

United States Coast Guard High Latitude Region Mission Analysis Capstone Summary

Prepared for the United States Coast Guard

July 2010

ABS Consulting

AN ABS GROUP COMPANY

1525 Wilson Blvd., Suite 625
Arlington, VA 22209



Notice

This report includes pre-decisional data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed—in whole or in part—for any purpose other than to evaluate this mission analysis. This restriction does not limit the Government's right to use information contained in these data if they are obtained from another source without restriction.

Table of Contents

Introduction.....	1
Summary.....	2
Background.....	3
Role of the Coast Guard	3
Polar Regions Issues and Trends	6
Economic	6
Political	6
Environmental.....	7
Mission Analysis Tools.....	8
Functional Requirements and Capabilities Analysis	9
Gaps in Arctic Mission Performance.....	10
Gaps in Antarctic Mission Performance.....	11
Solutions	12
Polar Icebreaking Needs	12
Aircraft and Forward Operating Locations.....	13
Concluding Remarks	15

Introduction

Arctic affairs now have an unprecedented degree of attention from the nations that surround the Arctic Basin as well as from non-Arctic countries such as China, Japan, and Korea. While the rate of increase in human activity (e.g., transportation, resource exploitation, and tourism) and the needs of indigenous peoples can be debated, it is evident that activity will increase and new challenges will arise.

At the opposite pole, the ice-covered continent of Antarctica and the vast Southern Ocean surrounding it are far from the United States geographically, and have attracted very little public attention over the last half-century. The U.S. Government, however, has led efforts to establish agreements for common use and governance and to maintain its role and interests through active, yet peaceful means. The United States played a leading role in creating the Antarctic Treaty System, has maintained the most robust national program of scientific investigation and supporting logistics in the area, and has articulated, through policy directives and budget funding, a continuing high-level of national involvement in Antarctic affairs.

Polar region changes are affecting the U.S. government's posture in the Arctic region, but pose more subtle issues in the Antarctic, where the U.S. seeks to maintain its active and influential presence. The Coast Guard's capabilities and capacity to execute missions in the polar regions is a primary tool for the U.S. government to advance national interest objectives in the regions. To address the Coast Guard's present and future ability to conduct its missions in the Arctic and Antarctic regions, referred to as

the high latitude regions, the Coast Guard commissioned an independent series of studies. This paper provides a synopsis of the three-volume body of literature that consists of the following mission analysis reports:

- Volume 1 – Polar Icebreaking Needs
- Volume 2 – Arctic Mission Area Needs
- Volume 3 – Antarctic Mission Area Needs

These analyses are intended to inform key decision makers evaluating upcoming acquisition and sustainment decisions for the Coast Guard's fleet of icebreaking vessels and associated aircraft, communications and forward operating locations. The Coast Guard follows Department of Homeland Security acquisition management policy and the guidelines of the Major Systems Acquisition Manual for planning material and non-material acquisitions. The first step in the process is the mission analysis that establishes which requirements (laws, orders, and agreements) the Coast Guard must respond to, whether it has adequate resources, and, in the event that resource gaps exist, what combinations of material and non-material solutions will meet the requirements to close those gaps. The three-volume high latitude mission analysis series identifies the Coast Guard's responsibilities in the polar regions, discusses the nature of the activities it must perform over the next 30 years, and concludes with a high-level summary of the Coast Guard's material and non-material needs to meet the requirements.

Summary

The mission analysis of the Arctic region concludes that future capability and capacity gaps will significantly impact four mission areas: Defense Readiness; Ice Operations; Marine Environmental Protection; and Ports, Waterways, and Coastal Security. These mission areas address the protection of important national interests in a geographic area where other nations are actively pursuing their own national goals. U.S. national policy and laws define the requirements to assert the nation's jurisdiction over its territory and interests; to ensure the security of its people and critical infrastructure; to participate fully in the collection of scientific knowledge; to support commercial enterprises with public utility; and to ensure that the Arctic environment is not degraded by increased human activity.

The common and dominant contributor to these significant mission impacts is the gap in polar icebreaking capability. Age and the increasing maintenance demands of the Coast Guard's icebreaker fleet will further extend mission performance gaps in the coming years. POLAR SEA is inoperative until 2011 and will reach the end of its service life in 2014. POLAR STAR commenced a major refit in May 2010 and is expected to return to service in late 2013 with a 6- to 7-year remaining service life. The Coast Guard's only medium icebreaker, HEALY, will remain in-service until 2030.

The mission analysis of the Antarctic region concludes that existing capability and capacity gaps are expected to significantly impact Coast Guard performance in Defense Readiness and Ice Operations. Future gaps may involve an inability to carry out probable and easily-projected mission requirements, such as the McMurdo resupply, and readiness to respond to less-predictable events. By their nature, contingencies requiring the use of military capabilities often occur quickly. As is the case in the Arctic, the deterioration of the Coast Guard's icebreaker fleet is the primary driver for this significant mission impact. The recently issued Naval Operations Concept 2010 establishes requirements

for continuous icebreaker presence in both regions, which further exacerbates the capability gap left by the deterioration of the icebreaker fleet.

Other factors contributing to the impact on the Coast Guard's ability to carry out its missions include gaps in communications system capability, limited forward operating locations, and gaps in environmental response and mitigation capability in ice-covered waters.

Operations research modeling considering the demand for polar icebreakers concludes:

- **The Coast Guard requires three heavy and three medium icebreakers to fulfill its statutory missions.**
- **The Coast Guard requires six heavy and four medium icebreakers to fulfill its statutory missions *and* maintain the continuous presence requirements of the Naval Operations Concept.**
- **Applying non-material alternatives for crewing and homeporting reduces the overall requirement to four heavy and two medium icebreakers.**

As part of the mission analyses, risk analysis examined a set of theoretical mixes (force packages) of Coast Guard assets consisting of icebreakers, their embarked helicopters, and deployment alternatives using aviation forward operating locations in Arctic Alaska. The analysis considered force packages that the Coast Guard could use in response to incidents that may occur in the future Arctic environment and compares the performance of potential force packages applied to the region that is not currently being serviced by the Coast Guard's Bering Sea presence. Recapitalizing the aging icebreaker fleet would provide a foundation for build-out of an appropriate Arctic force package through investments in communications systems, forward operating locations and medium range helicopters.

