually no additional cost, already in-place programs."

There is sufficient force structure, manpower, and more than enough Air Force and civilian facilities (e.g. airfields) throughout the state of Alaska (not to mention Thule AB, Greenland) to respond to any crisis in the High North: be it SAR, environmental disaster, aggression or support to our Canadian ally to meet any or all three.[21]

Toward an Air Force Arctic Strategy – What Should It Contain?

An Air Force Arctic Strategy should raise awareness (i.e. "air mindedness") of the in- place Air Force assets in the Arctic and provide innovative ways to partner them with Sister Services and other High North nations. It should reference DOD's Arctic Strategy, the National *Strategy for the Arctic Region,* and the overarching Presidential Directives that set its framework.

In its Preface, it should acknowledge that combating Climate Change is a whole-of- government challenge and publicize specific Air Force initiatives to cut carbon emissions and to find innovative solutions to the other climate issues. Further, its Preface should succinctly comment on emerging events in the region, including climate change, loss of sea ice, the potential for increased commerce in the High North, conflicting claims for the Arctic seabed, and the growing militarization of the region by Russia. In doing so it should convey the message that important events in the High North will not pause until some future date when icebreakers and deep water ports may be available; they are happening now. Although the Navy and the Coast Guard have ignored in-place Air Force assets in their High North planning, USAF capabilities–in air, space and cyberspace – are the *sine qua* non for success. Bidden or unbidden, the point must be made that the Air Force must be a part of the solution.

Its body should complement and expand DOD's Arctic guidance, focusing on its two Supporting Objectives: "Ensure security, support safety and promote defense cooperation" and "Prepare for a wide range of challenges and contingencies." It also should support Sister Service Arctic *Strategies and Roadmaps* by finding lanes in their works that align with Air Force capabilities. SAR, Command and Control, UAVs, airlift, and airspace sovereignty come quickly to mind. Thus, the overarching goals of an Air Force Arctic Strategy should be to highlight USAF Arctic current capabilities, suggest ways to interface with Sister Service Strategies and Roadmaps, and present future needs to USNORTHCOM, the advocate for the High North.

Having NORTHCOM as an advocate is a definite plus, but the Air Force must ensure that NORTHCOM acknowledges USAF capabilities and includes them in its Arctic planning and advocacy.

Part of DOD's first objective, "… promote defense cooperation," should be embraced by the Air Force. We should expand military-to-military contacts with other High North nations, especially members of the Arctic Council) to create an interchange of tactics, techniques, and procedures to assure safe and effective flight operations. Joint exercises, officer exchanges, and a flow of information and ideas will have a synergistic effect for all parties. Note: although a member of Arctic Council, Iceland has no military forces. Further, the Strategy should task the Air Force to survey possible Forward Operating Bases near above the Arctic Circle using previous WWII, Cold War DEW Line locations, and existing commercial airfields as points of reference. For example, Wiley Post/Will Rogers Memorial Airport services Point Barrow, the northernmost point of all US territory. Its asphalt runway is 7100 X 150 feet. To the west are three more airfields with runways of 5000 feet or more: the aptly-named Lonely Air Station, a military airfield supporting the Point Lonely Short Range Radar Site with a 5000 foot gravel runway; a private airfield, Ugnu Kuparuk, with a 6551 foot asphalt runway; and Deadhorse Airport, with 6500 feet of asphalt runway. Last November, C-17s delivered elements of an Army Stryker Brigade Combat Team to Deadhorse as part of Operation Arctic Pegasus. On the Chukchi Sea is Ralph Wein Memorial Airport, south of Kotzebue, featuring a 6300 foot asphalt runway, hangers, and commercial service.[22]

Additionally, use of compacted snow and gravel runways – already proven to be viable landing surfaces under the right conditions – will widen the choices of airfields throughout the region. Despite the Coast Guard's continued assertion that there are no suitable airfields north of the Arctic Circle, these-and several others-should be considered as contingency airfields for any rescue operation or oil spill event in the Northwest Passage. Further, existing hangers and shops in these locations should be reviewed for use in emergencies. Projected use would be during the summer season and in the "shoulder" months in late spring and early fall (see Navy's Arctic *Roadmap*, page 11, for a good explanation of "shoulders"), as these are times when most human activity will occur.)[23]

