



# Coast Guard Polar Icebreaker Modernization: Background, Issues, and Options for Congress

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## Summary

Of the Coast Guard's three polar icebreakers, two—Polar Star and Polar Sea—have exceeded their intended 30-year service lives. The Polar Star is not operational and has been in caretaker status since July 1, 2006. A 2007 report from the National Research Council (NRC) on the U.S. polar icebreaking fleet states that “U.S. [polar] icebreaking capability is now at risk of being unable to support national interests in the north and the south.” On July 16, 2008, Admiral Thad Allen, the Commandant of the Coast Guard, testified that: “Today, our nation is at a crossroads with Coast Guard domestic and international icebreaking capabilities. We have important decisions to make. And I believe we must address our icebreaking needs now.... ”

The Coast Guard is studying how many polar icebreakers, with what capabilities, should be procured as replacements for Polar Star and Polar Sea. Under the Coast Guard's current schedule, the first replacement polar icebreaker might enter service in 8 to 10 years, by which time Polar Star and Polar Sea could be about 40 years old. The Coast Guard estimated in February 2008 that new replacement ships might cost \$800 million to \$925 million each in 2008 dollars, and that the alternative of extending the service lives of Polar Sea and Polar Star for 25 years might cost about \$400 million per ship.

The FY2009 Department of Homeland Security (DHS) appropriations act (Division D of H.R. 2638/P.L. 110-329 of September 30, 2008) provided \$30.3 million to reactivate Polar Star for 7 to 10 years of service life. The Coast Guard's proposed FY2010 budget does not request any funding in the service's Acquisition, Construction, and Improvements (AC&I) account for polar icebreaker sustainment, or for acquisition of new polar icebreakers.

Potential policy issues for Congress regarding Coast Guard polar icebreaker modernization include the numbers and capabilities of polar icebreakers the Coast Guard will need in the future; whether to provide these icebreakers through construction of new ships or service life extensions of Polar Star and/or Polar Sea; whether to accelerate the Coast Guard's current schedule for acquiring replacement ships; whether new ships should be nuclear powered; whether new ships should be funded entirely in the Coast Guard budget, or partly or entirely in some other part of the federal budget, such as the Department of Defense (DOD) budget, the National Science Foundation (NSF) budget, or both; and whether, as an interim measure, the Polar Star should be repaired and placed back into service.

Congress's options regarding Coast Guard polar icebreaker modernization include but are not limited to the following: approving the Coast Guard's current plan; holding hearings to solicit additional information on the issue; directing the Coast Guard to include the option of nuclear power in its studies of requirements for future icebreakers; directing the Coast Guard to pursue a particular acquisition strategy for icebreaker modernization; accelerating the procurement of new icebreakers relative to the Coast Guard's current plan; funding the procurement of new icebreakers partly or entirely in the DOD and/or NSF budget rather than entirely the Coast Guard budget; and directing the Coast Guard to reactivate Polar Star. This report will be updated as events warrant.

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## Introduction

Polar icebreakers can operate in the extreme conditions of, and break through the thick ice found in, the Arctic Ocean and the waters surrounding Antarctica. Of the Coast Guard's three polar icebreakers, two—Polar Star and Polar Sea—have exceeded their intended 30-year service lives. The Polar Star is not operational and has been in caretaker status since July 1, 2006.<sup>1</sup> The Coast Guard's third polar icebreaker—Healy—is much younger and in operational condition, but has less icebreaking capability than the other two ships.

A 2007 report from the National Research Council (NRC) on the U.S. polar icebreaking fleet states that “Over the last decade, some routine maintenance on [Polar Star and Polar Sea] has been deferred due to a lack of funds and no major life extension program has been planned; as a consequence, U.S. [polar] icebreaking capability is now at risk of being unable to support national interests in the north and the south.”<sup>2</sup>

On July 16, 2008, Admiral Thad Allen, the Commandant of the Coast Guard, testified that: “Today, our nation is at a crossroads with Coast Guard domestic and international icebreaking capabilities. We have important decisions to make. And I believe we must address our icebreaking needs now, to ensure we will continue to prosper in the years and decades to come, whether on the Great Lakes, the critical waterways of the East Coast or the harsh operating environments of the polar region.”<sup>3</sup> An August 17, 2008, press report quotes Admiral Allen as stating that, in light of the time required to build a new polar icebreaker, “I think we’re at a crisis point on making a decision.”<sup>4</sup>

The Coast Guard is studying how many polar icebreakers, with what capabilities, should be procured as replacements for Polar Star and Polar Sea. Under the Coast Guard's current schedule, the first replacement polar icebreaker might enter service in 8 to 10 years, by which time Polar Star and Polar Sea could be about 40 years old.

The FY2009 Department of Homeland Security (DHS) appropriations act (Division D of H.R. 2638/P.L. 110-329 of September 30, 2008) provided \$30.3 million to reactivate Polar Star for 7 to 10 years of service life. The Coast Guard's proposed FY2010 budget does not request any funding in the service's Acquisition, Construction, and Improvements (AC&I) account for polar icebreaker sustainment, or for acquisition of new polar icebreakers.

The issue for Congress that is addressed in this report is whether to approve or modify the Coast Guard's plans for modernizing its polar icebreakers. Congressional decisions on this issue could affect the Coast Guard's ability to perform its polar missions, Coast Guard funding requirements, and the U.S. shipbuilding industrial base.