Background

Both polar regions are important to the United States. The U.S. is one of five nations whose waters include the Arctic Ocean, and one of eight nations that has territory and citizens in the Arctic. The U.S. holds obligations to the citizens of Alaska as well as a range of international responsibilities, treaty obligations, and policy interests there. In Antarctica, the U.S. has contributed more than a half-century of international leadership to preserve the area from political conflict and environmental damage. Longstanding U.S. policy is articulated in a variety of official instruments.

Arctic. National Security Presidential Directive 66/Homeland Security Presidential Directive 25 (NSPD 66/HSPD 25) of 2009 articulates U.S. interests and policy in the Arctic. The six elements of the policy provide context for Coast Guard mission performance:

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

Antarctic. Presidential Decision Directive 26 (PDD 26) articulates national policy objectives in the Antarctic and was reaffirmed as the current source of presidential Antarctic policy by NSPD 66. The objectives of U.S. policy toward the Antarctic are:

1. Protecting the relatively unspoiled environment of Antarctica and its associated ecosystems.
2. Preserving and pursuing unique opportunities for scientific research to understand Antarctica and its global physical and environmental systems.
3. Maintaining Antarctica as an area of international cooperation reserved exclusively for peaceful purposes.
4. Ensure the conservation and sustainable management of the living resources in the oceans surrounding Antarctica.

These national policies ultimately establish authorities and mandates for the conduct of Coast Guard missions in the high latitude regions. National policy is implemented through U.S. law, international treaties, and agreements and policies of the federal departments and agencies, including:

- United States Code - the general and permanent laws of the United States, divided by subject into 50 titles.
- International Agreements such as the conventions facilitated by the International Maritime Organization (IMO), whose main purpose is to develop and maintain a comprehensive regulatory framework for shipping.
- Presidential Orders and United States National Policy - Orders of varying types under powers granted to the executive branch.
- Federal departmental agreements and strategies - Agreements with, for example, the Department of Defense (DoD) agencies to implement national defense and security strategies.

ROLE OF THE COAST GUARD

The U.S. Coast Guard is a military, multi-mission, maritime service within the Department of Homeland Security and is one of the nation's five armed services. Its core roles are to protect the public, the environment, and U.S. economic

and security interests in any maritime region in which those interests may be at risk, including international waters and America's coasts, ports, and inland waterways.

The Coast Guard is assigned a wide range of responsibilities that apply to the high latitude regions through legislation and executive orders, or are transferred to the Coast Guard by agreements with other agencies. Notably:

- The Coast Guard shall develop, and operate, with regard to the requirements of national defense, aids to maritime navigation, ice-breaking facilities, and rescue facilities, and shall maintain a state of readiness to function as a specialized service in the Navy in time of war (14 USC 2).
- [The Secretary] shall prescribe and enforce rules and regulations for maintenance, and operation of lights and other signals on fixed and floating structures to protect marine navigation (14 USC 85).
- [Congress finds that] the United States has important security, economic, and environmental interests in developing and maintaining a fleet of icebreaking vessels capable of operating effectively in the heavy ice regions of the Arctic (15 U.S.C. 4101) and Antarctic (16 USC 2431(d)(6)).
- [The Secretary] shall develop capabilities to protect borders, preserve the global mobility of U.S. vessels and project a sovereign U.S. maritime presence in the Arctic in support of U.S. interests (NSPD 66/HSPD 25).
- The Coast Guard shall provide assistance, equipment, and other resources when required by a Federal On-Scene Coordinator, and maintain all Coast Guard response equipment (33 USC).
- The Coast Guard shall issue safety and manning regulations for vessels, rigs, and platforms (43 USC 1356, 46 USC 3306).
- The Coast Guard shall provide the logistic support requested by the NSF to allow the U.S. Antarctic Program to maintain an active and influential presence in Antarctica (Presidential Memorandum 6646, 1982).

- The Coast Guard will maintain and operate all U.S. icebreakers, participate in peacetime operations in polar regions for environmental and readiness training, and provide mobilization capability to support military operations in high latitudes (Department of Navy and Department of Treasury Agreement on the Operation of Icebreakers, 1965).
- [The Secretary] shall enforce terms of the Antarctic Conservation Act of 1978 regarding disposal of prohibited waste, harmful interference with native birds, mammals or plants (16 USC 2401-2413).

Table 1 lists representative authorities and mandates that establish Coast Guard high latitude mission requirements in the.

In addition to the authorities and mandates that establish statutory mission requirements, the following studies and naval strategy further define and establish requirements:

Polar Icebreaker Requirements Study (PIRS), 1984 - A study directed by the Office of Management and Budget to assess the nation's needs for polar icebreakers. The study concluded: "An icebreaker fleet is essential to the national interest" and "should be operated by the Coast Guard."

Polar Icebreaker Requirements Report to the President, 1990 - Required by the Coast Guard Authorization Act of 1988 (Public Law 100-448). It updates the 1984 PIRS and identifies peacetime and wartime requirements for icebreakers, and introduced consideration of operational reach and flexibility.

Polar Icebreakers in a Changing World: An Assessment of U.S. Needs, 2007 - Conducted by the National Research Council of the National Academies, this report concluded that national interests in the polar regions require the U.S. to begin immediately to design and construct two new polar icebreakers to be operated by the Coast Guard.

Naval Operations Concept, 2010 - Describes when, where and how U.S. naval forces [including Coast Guard icebreakers] will contribute to enhancing security, preventing conflict and prevailing in war.