The Air National Guard has led the way by partnering its ski-equipped LC-130s of the New York Air National Guard's 109 AW with the Canadian Forces in its annual exercise "Operation Nunalivut."[24] Active Air Force units should follow suit to partner with all the nations of the High North in joint/multilateral exercises. Particular emphasis should be on austere airfield operations, interoperability of airframes and communications, logistics, and Search and Rescue techniques. These partnerships would solidify future roles for the military in the Arctic under the 2011 Nuuk Agreement (SAR) and the 2013 Kiruna Declaration (oil spill response), which requires all Arctic Council nations to respond to requests for aid. The National Guard should add State to State Partnership programs with these same nations to build on its successful Arctic exercises with Canada. Although there are 70 partnerships around the world, no partnerships with High North nations exist. Vigorous pursuit of such partnerships will open up training and support opportunities in the High North for a variety of ANG units and weapon systems and foster the concept of "air-mindedness" as well.

The Second DOD Objective, "Prepare for a wide range of challenges and contingencies," can be met with the same military forces and innovative use of facilities outlined above, much in the way Defense Support to Civil Authorities is used to combat natural disasters in the lower 48 states. In addition, other congruent Air Force missions that should be expanded in the Arctic include the management and oversight of weather, of surveillance platforms, and an upgrade communications capabilities. In a region with rapidly changing, often unpredictable, weather conditions and notoriously uncertain navigational aids, the Air Force must to provide a constellation of overhead capabilities through a strong space launch program. It also must improve its weather forecasting capabilities in the region by engaging WC-130 assets during the non-hurricane season for proactive weather research in the Arctic. Uneven communications in the Arctic, particularly above the Arctic Circle, make access to secure communications difficult, and interruption of critical communication nodes could be fatal to both operations and personnel in the Arctic's harsh, unforgiving environment. Because the Air Force is a leader in cyber operations, it must be a part of any Arctic cyber assurance strategy and should partner with DOD, Agency, and other government entities to make this happen. The Strategy should consider embedding Cyber Protect Teams (CPT) within the Alaskan Command's 11th Air Force as well At the macro level, Air Education and Training Command (AETC) should pursue initiatives in both training and education to further Arctic Air-Mindedness in the Air Force and throughout DOD. It should increase its class sizes and through-put at its Arctic Survival School (Detachment 1, 66th Training Squadron) at Eielson AFB, AK, ensuring a cadre of trained and competent Air Force personnel for all Arctic missions. As a minimum, this should include all aircrew members assigned to Arctic bases and all personnel whose duties could place them in cold-weather survival situations. In the long term, it should seek additional funding and instructors from across DOD (and the Coast Guard) to transform it into a Joint Service school.

AETC also should reinstitute the study of the Air Force in the Arctic at its academic roots: Air University (AU), utilizing the research capabilities of the entire University to explore pertinent Arctic issues and to offer courses at Air Command and Staff College and Air War College to encourage Air Force thinking concerning strategic and operational issues in the High North. Course development for Arctic-specific issues (Arctic "air-mindedness") could reside in a new Arctic Studies Group at AU, similar to those recently established at the Naval War College and the US Coast Guard Academy.[25]

Final Thoughts

To operate in the High North without an Air Force Arctic Strategy and to remain silent on issues in the Arctic that are clearly within the Air Force's purview is to allow other Services to dictate our roles and missions there. The Air Force must pursue an Arctic Strategy of its own and do it sooner rather than later. The result of further inaction will be a loss of visibility for the Air Force, an abdication of its mission in the High North, and a diminished capability for this nation in the last frontier on Earth. ❑

"If you don't know where you are going, you'll end up someplace else."

Lawrence P. Berra (1925 - 2015)

Notes

1. It also is the DOD Executive Agent for the Antarctic (via the Secretary of the Air Force Deputy for Manpower and Reserve Affairs - SAF/MR), and conducts yearly deployments to the continent with ski- equipped New York Air National Guard LC-130s. Air Force Reserve Command. "Annual Operation Deep Freeze to commence Sept. 29." http://www.afrc.af.mil/News/ArticleDisplay/tabid/136/Article/620323/annual-operation-deep-freeze- to-commence-sept-28.aspx.