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<sup>1</sup> Source for July 1, 2006, date: U.S. Coast Guard email to CRS on February 22, 2008.

<sup>2</sup> National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, p. 2.

<sup>3</sup> Source: Transcript of spoken remarks of Admiral Allen at July 16, 2008, hearing on Coast Guard icebreaking needs before the Coast Guard and Maritime transportation subcommittee of the House Transportation and Infrastructure Committee.

<sup>4</sup> Andrew C. Revkin, “A Push To Increase Icebreakers In The Arctic,” *New York Times*, August 17, 2008: 6.

The scope of this CRS report is limited to the question of Coast Guard polar icebreaker modernization. Other CRS reports cover certain other issues relating to the polar regions.

## Background

### Context for Issue

The issue of polar icebreaker modernization comes at a time of:

- increased interest and activities in polar regions, particularly the Arctic, due in large part to melting of Arctic ice;
- emerging debates over Arctic sovereignty and exclusive economic zones (EEZs) in the Arctic;
- concerns about the Coast Guard's ability to perform all of its various missions, including polar missions, within available resources; and
- concerns for the U.S. shipbuilding industrial base.

Regarding the first two items above, many observers anticipate that the melting of Arctic ice in coming years will open up potentially important sea transportation routes through the Arctic and make it possible (or easier) to explore for oil and other resources in the region. Emerging debates over Arctic sovereignty and EEZs in the Arctic stem to a large degree from these anticipated developments. Russia, Canada, Denmark, and the United States in the last few years, and particularly since the summer of 2007, have been taking various actions to assert their claims regarding Arctic sovereignty and EEZs, gather evidence to support potential claims, or plan for increased operations in the Arctic.<sup>5</sup> The Coast Guard stated in 2008 that:

Recent years have seen a significant increase in Polar activity, including efforts by multiple Arctic nations to define and claim Arctic seabed and access to natural resources. Energy security needs, protection of U.S. sovereignty, increased Arctic shipping, prevention and

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<sup>5</sup> For additional discussion, see, for example, Anthony L. Russell, "Carpe Diem, Seizing Strategic Opportunity in the Arctic," *Joint Force Quarterly*, Issue 51, 4<sup>th</sup> Quarter 2008: 94-101; Andrew C. Revkin, "A Push To Increase Icebreakers In The Arctic," *New York Times*, August 17, 2008: 6; Rebekah Gordon, "Coast Guard Commandant's Alaska Visit Assessed Outlook in Arctic," *Inside the Navy*, August 11, 2008; John C. Marcario, "Arctic Presence," *Seapower*, August 2008: 32-33; Matt Hilburn, "Trans-Arctic Shipping," *Seapower*, August 2008: 34-36; "Russian Navy Boosts Combat Presence in Arctic," *DefenseNews.com (Agence France-Presse)*, July 14, 2008; "Warships To Be Sent To Arctic," *Atlanta Journal-Constitution*, July 15, 2008; Zachary M. Peterson, "U.S. and Canadian Coast Guard Chiefs Discuss Growing Arctic Mission," *Inside the Navy*, Adrian Blomfield, "Russia Plans Arctic Military Build-Up," *London Daily Telegraph*, June 16, 2008; Lolita Baldor, "AP Interview: US Military Eyes More Northern Border Patrols," *WashingtonPost.com*, May 12, 2008 (also published by *NavyTimes.com* on May 13, 2008, under the headline "As Ice Melts, NorthCom Eyes Arctic Patrols"); Alex Shoumatoff, "The Arctic Oil Rush," *Vanity Fair*, May 2008; Scott G. Borgerson, "Arctic Meltdown, The Economic and Security Implications of Global Warming," *Foreign Affairs*, March/April 2008; Caitlin Harrington, "Eyeing Up the New Arctic," *Jane's Defence Weekly*, January 16, 2008: 22-27; Richard Burgess, "The New Cold War?," *Seapower*, October 2007: 14-16,18; David Pugliese, "Wake Up Call?," *Seapower*, October 2007: 19-20, 22; Deborah Zabarenko, "U.S. Resumes Mapping Of Arctic Seabed," *Washington Times*, August 15, 2007; Ian Austen, "Canada Announces Plans For 2 New Bases In Its Far North," *New York Times*, August 11, 2007; "Canada To Strengthen Arctic Claim," *BBC News*, August 10, 2008; C. J. Chivers, "Russians Plant Flag on the Arctic Seabed," *New York Times*, August 3, 2007; and Fred Weir, "As Icecaps Melt, Russia Races For Arctic's Resources," *Christian Science Monitor*, July 31, 2007.

response activities, as well as the growing need for Arctic domain awareness will increase the tempo of Coast Guard operations in the region. The Coast Guard is often the sole Federal presence in the Arctic and the only entity positioned and capable of protecting U.S. sovereignty while supporting scientific research. The Coast Guard is aggressively considering alternatives to improve and sustain operational presence in the Polar Regions.<sup>6</sup>

## Missions of U.S. Polar Icebreakers

The missions of U.S. polar icebreakers can be summarized as follows:

- conducting and supporting scientific research in the Arctic and Antarctic;
- defending U.S. sovereignty in the Arctic by helping to maintain a presence in the region;
- defending other U.S. interests in polar regions, including economic interests relating to the U.S. exclusive economic zone (EEZ) north of Alaska;
- monitoring sea traffic in the Arctic, including ships bound for the United States; and
- conducting other typical Coast Guard missions (such as search and rescue, law enforcement, and protection of marine resources) in Arctic waters, including U.S. territorial waters north of Alaska.