Table 1 Authorities and Mandates for the High Latitude Regions

U.S. Code

- Title 6 – Domestic Security
- Title 14 – Coast Guard
- Title 15 – Commerce and Trade
- Title 16 – Conservation
- Title 33 – Navigation and Navigable Waterways
- Title 46 – Shipping

Statutes

- Homeland Security Act of 2002
- Arctic Research and Policy Act of 1984
- Ports and Waterways Safety Act of 1972
- Federal Water Pollution Control Act of 1972 (as amended)
- Magnuson-Stevens Fishery Conservation and Management Act of 1976 (as amended)
- Port and Tanker Safety Act of 1978
- Antarctic Conservation Act of 1978
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980
- Act to Prevent Pollution from Ships of 1980
- Oil Pollution Act (OPA) of 1990
- Antarctica Science, Tourism, and Conservation Act of 1996
- Maritime Transportation Security Act of 2002
- Maritime Pollution Prevention Act of 2008

Treaties and Conventions

- Convention on International Civil Aviation, 1947
- Antarctic Treaty, 1959
- Convention of the High Seas, 1958
- International Convention on the Prevention of Pollution from Ships, 1973 (modified in 1978)
- Convention on the Safety of Life at Sea (SOLAS), 1974
- International Convention on Maritime Search and Rescue, 1979
- Convention on the Conservation of Antarctic Living Marine Resources, 1980
- Protocol on Environmental Protection to the Antarctic Treaty, 1991

Presidential Directives

- PDD 26 – Antarctic Policy
- PDD 36 – U.S. Policy on Protecting the Ocean Environment
- National Security Decision Memorandum (NSDM) 71 – U.S. Antarctic Policy and Program
- NSDM 318 – U.S. Policy for Antarctica
- Presidential Memorandum 6646 – U.S. Antarctic Policy and Programs
- NSPD 41/HSPD 13 – Maritime Security Policy
- NSPD 66/HSPD 25 – Arctic Region Policy

Interagency Agreements

- MOA between the Department of the Navy and the Department of the Treasury on the Operation of Icebreakers, 1965
- MOA between the Department of Defense and the Department of Homeland Security on the Use of U.S. Coast Guard Capabilities and Resources in Support of the U.S. Military Strategy, 2008, with a 2010 update to Annex E of the 2008 MOA

POLAR REGIONS ISSUES AND TRENDS

The distances associated with carrying out the Coast Guard missions in the high latitude regions impact the Coast Guard's ability to provide the same level of service that it currently provides in other U.S. territorial waters. Figure 1 illustrates key locations and distances that must be considered in performing high latitude Coast Guard missions.

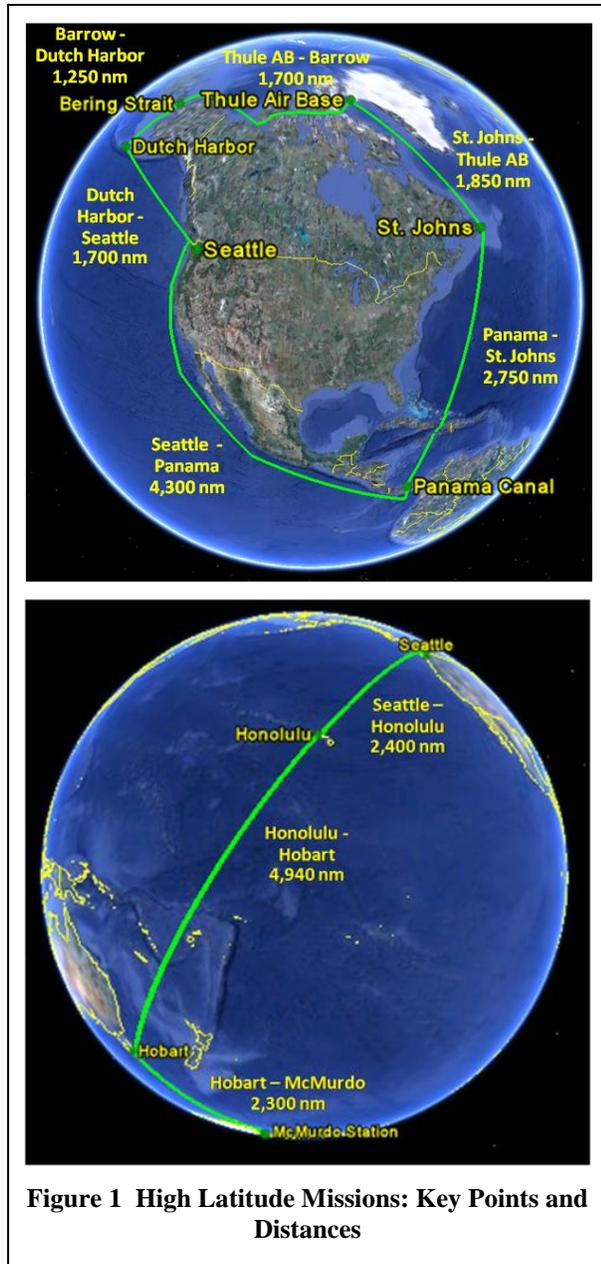


Figure 1 High Latitude Missions: Key Points and Distances

Economic

Arctic. The level of commercial activity in the Arctic region influences the demand for Coast Guard regulatory and support services. The major drivers for future activity in the Arctic are oil and gas exploration and recovery, and the potential for new shipping routes between the Atlantic and Pacific Oceans and within the Arctic Basin.

Antarctic. Commercial activity in Antarctica has been limited to tourism and fishing in the Southern Ocean. Various mineral and petroleum resources have been located in Antarctica; however, commercial exploitation is currently prohibited by international treaties.

Political

Arctic. The United Nations Convention on the Law of the Sea (UNCLOS), an international agreement establishing rules for use of the world's oceans and their resources, provides a fundamental international framework for the Arctic, especially with respect to national rights to the seabed and ocean. While the U.S. is a signatory of UNCLOS, it has not ratified the agreement but generally abides by its provisions. Five nations claim parts of the Arctic Ocean as their territorial seas and exclusive economic zones. The United States, Canada, Denmark (Greenland), Norway, and the Russian Federation all border the Arctic Ocean, and more than one-third of the Russian Federation is north of the Arctic Circle. Sweden, Finland, and Iceland also have territory above the Arctic Circle. These eight nations comprise the Arctic Council, which is not an organization that produces binding agreements, but rather an intergovernmental forum.