2. Louis Degoes & James T. Neal. "Selected military geology projects in the Arctic, 1950-1970" in J.R. Underwood, Jr. & Peter L. Guth, eds. "Military Geology in War and Peace." Boulder, Colorado. Geological Society of North America. 1998. 205, 208 – 209.

3. Degoes & Neal. "Selected military geology projects." 205.

4. "History of the Research Studies Institute, 1 April through 30 June, 1952. Arctic, Desert, Tropic Information Center." Maxwell AFB, Al. pp. 11-15The following winter, ADTIC personnel spent 90 days in Greenland participating in Project Mint Julip, a study of smooth ice to determine if it were feasible to establish a scientific project on the ice and maintain it solely by air. "History of the Research Studies Institute, 1 January - 30 June, 1953. Arctic, Desert, Tropic Information Center." Maxwell AFB, Al. 14.

5. Department of Defense Arctic Strategy. Department of Defense, Washington, D. C. November, 2013. The Strategy acknowledges that it is "nested" under a number of documents relating to the Arctic and "complements" DOD's Strategy for Homeland Defense and Defense Support of Civil Authorities. 2. Footnote 3. http://www.defense.gov/pubs/2013_Arctic_Strategy.pdf.

6. DOD Arctic Strategy. 12 - 13.

7. DOD Arctic Strategy. 5-7.

8. "Arctic Planning: DOD Expects to play a Supporting role to Other Federal Agencies and Has Efforts Underway to Address Capability Needs and Update Plans." United States Government Accountability Office Report to Congressional Committees. June 15, 2015. GAO-15-566, 10. www.gao.gov/assets/680/670903.pdf. GAO-15-566.15.

9. U.S. Navy Arctic Roadmap 2014 – 2030. Navy Task Force Climate Change. February, 2014. 11-12. www.navy.mil/docs/USN_arctic_roadmap.pdf.

10. Navy Arctic Roadmap 2014-2030. 18.

11. Andreas Kuersten, "Assessing The U.S. Navy's Arctic Roadmap." Center for International Maritime Security. June 21, 2015. http://cimsec.org/assessing-the-u-s-navys-arctic-roadmap/17117.

12. U.S. Naval War College. "Game Report, Fleet Arctic Operations Game, September 13 – 16, 2011." 37. https://www.usnwc.edu/getattachment/Research—Gaming/War-Gaming/Documents/Publications/Game- Reports/FAOG_Game-Report_09-2011.pdf.

13. "Coast Guard Commandant "delighted" to get AF C-27s." Claudette Roulo. American Forces Press Service. April 10, 2014. http://www.military.com/daily-news/2014/04/10/coast-guard-commandant-delighted-to-get-af-c- 27s.html?comp=7000023468292&rank=1.

14. Tim Ellis, KUAC, TV -9. "Test of Readiness: Cruise Ship to Transit Northwest Passage Opened by Sea-ice Retreat." October 23, 2015. http://fm.kuac.org/post/test-readiness-cruise-ship-transit-northwest-passage-opened-sea-ice- retreat.

15. "U.S. Draws Map of Rich Arctic Floor ahead of Big Melt," Wall Street Journal, 31 August 2007, http://online.wsj.com/article/SB118848493718613526.html#articleTabs%3Darticle

An article in 2012 points out that only about 10 percent of Canadian Arctic waters are charted "to a modern standard." See K. Joseph Spears and Michael K. P. Dorey, "Arctic Cruise Ships: The Pressing Need for Search and Rescue," Canadian Sailings, 17 October 2012, http://www.canadiansailings.ca/?p=4830$print=1

16.The Ilulissat Declaration, Arctic Ocean Conference, Ilulissat, Greenland, 27–29 May 2008, 2, http://www.oceanlaw.org/downloads/arctic/Ilulissat_Declaration.pdf ; and the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic [Nuuk Agreement], 12 May 2011, preamble and art. 3, par. 3, http://www.ifrc.org/docs/idrl/N813EN.pdf.