Supporting National Science Foundation (NSF) research activities in the Arctic and Antarctic has accounted in the past for a significant portion of U.S. polar icebreaker operations. Supporting NSF research in the Antarctic has included performing—or, in more recent years, standing ready to assist in—an annual mission to break through the Antarctic ice so as to resupply McMurdo Station, the large U.S. Antarctic research station located on the shore of McMurdo Sound, near the Ross Ice Shelf.

Although polar ice is melting due to climate change, observers generally expect that this development will not eliminate the need for U.S. polar icebreakers, and in some respects might increase mission demands for them. Even with the melting of polar ice, there are still significant ice-covered areas in the polar regions. Melting of polar ice could lead in coming years to increased commercial ship, cruise ship, and naval surface ship operations, as well as increased exploration for oil and other resources, in and through the polar regions—activities that could require increased levels of support from polar icebreakers. Changing ice conditions in Antarctic waters have made the McMurdo resupply mission more challenging since 2000.<sup>7</sup>

## Current U.S. Polar Icebreakers

The U.S. polar icebreaker fleet currently includes four ships—three Coast Guard ships and one ship operated by the NSF. The ships are described briefly below, and then summarized in **Table 1**. Uses of the three Coast Guard polar icebreakers in FY2005-FY2007 by operational hours are summarized in **Table 2**.

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<sup>6</sup> U.S. Coast Guard, *Posture Statement With [FY] 2009 Budget In Brief*, Washington, 2008. (February 2008) pp. 33-34.

<sup>7</sup> National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, pp. 6-7, 14, 63.

## Three Coast Guard Ships

The Coast Guard's three polar icebreakers are multimission ships that can break through ice, support scientific research operations, and perform other missions typically performed by Coast Guard ships.

### *Polar Star and Polar Sea*

Polar Star (WAGB-10) and Polar Sea (WAGB-11),<sup>8</sup> sister ships built to the same general design, were procured in the early 1970s as replacements for earlier U.S. icebreakers. They were designed for 30-year service lives, and were built by Lockheed Shipbuilding of Seattle, WA, a division of Lockheed that also built ships for the U.S. Navy, but which exited the shipbuilding business in the late 1980s.

The ships are 399 feet long and displace about 13,300 tons.<sup>9</sup> They are the world's most powerful non-nuclear-powered icebreakers, with a capability to break through ice up to 6 feet thick at a speed of 3 knots. In addition to a crew of 134, each ship can embark a scientific research staff of up to 20 people.

*Polar Star.* Polar Star was commissioned into service on January 19, 1976, and consequently is now beyond its intended 30-year service life. The ship currently is not in operational condition due to worn out electric motors and other problems. The Coast Guard placed the ship in caretaker status on July 1, 2006; it is tied up at a pier in Seattle.<sup>10</sup> Under caretaker status, the Coast Guard is retaining the ship as a non-operational asset with a potential for being reactivated. The ship is assigned a reduced crew of 34 that keeps the ship clean and painted and tests the ship's machinery on a periodic basis, but the ship is not moved, and the ship's major mechanical problems are not being repaired. Keeping the ship in caretaker status, the Coast Guard states, costs about \$3 million per year.<sup>11</sup> As discussed later in this report, the ship would require millions of dollars of maintenance and repair work to be returned to service.

*Polar Sea.* Polar Sea was commissioned into service on February 23, 1978, and thus is also now beyond its intended 30-year service life. The ship is in operational condition but due to its age requires increasing amounts of maintenance to remain in operation.

### *Healy*

Healy (WAGB-20) was procured in the early 1990s as a complement to Polar Star and Polar Sea, and was commissioned into service on August 21, 2000. The ship was built by Avondale Industries, a shipyard located near New Orleans, LA, that has built numerous Coast Guard and Navy ships, and which now forms part of Northrop Grumman Shipbuilding.

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<sup>8</sup> The designation WAGB means Coast Guard icebreaker. More specifically, W means Coast Guard ship, A means auxiliary, G means miscellaneous purpose, and B means icebreaker.

<sup>9</sup> By comparison, the Coast Guard's new National Security Cutters—its new high-endurance cutters—are about 418 feet long and displace roughly 4,000 tons.

<sup>10</sup> The Coast Guard's official term for the ship's current status is "In Commission, Special."

<sup>11</sup> Source: Transcript of spoken remarks of Admiral Thad Allen at July 16, 2008, hearing on Coast Guard icebreaking needs before the Coast Guard and Maritime transportation subcommittee of the House Transportation and Infrastructure Committee.



Healy is a bit larger than Polar Star and Polar Sea—it is 420 feet long and displaces about 16,200 tons. Compared to Polar Star and Polar Sea, Healy has less icebreaking capability, but more capability for supporting scientific research. The ship can break through ice up to 4½ feet thick at a speed of 3 knots, and embark a scientific research staff of up to 50. The ship is used primarily for supporting scientific research in the Arctic.