Antarctic. Because of the longevity of the original Antarctic Treaty, the number of nations that have acceded to the treaty, and the practice of the consultative parties to expand the Antarctic Treaty System to cover additional issues, there is no evidence to suggest that significant changes will occur to the fundamental governance of Antarctica. Increased levels of activity in Antarctica may influence the members of the Treaty System to act in a more agile manner or enlist the assistance of other international organizations. Most recently, at the 2009 meeting of

the International Maritime Organization (IMO), the Assembly adopted new guidelines for ships operating in Antarctic waters. These guidelines include chapters on construction, equipment, operations (including crewing), environmental protection, and damage control. The IMO has also proposed amendments to prohibit carriage or use of heavy grade oil in the Antarctic. In recognition of further growth in shipping in polar waters, and with strong support from its member states, the IMO is working to develop and expand the Polar Guidelines into a mandatory "Polar Code."

Environmental

Arctic. The reduction in the amount of polar ice has become an iconic image for the changing Arctic. Open source literature has focused on the potential for shipping through the Northern Sea Route (north of the Eurasian continent) and Northwest Passage (north of North America) and the impact of reductions in sea ice on local residents and ecosystems. Figure 2 shows the extent of Arctic sea ice in 2009 compared to historic averages.

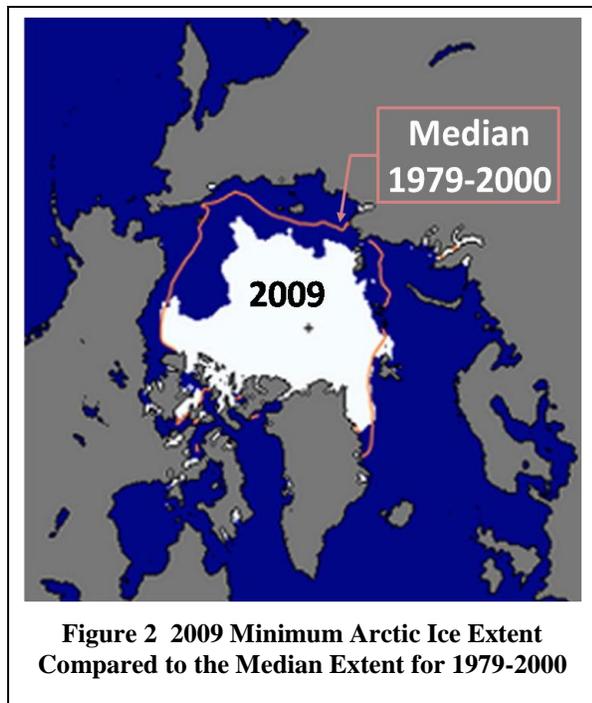


Figure 2 2009 Minimum Arctic Ice Extent Compared to the Median Extent for 1979-2000

Numerous studies and climate predictions address future Arctic sea ice conditions. The overall consensus of the studies is that the Arctic Ocean is moving toward an ice-diminished condition, which would allow greater marine access to and through the region, longer seasons of navigation, and less difficult ice conditions for marine operations.

Although ice forecasting models indicate that large parts of the Arctic may see much less ice in the summer, several enduring characteristics still provide challenges to surface navigation. First, large amounts of ice will still form in the Arctic over the winter. Second, although the summer melt is ultimately expected to bring an end to the presence of harder, multi-year ice, first-year ice can cause problems as it forms ridges and is packed tightly by weather conditions. Moving ice can worsen these conditions as it comes up against land. The reduction in ice cover during the shoulder seasons (i.e., the spring and fall when the polar regions undergo the transformation between open and ice-covered water) will permit greater influence by winds and currents. While this ice will not be as thick as the multi-year ice, increased mobility will make its location less predictable, and therefore increase the risk for ships operating in the area to become trapped, forced aground or damaged by ice impacts.

Antarctic. In December 2009 the Scientific Committee on Antarctic Research (SCAR) published a review of Antarctica's climate and its relationship with the global climate system, identifying several ongoing changes to the local environment that will influence Coast Guard operations in the Southern Ocean. Although the long-term prediction (extending to the late twenty-first century) is for sea ice surrounding the continent to decrease by one third, the short-term trend is for sea ice cover to increase.

Mission Analysis Tools

Mission analysis is a continuous, iterative analysis of assigned mission responsibilities to identify gaps in current and projected Coast Guard mission capabilities. The process begins with an assessment of the authorities and mandates that stipulate the requirements that the Coast Guard carry out missions in the high latitude regions. Considering the impact of polar region issues and trends, the authorities and mandates then translate into a series of functional requirements and functional capabilities assessed through an examination of **D**octrine, **O**rganization, **T**raining, **M**aterial, **L**eadership and education, **P**ersonnel, and **F**acilities. The DOTMLPF analysis considers the material and non-material capabilities that the Coast Guard has to meet its requirements.

Because the projected future missions of the Coast Guard in the Arctic will result in an increase in demand for Coast Guard services, the Arctic Mission Analysis applied a risk analysis to gain insight into how well the Coast Guard may be able to respond to an increase in demand in its response missions. The risk analysis enables analysts to develop a “snapshot” that characterizes the relationship between incident risk (demand) and Coast Guard response capabilities. The analysis identifies the high latitude region activities most likely to drive a Coast Guard response, the areas in which events requiring response would be expected to occur, and then applies time/speed/distance calculations and response time limits to identify changes in the percentage of successful responses as a function of the spatial deployment of Coast Guard resources. This analysis leads to an understanding of the sources and locations of the leading risk drivers. Integral to the analysis are material and non-material alternatives for satisfying mission requirements.

The risk analysis considers as alternatives a mix of surface vessels (ice-capable and not ice-capable); aviation assets that are either deployed on surface vessels, or at forward operating locations; and the associated communications infrastructure. The risk analysis examines relative

changes to mission performance achieved through the use of alternative spatial force distributions. While the Coast Guard currently has the authority to seek resources for emerging Arctic missions, funding constraints and other priorities complicate the timely development of required capabilities and capacities. The Arctic mission analysis uses the risk analysis to evaluate options to investigate the most effective use of resources in the Arctic region from a risk reduction standpoint.