In drawing the boundaries of those areas, the Declaration was careful not to assert that those boundaries won't be used as precedents for an unresolved boundary disputes (art. 3, par. 2).

17. Arctic Council, Ibid., part. 7, pars. 3 (d) and (e). The Nuuk Agreement also details each nation's "Competent Authority" (appendix 1), SAR agencies (appendix 2), and rescue coordination center (RCC) locations (appendix 3).

18. "The Arctic Is a Long Way from Canada's Search and Rescue Techs," Nunatsiaq Online, 3 November 2010, http://www.nunatsiaqonline.ca/stories/article/556011_the_arctic_is_a_long_way_from_canadas_search_and_res cue_techs/. The original article indicated that Trenton, Ontario, was closer to Quito, Ecuador, than to Nuavut, but that distance was calculated via "flat-earth" Mercator maps. Plots using Google Earth extend the distance to a line just below Panama, bisecting Venezuela and through the northern part of Colombia.

19. David Perera, "Papp: Coast Guard Plans No Arctic Shoreside Infrastructure," Fierce Homeland Security, 22 May 2013, http://www.fiercehomelandsecurity.com/story/papp-coast-guard-plans-no-arctic-shoreside-infrastructure/2013-05-22.

20. Ronald O'Rourke, Coast Guard Polar Icebreaker Modernization: Background and Issues for Congress, CRS Report for Congress RL 34391 (Washington, DC: Congressional Research Service, 24 July 2013), "Summary," http://www.fas.org/sgp/crs/weapons/RL34391.pdf.

21. Two Air Force bases sit well above 60 degrees, well positioned for launch and recovery of any SAR effort: Eielson AFB at 64°39'56" N and Thule Air Base (with its 10,000-feet runway), 750 miles north of the Arctic Circle at 74°31'52" N. South of Eielson is JBER with another 10,000-feet runway as well as the 11th RCC. At the outer edge of the Aleutian Island chain sits Eareckson Air Force Station (formerly Shemya AFB), a contractor-maintained alternate / emergency landing field / refueling location and the site of an Air Force "Cobra Dane" radar installation. Eareckson's 10,000-feet runway and several hangars constitute a far-western basing resource for any SAR operation. The number and variety of Air Force aircraft available at Eielson and JBER would greatly expand SAR response options. Eielson is home to the 354th Fighter Wing (F-16s) and the Alaska Air National Guard's 168th Air Refueling Wing. JBER hosts the Air National Guard's 176th Wing (C-17s and C-130s as well as HC-130 and HH-60GSAR aircraft). It also hosts the Air Force's 3rd Wing, with C-17s, C-12s, the E-3 Airborne Warning and Control System aircraft, a number of fighters, and two air and space operations centers.

22. All Airfield descriptions noted above can be found at https://www.airnav.com. Last November, C-17s delivered elements of an Army Stryker Brigade Combat Team to Deadhorse as part of Operation Arctic Pegasus. "In June of this year, the U.S. Coast Guard announced the stationing of two MH-60 Jayhawk helicopters at an Alaska Army National Guard facility in Kotzebue. These will remain on station to support Arctic Shield exercises this summer. While these will provide increased coverage of the northern approaches to the Bering Strait, they are well below the approaches to the Northwest Passage. U.S. Coast Guard 17th Naval District Photo Release, 24 June, 2016. "Coast Guard, Alaska Army National Guard hold roll-in ceremony for Air Facility om Kotzebue, Alaska." Accessed at C:\Users\1109422955C\Documents\Photo Release Coast Guard, Alaska Army National Guard hold roll-in ceremony for Air Facility in Kotzebue, Alaska.htm."

23. Navy Arctic Roadmap 2014-2030. 11. The Bering Strait, according to Navy projections, will be ice-free for 23 weeks by 2020.

24. TSgt Catherine Schmidt. "109 AW aids Canada with Operation Nunalivut 2015." http://www.109aw.ang.af.mil/news/story.asp?id=123447974.

25. U S Navy War College. "Arctic Studies Group." https://www.usnwc.edu/Research—Gaming/Arctic-Studies- Group.aspx.

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