### One National Science Foundation Ship

The nation's fourth polar icebreaker is Nathaniel B. Palmer, which was built for the NSF in 1992 by North American Shipbuilding, of Larose, LA. The ship, called Palmer for short, is owned by Edison Chouest Offshore (ECO) of Galliano, LA, a firm that owns and operates research ships and offshore deepwater service ships.<sup>12</sup> NSF uses a contractor, Raytheon Polar Services Company (RPSC), to lease the ship from ECO.<sup>13</sup> Palmer is considerably smaller than the Coast Guard's three polar icebreakers—it is 308 feet long and has a displacement of about 6,500 tons. It is operated by a crew of about 22, and can embark a scientific staff of 27 to 37.<sup>14</sup>

Unlike the Coast Guard's three polar icebreakers, which are multimission ships, Palmer was purpose-built as a single-mission ship for conducting and supporting scientific research in the Antarctic. It has less icebreaking capability than the Coast Guard's polar icebreakers, being capable of breaking ice up to 3 feet thick at speeds of 3 knots. This capability is sufficient for breaking through the more benign ice conditions found in the vicinity of the Antarctic Peninsula, to resupply Palmer Station, a U.S. research station on the peninsula. Some observers might view Palmer not so much as an icebreaker as an oceanographic research ship with enough icebreaking capability for the Antarctic Peninsula. Palmer's icebreaking capability is not considered sufficient to perform the MucMurdo resupply mission.

**Table 1. U.S. Polar Icebreakers**

	<b>Polar Star</b>	<b>Polar Sea</b>	<b>Healy</b>	<b>Palmer</b>
<b>Operator</b>	USCG	USCG	USCG	NSF
<b>U.S.-Government owned?</b>	Yes	Yes	Yes	No <sup>a</sup>
<b>Currently in operational condition?</b>	No (caretaker status)	Yes	Yes	Yes
<b>Entered service</b>	1976	1978	2000	1992
<b>Length (feet)</b>	399	399	420	308
<b>Displacement (tons)</b>	13,300	13,300	16,200	6,500

<sup>12</sup> For more on ECO, see the firm's website at <http://www.chouest.com/>.

<sup>13</sup> For more on RPSC, see the division's website at <http://rpsc.raytheon.com/>

<sup>14</sup> Sources vary on the exact number of scientific staff that can be embarked on Palmer. For some basic information on the ship, see <http://www.nsf.gov/od/opp/support/nathpalm.jsp>, <http://www.usap.gov/vesselScienceAndOperations/contentHandler.cfm?id=22>, [http://www.usap.gov/vesselScienceAndOperations/documents/prvnews\\_june03.pdf](http://www.usap.gov/vesselScienceAndOperations/documents/prvnews_june03.pdf), <http://nsf.gov/od/opp/antarct/treaty/pdf/plans0607/15plan07.pdf>, <http://www.nsf.gov/pubs/1996/nsf9693/fls.htm>, and <http://www.hazegray.org/worldnav/usa/nsf.htm>.

	Polar Star	Polar Sea	Healy	Palmer
<b>Icebreaking capability (ice thickness in feet) at 3 knots</b>	6 feet	6 feet	4.5 feet	3 feet
<b>Crew (when operational)</b>	134 <sup>b</sup>	134	67	22
<b>Additional scientific staff</b>	20	20	50	27-37

**Sources:** Prepared by CRS using data from U.S. Coast Guard, National Research Council, National Science Foundation and (for Palmer) additional online reference sources.

- Owned by Edison Chouest Offshore (ECO) of Galliano, LA, and leased to NSF through Raytheon Polar Services Company (RPSC).
- Currently assigned a caretaker crew of 34.

**Table 2. Uses of Coast Guard Polar Icebreakers**

(FY2005-FY2007, in mission hours)

Mission area	Polar Star			Polar Sea			Healy		
	FY 05	FY 06	FY 07	FY 05	FY 06	FY 07	FY 05	FY 06	FY 07
SAR	31					2			
ATON									
Ice Ops	1,809	1,642				2,658	3,563	3,210	2,930
MEP						16			
LMR	193								
PWCS									
DR						121			94
Support	34			1	802	21	256	424	596
<b>Total</b>	<b>2,066</b>	<b>1,642</b>	<b>0</b>	<b>1</b>	<b>802</b>	<b>2,818</b>	<b>3,819</b>	<b>3,634</b>	<b>3,620</b>

**Source:** U.S. Coast Guard data provided to CRS on June 12 and 20, 2008.

**Notes:** **SAR** = search and rescue; **ATON** = aids to navigation; **Ice Ops** = ice operations, polar icebreaking and domestic ice; **MEP** = marine environmental protection; **LMR** = living marine resources; **PWCS** = ports, waterways, and coastal security; **DR** = defense readiness; **Support** = includes operations such as training, public affairs, cooperation with federal, state, and local agencies.

The Coast Guard states further that: “For CGC [Coast Guard Cutter] HEALY, all of the Polar Operations hours are either transit to/from the operating area or scientific research. For CGC POLAR SEA/POLAR STAR, all of the Polar Operations hours are transit to/from the operating area, scientific research or mobility logistics (icebreaking for re-supply). We estimate 25% transit / 75% scientific research for HEALY and 50% transit / 10% scientific research / 40% mobility logistics for POLAR SEA/POLAR STAR.”

## Summary

In summary, the U.S. polar icebreaking fleet currently includes one ship that is used primarily for scientific research in the Arctic (Healy), one ship that is used for scientific research in the Antarctic (Palmer), one ship that can operate in either polar area and is capable of performing the

challenging McMurdo resupply mission (Polar Sea), and a fourth ship with similar capabilities that is not in operational condition and is in caretaker status (Polar Star).