The Polar Icebreaker Mission Analysis identifies the medium and heavy icebreaking capacity required to fulfill Coast Guard icebreaking mission requirements. The analysis uses a notional deployment schedule which assigns specific platforms to specific mission activities (deployments). The analysis uses a software model to build schedule parameters for each mission activity to determine the best solution (the type and number of icebreakers needed to fulfill mission demand). Scenarios incorporated post-deployment in-port periods for maintenance and replenishment as well as the number and types of assets with the capability to perform each mission. The study team created the Cutter Capacity Demand Tool, an operations research modeling technique, to determine the optimal solution to a set of linear mathematical constraints, where the solutions must be integers (whole numbers) – in this case, the number of icebreakers required.

The Coast Guard is conducting an independent business case analysis to identify options available for the restoration of its polar icebreaker capacity. The business case analysis identifies possible material alternatives (reconstruction, new acquisition, service life extension) to meet the required capability, and the projected cost of those alternatives. The business case analysis provides estimates of acquisition and life-cycle costs for heavy and medium icebreakers. Polar Icebreaking Mission Analysis uses the business case analysis cost analyses to formulate rough order of magnitude costs for heavy and medium icebreakers.

Functional Requirements and Capabilities Analysis

The mission analysis derives functional requirements and capabilities from the **Authorities and Mandates** and polar region trends, and then describes the functional capabilities the Coast Guard employs or can employ to satisfy the functional requirements. Finally, the mission analysis identifies gaps that exist between required functional capabilities and those that currently exist.

Functional Requirements are those *activities that the Coast Guard must be able to perform* to satisfy the mandates. Giving consideration to the 11 basic Coast Guard missions, the mission analysis identifies 113 functional requirements for executing Coast Guard missions

in the high latitude regions. **Functional Capabilities** are the ability to achieve a desired effect under specified standards and conditions through combinations of means and ways across the capability elements (e.g., doctrine, organization, training). Table 2 illustrates the flow down from authorities and mandates to functional requirements to functional capabilities. The capability analysis is the mission analysis report series' primary analytic tool for assessing performance gaps. The risk analysis and cutter demand tool support the capability analysis by assessing the performance of alternatives in meeting the required capability and capacity.

Table 2 Flowdown of Authorities and Mandates to Functional Requirements and Capabilities

Authorities & Mandates	14 USC 2: Primary Duties	
	<ul style="list-style-type: none"> ...shall develop, establish, maintain, and operate, with due regard to the requirements of... national defense, aids to maritime navigation, ice-breaking facilities, and rescue facilities for the promotion of safety on, under, and over the high seas and waters subject to the jurisdiction of the U.S. ...shall maintain a state of readiness to function as a specialized service in the Navy in time of war, including the fulfillment of Maritime Defense Zone command responsibilities. 	
	14 USC 93: Authority to Maintain Facilities	
	For the purpose of executing the duties and functions of the Coast Guard the Commandant may maintain water, land, and air patrols, and ice-breaking facilities.	
	14 USC 141: Assistance to Other Agencies	
	...may... utilize its personnel and facilities to assist any Federal agency, State, Territory, possession, or political subdivision thereof... to perform any activity for which such personnel and facilities are especially qualified.	
	...additional Authorities and Mandates for all 11 Coast Guard missions.	



Functional Requirements	Functional Requirement	Details
		Defense Readiness - <i>Provide mobilization capability to support military operations and logistics.</i>
	... remaining Functional Requirements for all 11 missions (113 total).	



Functional Capabilities	Capability Element	Functional Capability	Contribution to Mission Performance
		Material	Heavy and Medium Icebreaker Capability
	... other Functional Capabilities assessed for the 11 missions considering Doctrine, Organization, Training, Material, Leadership and education, Personnel, and Facilities.		

The analysis compares functional requirements to the current capabilities to identify gaps and their impact(s) on mission performance. Table 3 summarizes the significance of gaps in performing the 11 basic Coast Guard missions, and characterizes the impacts as significant, moderate, low, or none. These impacts account for all the identified gaps in aggregate.

Table 3 Impact of Gaps on Mission Performance

Mission	Impact of Gap on Mission Performance	
	Arctic	Antarctic
Aids to Navigation	Moderate	None
Defense Readiness	Significant	Significant
Drug Interdiction	None	None
Ice Operations	Significant	Significant
Living Marine Resources	Low	Low
Marine Environmental Protection	Significant	Moderate
Marine Safety	Low	Low
Migrant Interdiction	None	None
Other Law Enforcement	Moderate	Moderate
Ports, Waterways, and Coastal Security	Significant	None
Search and Rescue	Moderate	Low

GAPS IN ARCTIC MISSION PERFORMANCE

High Latitude Mission Analysis Report Volume 2 concludes that future capability and capacity gaps will significantly impact four mission areas in the Arctic: Defense Readiness, Ice Operations, Marine Environmental Protection, and Ports, Waterways, and Coastal Security. These mission areas address the protection of important national interests in a geographic area where other nations are actively pursuing their own national goals. U.S. national policy and laws define the requirements to assert the na-

tion's jurisdiction over its territory and interests; to ensure the security of its people and critical infrastructure; to participate fully in the collection of scientific knowledge; to support commercial enterprises with public utility; and to ensure that the Arctic environment is not degraded by increased human activity.

The Coast Guard's ability to support Defense Readiness mission requirements in the Arctic is closely linked to DoD responsibilities. The Coast Guard presently possesses the only surface vessels capable of operating in ice-covered and ice-diminished waters. The Coast Guard supports (1) DoD missions such as the resupply of Thule Air Base in Greenland and logistics support (backup) for McMurdo Station in Antarctica and (2) Department of State (DoS) directed Freedom of Navigation Operations. These unique Coast Guard capabilities have been noted by the Joint Chiefs of Staff, the Navy's Task Force Climate Change, and the recently issued Naval Operations Concept 2010.