## NSF Funding for Icebreaker Operations and Maintenance

Since FY2006, costs for operating and maintaining the Coast Guard's polar icebreakers have been funded in the NSF's budget rather than the Coast Guard's budget. The transfer of polar icebreaker operation and maintenance funding from the Coast Guard's budget to the NSF's budget was requested by the administration as part of its FY2006 budget submission, and approved by Congress as part of its action on the FY2006 Coast Guard and NSF budgets. The transfer was made in view of the fact that a large portion of the Coast Guard's polar icebreaking operations are conducted in support of NSF research activities. The funding arrangement is covered by a 2005 memorandum of agreement (MOA) between the Coast Guard and NSF.

Some observers have questioned whether it is appropriate for the operation and maintenance of Coast Guard polar icebreakers to be funded through the NSF budget. The 2007 NRC report, for example, states that the arrangement "has increased management difficulties by spreading management decisions related to the polar icebreakers across two agencies"; that "[t]he NSF is now fiscally responsible, and making decisions, for missions outside its core mission and expertise"; and that "the U.S. Coast Guard has been put in a situation in which it has the role of operating a ship for which it does not have full budget and management control."<sup>15</sup>

The issue was discussed at the July 16, 2008, hearing on Coast Guard icebreaker needs. For additional discussion, see **Appendix B**.

A March 24, 2008 press report stated:

The Coast Guard splits responsibility for its icebreakers with the National Science Foundation, which under a 2006 law pays to run and maintain the ships, albeit with Coast Guard crews, after they were designated as primarily for research purposes. But starting next year, the NSF doesn't plan to continue paying to maintain the oldest ship, the Polar Star, which has been in reserve status since 2006. With no funding, the Polar Star would lose its skeleton crew and its capability to become operational with about 12 months' notice.<sup>16</sup>

## 2007 National Research Council Report

The most recent major study relating to Coast Guard polar icebreakers is the 2007 National Research Council (NRC) report, *Polar Icebreakers in a Changing World: An Assessment of U.S. Needs*, which assessed roles and future needs for Coast Guard polar icebreakers.<sup>17</sup> The NRC is a part of the National Academies. The study was completed in 2006 and published in 2007. Some sources refer to the study as the 2006 NRC report.

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<sup>15</sup> National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, p.101.

<sup>16</sup> Philip Ewing, "CG Steps Up Bid to Rescue Icebreaker Funding," *Navy Times*, March 24, 2008.

<sup>17</sup> National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, 122 pp.

## **Origin of Study**

The study was required by report language accompanying the FY2005 DHS appropriations act (H.R. 4567/P.L. 108-334).<sup>18</sup> A hearing on the report was held by the Coast Guard and Maritime Transportation subcommittee of the House Transportation and Infrastructure Committee on September 26, 2006.

## **Conclusions and Recommendations**

The NRC report makes the following conclusions and recommendations:

The [study] committee finds that both operations and maintenance of the polar icebreaker fleet have been underfunded for many years, and the capabilities of the nation's icebreaking fleet have diminished substantially. Deferred long-term maintenance and failure to execute a plan for replacement or refurbishment of the nation's icebreaking ships have placed national interests in the polar regions at risk. The nation needs the capability to operate in both polar regions reliably and at will. Specifically, the committee recommends the following:

- The United States should continue to project an active and influential presence in the Arctic to support its interests. This requires U.S. government polar icebreaking capability to ensure year-round access throughout the region.
- The United States should continue to project an active and influential presence in the Antarctic to support its interests. The nation should reliably control sufficient icebreaking capability to break a channel into and ensure the maritime resupply of McMurdo Station.
- The United States should maintain leadership in polar research. This requires icebreaking capability to provide access to the deep Arctic and the ice-covered waters of the Antarctic.

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<sup>18</sup> H.R. 4567/P.L. 108-334 of October 18, 2004. The related Senate bill was S. 2537. The Senate report on S. 2537 (S.Rept. 108-280 of June 17, 2004) stated:

The Committee expects the Commandant to enter into an arrangement with the National Academy of Sciences to conduct a comprehensive study of the role of Coast Guard icebreakers in supporting United States operations in the Antarctic and the Arctic. The study should include different scenarios for continuing those operations including service life extension or replacement of existing Coast Guard icebreakers and alternative methods that do not use Coast Guard icebreakers. The study should also address changes in the roles and missions of Coast Guard icebreakers in support of future marine operations in the Arctic that may develop due to environmental change, including the amount and kind of icebreaking support that may be required in the future to support marine operations in the Northern Sea Route and the Northwest Passage; the suitability of the Polar Class icebreakers for these new roles; and appropriate changes in existing laws governing Coast Guard icebreaking operations and the potential for new operating regimes. The study should be submitted to the Committee no later than September 30, 2005.

The conference report on H.R. 4567 (H.Rept. 108-774 of October 9, 2004) stated:

As discussed in the Senate report and the Coast Guard authorization bill for fiscal year 2005, the conferees require the National Academy of Sciences to study the role of Coast Guard icebreakers.

The earlier House report on H.R. 4567 (H.Rept. 108-541 of June 15, 2004) contained language directing a similar report from the Coast Guard rather than the National Academies. (See the passage in the House report under the header "Icebreaking.")