The common and dominant contributor to these significant mission impacts is the gap in polar icebreaking capability. The increasing obsolescence of the Coast Guard's icebreaker fleet will further exacerbate mission performance gaps in the coming years. POLAR SEA is inoperative until 2011 and will reach the end of its service life in 2014. Disabling short-term engineering problems discovered on POLAR SEA in June 2010 have resulted in the cancellation of two polar deployments until at least early 2011. POLAR STAR commenced a major refit in May 2010 and is expected to return to service in late 2014 with a 6- to 7-year remaining service life. The Coast Guard's only medium icebreaker, HEALY, will remain in-service until 2030. Figure 3 illustrates the remaining service life of the current Coast Guard icebreaking fleet.

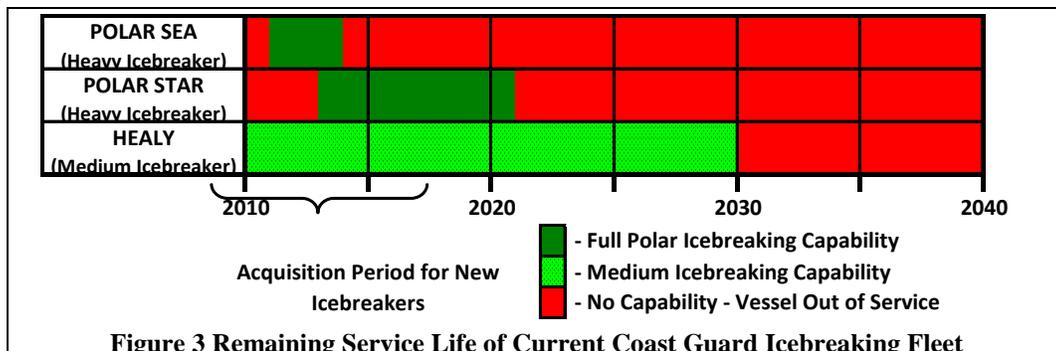


Figure 3 Remaining Service Life of Current Coast Guard Icebreaking Fleet

The gap in polar icebreaking capacity has resulted in a lack of at-sea time for crews and senior personnel and a corresponding gap in training and leadership. In addition to providing multi-mission capability and intrinsic mobility, a helicopter-capable surface unit would eliminate the need for acquiring an expensive shore-based infrastructure that may only be needed on a seasonal or occasional basis. The most capable surface unit would be a polar icebreaker. Polar icebreakers can transit safely in a variety of ice conditions and have the endurance to operate far from logistics bases. The Coast Guard's polar icebreakers have conducted a wide range of planned and unscheduled Coast Guard missions in the past. Polar icebreakers possess the ability to carry large numbers of passengers, cargo, boats, and helicopters. Polar icebreakers also have substantial command, control, and communications capabilities. The flexibility and mobility of polar icebreakers would assist the Coast Guard in closing future mission performance gaps effectively.

Other capability gaps contributing to the impact on Coast Guard ability to carry out its missions in the Arctic include:

- Communications System Capability - Continuous coverage along Alaska's West Coast, the Bering Strait, and throughout the North Slope is required for exchanging voice and data communications with Coast Guard units and other government and commercial platforms offshore.
- Forward Operating Locations - No suitable facilities currently exist on the North Slope or near the Bering Strait with facilities sufficient to support extended aircraft servicing and maintenance. Aircraft must travel long distances and expend significant time transiting to and from adequate facilities. This gap reduces on-scene presence and capability to support sustained operations in the region.
- Environmental response in ice-covered waters - The technology and procedures for assessment and mitigation measures for oil spills in ice-covered waters are not fully developed or tested.

Capability gaps in the Arctic region have moderate impacts on Aids to Navigation (AtoN),

Search and Rescue (SAR), and Other Law Enforcement (OLE) missions. Both AtoN and SAR involve the safety of mariners and will gain more importance not only as commerce and tourism cause an increase in maritime traffic, but as U.S. citizens in northern Alaska face more unpredictable conditions. Performance of OLE will be increasingly necessary to ensure the integrity of U.S. living marine resources from outside pressures.

GAPS IN ANTARCTIC MISSION PERFORMANCE

Existing capability and capacity gaps are expected to significantly impact future Coast Guard performance in two Antarctic mission areas: Defense Readiness and Ice Operations. Future gaps may involve an inability to carry out probable and easily projected mission requirements, such as the McMurdo resupply, or readiness to respond to less-predictable events. By their nature, contingencies requiring the use of military capabilities often occur quickly. As is the case in the Arctic, the deterioration of the Coast Guard's icebreaker fleet is the primary driver for this significant mission impact. This will further widen mission performance gaps in the coming years. The recently issued Naval Operations Concept 2010 requires a surface presence in both the Arctic and Antarctic. This further exacerbates the capability gap left by the deterioration of the icebreaker fleet.

The Coast Guard can expect moderate impacts in the mission performances areas of Marine Environmental Protection (MEP) and Other Law Enforcement (OLE) missions in the Antarctic. The increasing pressures for Illegal, Unlawful and Unregulated (IUU) fishing that are likely to spread to the relatively unexploited Antarctic waters will produce these moderate gap impacts if OLE action cannot be conducted around Antarctica. Coast Guard MEP responsibilities apply to the vessel activities associated with the support of U.S. Antarctic facilities and activities. While the odds of a hazardous material spill are relatively low, the impact in case of a slow or weak response would be very high. Again, without available polar icebreaking resources, U.S. ability to respond to Antarctic contingencies of any kind is problematic.

Solutions

Acquisition policy and practice is to first assess options for non-material solutions such as doctrine, organization, and training, to close gaps in mission performance capabilities. If changes can be made within the Coast Guard's current infrastructure to close gaps, non-material solutions, which are typically faster and less expensive than material solutions, are preferred. The significant deterioration of the Coast Guard icebreaker fleet and the emerging mission demands to meet future functional requirements in the high latitude regions dictate that the Coast Guard acquire material solutions to close the capability gaps. The non-material solutions presented in the mission analyses are predicated on a baseline of material solutions and are presented as options that may reduce the overall requirement for material solutions.