- National interests in the polar regions require that the United States immediately program, budget, design, and construct two new polar icebreakers to be operated by the U.S. Coast Guard.
- To provide continuity of U.S. icebreaking capabilities, the POLAR SEA should remain mission capable and the POLAR STAR should remain available for reactivation until the new polar icebreakers enter service.
- The U.S. Coast Guard should be provided sufficient operations and maintenance budget to support an increased, regular, and influential presence in the Arctic. Other agencies should reimburse incremental costs associated with directed mission tasking.
- Polar icebreakers are essential instruments of U.S. national policy in the changing polar regions. To ensure adequate national icebreaking capability into the future, a Presidential Decision Directive should be issued to clearly align agency responsibilities and budgetary authorities.<sup>19</sup>

## **Coast Guard Perspective**

The Coast Guard states it “generally supports” the NRC report, and that the Coast Guard “is working closely with interagency partners to determine a way forward with national polar policy that identifies broad U.S. interests and priorities in the Arctic and Antarctic that will ensure adequate maritime presence to further these interests. Identification and prioritization of U.S. national interests in these regions should drive development of associated USCG [U.S. Coast Guard] capability and resource requirements.” The Coast Guard also states: “Until those broad U.S. interests and priorities are identified, the current USG [U.S. Government] polar icebreaking fleet should be maintained in an operational status.”<sup>20</sup>

## **Current Coast Guard Plan**

As mentioned earlier, the Coast Guard is studying how many polar icebreakers, with what capabilities, should be procured as replacements for Polar Star and Polar Sea. Under the Coast Guard’s current schedule, the first replacement polar icebreaker might enter service in 8 to 10 years, by which time Polar Star and Polar Sea could be about 40 years old. Regarding its current plan for modernizing its polar icebreaker fleet, the Coast Guard stated in 2008 that it:

is awaiting the identification and prioritization of U.S. national policy in the Polar Regions in order to identify and develop the appropriate capability. In the meantime, the CG is proceeding with pre-acquisition activities, starting with project identification, to assess current capability gaps in Coast Guard mission performance in the high latitudes regions.<sup>21</sup>

A March 24, 2008 press report stated:

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<sup>19</sup> National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, pp. 2-3.

<sup>20</sup> Source: Coast Guard point paper provided to CRS on February 12, 2008, and dated with the same date, providing answers to questions from CRS concerning polar icebreaker modernization.

<sup>21</sup> Source: Coast Guard point paper provided to CRS on February 12, 2008, op cit.

[Coast Guard] Commanders in Alaska plan to conduct an unprecedented expedition to the Arctic this summer, including a trip already underway by the Healy, to get a clear sense of their capabilities and problems operating above the Bering Strait. When that survey is finished, probably by August, [Coast Guard Commandant Admiral Thad] Allen and the commander of District 17, Rear Adm. Arthur “Gene” Brooks, will be able to make their case to Congress for funding and new gear, Allen said.<sup>22</sup>

## **Cost Estimates for Certain Modernization Options**

The Coast Guard in February 2008 provided CRS with cost estimates for four potential options for modernizing the Coast Guard’s polar icebreaker fleet:<sup>23</sup>

### **New Replacement Ships**

The Coast Guard estimated in February 2008 that new replacement ships for the Polar Star and Polar Sea might cost between \$800 million and \$925 million per ship in 2008 dollars to procure. The Coast Guard said that this estimate:

is based on a ship with integrated electric drive, three propellers, and a combined diesel and gas (electric) propulsion plant. The icebreaking capability would be equivalent to the POLAR Class Icebreakers [i.e., Polar Star and Polar Sea] and research facilities and accommodations equivalent to HEALY. This cost includes all shipyard and government project costs. Total time to procure a new icebreaker [including mission analysis, studies, design, contract award, and construction] is eight to ten years.<sup>24</sup>

The Coast Guard further stated that this notional new ship would be designed for a 30-year service life.

As discussed in the “Legislative Activity” section, the Congressional Budget Office (CBO), as part of its estimate of the cost of Section 917 of S. 1892 (the Coast Guard Authorization Act for FY2008) as reported in the Senate, has estimated that the Coast Guard “would spend about \$1.4 billion over the next five years to purchase two icebreakers.”<sup>25</sup>

### **25-Year Service Life Extensions**

One alternative to procuring new replacement ships would be to extend the service lives of Polar Star and Polar Sea. The Coast Guard stated in February 2008 that performing the extensive maintenance, repair, and modernization work needed to extend the service lives of the two ships

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<sup>22</sup> Philip Ewing, “CG Steps Up Bid to Rescue Icebreaker Funding,” *Navy Times*, March 24, 2008.

<sup>23</sup> Source for information and quotations in this section: Coast Guard point paper provided to CRS on February 12, 2008, op cit.

<sup>24</sup> The Coast Guard states further that the estimate is based on the procurement cost of the Mackinaw (WAGB-30), a Great Lakes icebreaker that was procured a few years ago and commissioned into service with the Coast Guard in June 2006. The Mackinaw is 240 feet long, displaces 3,500 tons, and can break ice up to 2 feet, 8 inches thick at speeds of 3 knots, which is suitable for Great Lakes icebreaking. The Coast Guard says it scaled up the procurement cost for the Mackinaw in proportion to its size compared to that of a polar icebreaker, and then adjusted the resulting figure to account for the above-described capabilities of the notional replacement ship and recent construction costs at U.S. Gulf Coast shipyards.