POLAR ICEBREAKING NEEDS

Analysis of polar icebreaking needs and application of the operations research modeling tools consider the following: (1) the statutory mission functional requirements developed in the Arctic and Antarctic mission analyses, (2) the additional icebreaker presence requirements of the joint Naval Operations Concept, (3) the force mix analysis performed for the Arctic mission analysis, and (4) the use of conventionally powered icebreakers only (the use of nuclear powered icebreakers was not considered).

To meet the Coast Guard mission functional requirement, the Coast Guard icebreaking fleet must be capable of supporting the following missions:

- **Arctic North Patrol.** Continuous multi-mission icebreaker presence in the Arctic.
- **Arctic West Science.** Spring and summer science support in the Arctic.
- **Antarctic, McMurdo Station resupply.** Planned deployment for break-in, supply ship escort, and science support. This mission, conducted in the Antarctic summer, also requires standby icebreaker support for

backup in the event the primary vessel cannot complete the mission.

- **Thule Air Base Resupply and Polar Region Freedom of Navigation Transits.** Provide vessel escort operations in support of the Military Sealift Command's Operation *Pacer Goose*; then complete any Freedom of Navigation exercises in the region.

In addition, the joint Naval Operations Concept establishes the following mission requirements:

- **Assured access and assertion of U.S. policy in the Polar Regions.** The current demand for this mission requires continuous icebreaker presence in both Polar Regions.

Considering these missions, the analysis yields the following findings:

- **The Coast Guard requires three heavy and three medium icebreakers to fulfill its statutory missions.** These icebreakers are necessary to (1) satisfy Arctic winter and transition season demands and (2) provide sufficient capacity to also execute summer missions. Single-crewed icebreakers have sufficient capacity for all current and expected statutory missions. Multiple crewing provides no advantage because the number of icebreakers required is driven by winter and shoulder season requirements. Future use of multiple or augmented crews could provide additional capacity needed to absorb mission growth.
- **The Coast Guard requires six heavy and four medium icebreakers to fulfill its statutory missions and maintain the continuous presence requirements of the Naval Operations Concept.** Consistent with current practice, these icebreakers are single-crewed and homeported in Seattle Washington.

- **Applying crewing and home porting alternatives reduces the overall requirement to four heavy and two medium icebreakers.** This assessment of non-material solutions shows that the reduced number of icebreakers can be achieved by having all vessels operate with multiple crews and two of the heavy icebreakers homeporting in the Southern Hemisphere.

Leasing was also considered as a non-material solution. While there is no dispute that the Coast Guard’s polar icebreaker fleet is in need of recapitalization, the decision to acquire this capability through purchase of new vessels, reconstruction of existing ships, or commercial lease of suitable vessels must be resolved to provide the best value to the taxpayer. The multi-mission nature of the Coast Guard may provide opportunities to conduct some subset of its missions with non government-owned vessels. However, serious consideration must be given to the fact that the inherently governmental missions of the Coast Guard must be performed using government-owned and operated vessels. An interpretation of the national policy is needed to determine the resource level that best supports the nation’s interests.

Rough order-of-magnitude costs for heavy and medium icebreakers are provided in Table 4. These cost estimates were developed as part of the Coast Guard’s independent Polar Platform Business Case Analysis and are consistent with information presented by the Congressional Research Service to Congress on icebreaker modernization.

AIRCRAFT AND FORWARD OPERATING LOCATIONS

In addition to the assessment of polar ice-breaking needs, the Arctic mission analysis examined a set of theoretical mixes (force pack-

ages) of Coast Guard assets consisting of icebreakers, their embarked helicopters, and deployment alternatives using aviation forward operating locations in Arctic Alaska. The intent of this analysis is to provide additional information on risk reduction alternatives to inform the acquisition process. The analysis considers force packages that the Coast Guard will use in response to incidents that may occur in the future Arctic environment, including maritime accidents resulting in multiple casualties and/or a major oil spill. The risk analysis was applied to compare the performance of potential force packages applied to the region that is not currently being serviced by the Coast Guard Alaska Patrol (ALPAT). The analysis includes the following steps:

1. Create response incident categories for future events: cruise ship casualty, oil spill incident, shipping casualty, and recreational or subsistence fishing casualty. Identify the areas in which the events would occur by season (summer winter, shoulder). Assign times required for successful response (2, 12, or 24 hours), based on the type of incident.
2. Assign numerical values of risk to SAR and MEP scenarios requiring Coast Guard support based on how likely they are to occur and the resulting impact (in terms of property loss and loss of life) should they occur. These scenarios were derived from the Coast Guard’s previous development of the National Maritime Strategic Risk Assessment.
3. Identify force packages the Coast Guard may employ to affect these incidents.
4. Compare force packages and rate their relative effectiveness in responding to the SAR and MEP incidents in the context of reduction of loss of life and property.

Table 4 Acquisition Cost Estimates for Medium and Heavy Conventionally Powered Icebreakers

Acquisition Cost (\$M)		Number of Heavy Icebreakers						
		0	1	2	3	4	5	6
Number of Medium Icebreakers	0		\$856	\$1,663	\$2,439	\$3,207	\$3,961	\$4,704
	1	\$590	\$1,440	\$2,248	\$3,031	\$3,797	\$4,552	\$5,294
	2	\$1,152	\$2,002	\$2,809	\$3,593	\$4,359	\$5,113	\$5,856
	3	\$1,698	\$2,547	\$3,354	\$4,137	\$4,905	\$5,659	\$6,402
	4	\$2,231	\$3,080	\$3,888	\$4,670	\$5,438	\$6,192	\$6,935

Table 5 shows the composition and overall annual risk reduction for the six Coast Guard Arctic response postures. All of the force mixes add assets to the existing Coast Guard Alaska Patrol consisting of (1) a high-endurance cutter (not an icebreaker) deployed in the Bering Sea carrying a short range recovery helicopter, and (2) medium range recovery helicopters located at Kodiak in the Gulf of Alaska, and seasonally deployed to locations in Cold Bay and St. Paul Island. This baseline force package (used for comparison and not shown in the graphical results) has an extremely low annual risk reduction of 1% because this patrol cannot reasonably respond to northern area incidents.