<sup>25</sup> S.Rept. 110-261 of February 5, 2008, page 8. See also pages 6 and 7.

by 25 years might cost roughly \$400 million per ship. This figure, the Coast Guard said, is based on assessments made by independent contractors for the Coast Guard in 2004. The service life extension work, the Coast Guard said, would improve the two icebreakers' installed systems in certain areas. Although the work would be intended to permit the ships to operate for another 25 years, it would not return the cutters to new condition.

### **Reactivate Polar Star for 7 to 10 Years**

The Coast Guard estimated in February 2008 that it would cost \$56.6 million to perform the maintenance and repair work needed to reactivate Polar Star and extend its service life by 7 to 10 years, which is the approximate amount of time that would transpire under the Coast Guard's plan before a new replacement ship enters service. On July 16, 2008, the Coast Guard similarly testified that cost of extending the ship's service life by 7 to 10 years would be "into the \$60 million range."<sup>26</sup> The work would include system upgrades that have been installed in recent years on the Polar Sea but not the Polar Star. An additional cost would be incurred to create and train a full 134-person crew for the ship.

As discussed in the "Legislative Activity" section, CBO, as part of its estimate of the cost of Section 917 of S. 1892 (the Coast Guard Authorization Act for FY2008) as reported in the Senate, has estimated that "\$50 million would be spent over the [FY]2008-[FY]2010 period to recondition an existing USCG icebreaker, which is currently out of operation."<sup>27</sup>

### **Reactivate Polar Star for a Single Deployment**

The Coast Guard estimated in February 2008 that it would cost \$8.2 million to perform the maintenance and repair work needed to reactivate the Polar Star and make it ready for a single Deep Freeze deployment, meaning a deployment to Antarctica, such as the McMurdo resupply mission. On July 16, 2008, the Coast Guard provided a slightly different figure, testifying that the work would cost \$8.6 million.<sup>28</sup> The work, the Coast Guard says, would require between 12 months and 18 months to perform. Roughly half of the cost, the Coast Guard says, would be to rebuild the ship's worn out electric motors. As with the previous option, an additional cost would be incurred to create and train a full 134-person crew for the ship.

## **U.S. Shipbuilding Industrial Base**

The status of the U.S. shipbuilding industrial base, particularly the part that builds military ships for the U.S. government, has been a concern in Congress and elsewhere since the early 1990s, following the end of the Cold War, when the rate of Navy shipbuilding declined substantially. Concern has focused on, among other things, whether the total amount of work being received by shipyards is sufficient to maintain their financial health and to preserve key design and

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<sup>26</sup> Source: Transcript of spoken remarks of Admiral Thad Allen at July 16, 2008, hearing on Coast Guard icebreaking needs before the Coast Guard and Maritime transportation subcommittee of the House Transportation and Infrastructure Committee.

<sup>27</sup> S.Rept. 110-261 of February 5, 2008, page 8.

<sup>28</sup> Source: Transcript of spoken remarks of Admiral Thad Allen at July 16, 2008, hearing on Coast Guard icebreaking needs before the Coast Guard and Maritime transportation subcommittee of the House Transportation and Infrastructure Committee.

construction skills.<sup>29</sup> Other things held equal, construction of one or more new polar icebreakers for the Coast Guard could increase workloads at the yard or yards involved in their construction for a period of a few or several years.

## Issues for Congress

The issue of Coast Guard polar icebreaker modernization presents several potential policy issues for Congress, including but not necessarily limited to those discussed below.

### Polar Icebreaker Sustainment Funding

As mentioned earlier, the FY2009 Department of Homeland Security (DHS) appropriations act (Division D of H.R. 2638/P.L. 110-329 of September 30, 2008) provided \$30.3 million to reactivate Polar Star for 7 to 10 years of service life. One potential oversight issue for Congress concerns how the Coast Guard plans to use this funding, particularly since \$30.3 million represents only about one-half of the \$56.6 million to \$60 million that the Coast Guard estimated in 2008 would be needed to perform the maintenance and repair work needed to reactivate Polar Star and extend its service life by 7 to 10 years. A related question is whether and how the Coast Guard plans to generate the remaining \$26 million to \$30 million that would be needed to fully fund the estimated cost of reactivating Polar Star and extending its service live by 7 to 10 years.

### Number and Capabilities of Future Polar Icebreakers

One potential policy issue for Congress concerns how many polar icebreakers, with what capabilities, the Coast Guard will need in the future. Specific questions within this issue include the following:

- Will the Coast Guard need two polar icebreakers (the number it currently has in operational condition), three polar icebreakers (the number it currently has in inventory), or some higher number?
- Should new icebreakers be designed to cut through ice up to six feet thick, like Polar Star and Polar Sea, or less than six feet thick (like Healy and many foreign icebreakers), or more than six feet thick (like certain Russian icebreakers)?<sup>30</sup>
- Should new icebreakers be designed with the scientific research capabilities less than, greater than, or about equal to those of Healy?

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<sup>29</sup> In addition, certain shipyards on the U.S. Gulf Coast, including shipyards that build or have built ships for the Navy and the Coast Guard, sustained damage to their production facilities and workforces as a result of Hurricane Katrina in August 2005. The affected yards have since recovered or are now completing their recovery from this damage.