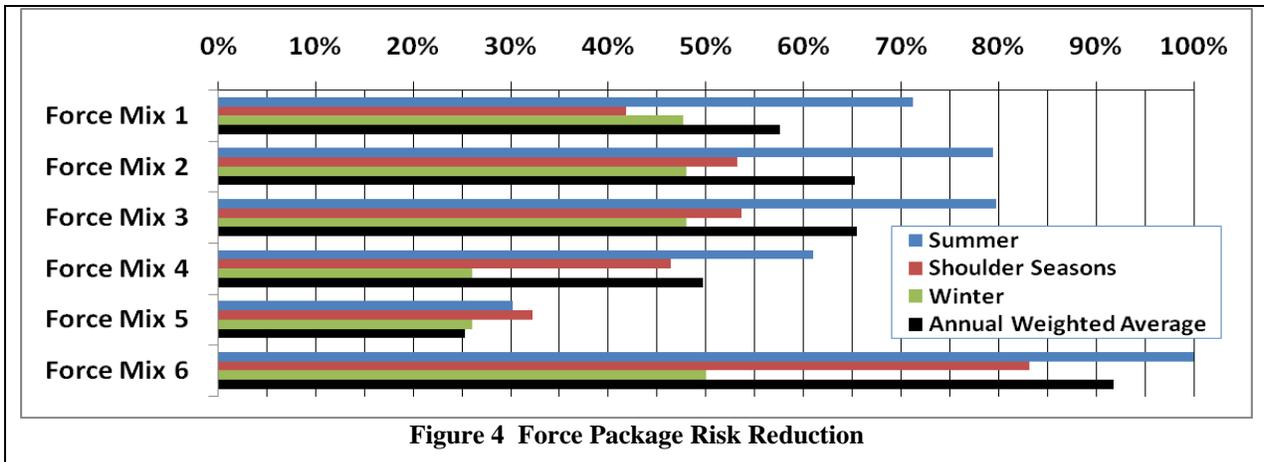
Figure 4 depicts the overall annual risk reduction and seasonal risk reduction for each force mix.

Note that summer risk forms the bulk of annual risk commensurate with the amount of northern Arctic human activity taking place in the summer as opposed to the other seasons.

These force packages and associated risk assessment provide a framework for acquisition planning as the Coast Guard implements a strategy for closing the capability gaps. By first recapitalizing the aging icebreakers, the Coast Guard provides a foundation for buildout of these force mixes. In addition to the cost of the icebreakers, the force packages require investment in forward operating locations and in medium range helicopters. The mission analysis reports developed rough order-of-magnitude cost estimates for forward operating locations at approximately \$36M each and for helicopters at \$9M each.

Table 5 Force Mixes Evaluation for Arctic Risk Reduction

Force Mix *	Cutter with 2 Helicopters **	2-Helo FOL **		Annual Risk Reduction	Remarks
		North Slope	NW Alaska		
1	North of Alaska	•		58%	Effective in mitigating North Slope risk but leaves considerable geographic coverage gap in the Bering Strait region.
2	North of Alaska		•	65%	Improvement over Force Mix 1 due to more widespread geographic distribution of assets in the northern Alaska area.
3	North of Alaska	•	•	66%	Slight improvement over Force Mix 2. Double North Slope helicopter coverage (cutter & FOL) versus expected mission demand creates an excess capacity/diminishing returns situation.
4	North of Bering Strait	•		50%	Poor performer against Force Mixes 1-3, demonstrates that a single cutter/helicopter combination is better used to service vessel and oil/gas exploitation risks which are more prevalent off the North Slope.
5	None	•	•	25%	Low-resource alternative using only helicopters at FOLs performs poorly because helicopters cannot tow or provide persistent presence to assist disabled vessels or respond to spills.
6	<ul style="list-style-type: none"> • North of Bering Strait • Chukchi Sea • Beaufort Sea 			92%	High-resource bounding deployment posture provides triple multi-mission cutter coverage, but requires 12 cutters to support.
<p>* All force mixes include the baseline ALPAT cutter/short range helicopter and seasonal medium range helicopter detachments at Cold Bay and St. Paul.</p> <p>** Medium range helicopters</p>					



CONCLUDING REMARKS

The Coast Guard commissioned an independent series of studies to assess its ability to conduct required missions in the high latitude regions. The studies show:

- The Coast Guard is a significant component of a whole of government solution in implementing national policy. The Coast Guard has statutory mission responsibilities in the Arctic and the Antarctic.
- Coast Guard mission requirements, including those in the high latitude regions flow from national interests and policy, laws, and other mandates.
- The three-volume high latitude mission analysis series identifies current and future gaps in the Coast Guard’s ability to meet its mission functional requirements and identifies material and non-material solutions to fill the most significant gaps.
- The Antarctic mission analysis (Volume 3) concludes that deficiencies are most pronounced in the Defense Readiness and Ice Operations mission areas. The primary finding is that additional heavy icebreaking capacity is required.
- The Arctic mission analysis (Volume 2) focuses on meeting the most basic Coast Guard roles – to save the lives and property of U.S. citizens in and around Alaska and protect the environment. The analysis shows that the current Coast Guard deployment posture is not capable of effective

response in northern Alaska and that response may be improved through a mix of deployed cutters, aircraft, and supporting infrastructure including forward operating locations and communications/navigation systems.

- The Polar Icebreaking needs analysis (Volume 1) focuses on the national capacity requirement for polar icebreakers. The cutter demand analysis considers all national requirements and concludes that additional icebreaking vessels are required to meet all national needs. The implementation of non-material alternatives can reduce the number of icebreakers required to meet capacity significantly.
- The existing icebreaker capacity, two in-operative heavy icebreakers and an operational medium icebreaker, does not represent a viable capability to the federal government. The time needed to augment this capability is on the order of 10 years. At that point, around 2020, the heavy icebreaking capability bridging strategy expires.

This mission analysis is all-encompassing as it examines all Coast Guard missions and responsibilities and offers a range of solutions for the service to independently fulfill its current and future mission demand. The Coast Guard should implement a measured polar region strategy and an incremental acquisition plan to address the highest order needs and reduce overall costs while optimizing service for the nation based on projected mission demand.