<sup>30</sup> A recently completed Russian nuclear-powered icebreaker called 50 Let Pobedy that is 524 feet long and displaces about 25,000 tons is reportedly capable of breaking through ice up to 2.8 meters (about 9.2 feet) thick, though not necessarily at a speed of 3 knots. Somewhat smaller nuclear-powered Russian icebreakers of the Arktika class, such as Yamal, reportedly can break through ice up to 2.3 meters (about 7.5 feet) thick at a speed of 3 knots. Yamal displaces about 23,500 tons. (Sources: <http://sr.se/cgi-bin/euroarctic/amnessida.asp?programID=2460&Nyheter=0&grupp=2604&artikel=1219680>, <http://en.rian.ru/russia/20070131/59989100.html>, and [http://www.coolantarctica.com/Antarctica%20fact%20file/ships/Yamal\\_ice\\_breaker.htm](http://www.coolantarctica.com/Antarctica%20fact%20file/ships/Yamal_ice_breaker.htm).)



In assessing this issue, factors that Congress may consider include, but are not limited to, the following:

- current and projected mission demands for Coast Guard polar icebreakers, including an assessment of how those demands might be affected in coming years by changing ice conditions and by future NSF decisions on how to acquire icebreaking services to support its research activities;
- the potential for various mission demands (not just those conducted in support of NSF research activities) to be met by non-Coast Guard icebreakers, including leases or charters of icebreakers owned by foreign governments or private firms; and
- the Coast Guard's overall missions-vs.-resources situation, which includes the Coast Guard's requirements to perform many non-polar missions and the Coast Guard's desire to fund programs, such as the Deepwater acquisition program, for performing these non-polar missions.<sup>31</sup>

Regarding the first factor above, the NSF states that although Coast Guard polar icebreakers are very capable, the NSF is mandated by presidential directive to perform its research activities in the most cost-effective way possible, and that it can be more expensive for NSF to support its research activities with Coast Guard polar icebreakers than with charters of icebreakers crewed by contractor personnel. Although Coast Guard polar icebreakers in the past have performed the annual McMurdo break-in mission, the NSF in recent years has chartered Russian and Swedish contractor-operated icebreakers to perform the mission (with a Coast Guard polar icebreaker standing ready to assist if needed). The NSF has also noted that Healy, though very capable in supporting Arctic research, operates at sea for about 200 days a year, as opposed to about 300 days a year for foreign contractor-operated polar icebreakers. For additional discussion of the issue, see **Appendix C**.

Regarding the second factor above, issues to consider would include, among other things, the potential availability of ships for lease, leasing costs, regulatory issues relating to long-term leases of capital assets for the U.S. government, and the ability of leased ships to perform the missions in question, including the mission of defending U.S. sovereignty in Arctic waters north of Alaska, the challenging McMurdo resupply mission, or missions that emerge suddenly in response to unexpected events.<sup>32</sup>

Advocates of a Coast Guard polar icebreaker fleet that included two ships—that is, Healy and one other ship—might argue that the Coast Guard has been able to operate with such a force since the Polar Star went into caretaker status on July 1, 2006, and that a force with Healy and one other ship would cost less than a larger icebreaker fleet and thereby permit the Coast Guard to better fund programs for performing its various non-polar missions.

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<sup>31</sup> For more on the Deepwater program, see CRS Report RL33753, *Coast Guard Deepwater Acquisition Programs: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke.

<sup>32</sup> The potential for using leased ships, and the possible limitations of this option, are discussed at several points in the 2007 NRC report. The report argues, among other things, that the availability of icebreakers for lease in coming years is open to question, that leased ships are not optimal for performing sovereignty-related operations, and that some foreign icebreakers might be capable of performing the McMurdo resupply mission. See, for example, pages 80-81 of the NRC report.

Advocates of a Coast Guard fleet that included three ships—Healy and two other icebreakers—might argue that the current force of Healy and one other operational ship has made it more difficult for the Coast Guard to perform the McMurdo resupply mission using its own assets, that a force that included Healy and two other ships would provide the Coast Guard with more flexibility for responding to contingencies or dealing with mechanical problems on one of the icebreakers, and that it would still be sufficiently affordable to permit the Coast Guard to adequately fund programs for performing non-polar missions.

Advocates of a Coast Guard fleet that included Healy and three or more other icebreakers might argue that such a fleet would provide additional capability for responding to potentially increased commercial and military activities in the Arctic, and more strongly signal U.S. commitment to defending its sovereignty and other interests in the region. They might argue that although this option would be more expensive than a smaller fleet, the added investment would be justified in light of the growing focus on U.S. polar interests.

The 2007 NRC report provided one perspective on the issue of required numbers and capabilities for U.S. polar icebreakers, stating:

Based on the current and future needs for icebreaking capabilities, the [study] committee concludes that the nation continues to require a polar icebreaking fleet that includes a minimum of three multimission ships [like the Coast Guard's three current polar icebreakers] and one single-mission [research] ship [like Palmer]. The committee finds that although the demand for icebreaking capability is predicted to increase, a fleet of three multimission and one single-mission icebreakers can meet the nation's future polar icebreaking needs through the application of the latest technology, creative crewing models, wise management of ice conditions, and more efficient use of the icebreaker fleet and other assets. The nation should immediately begin to program, design, and construct two new polar icebreakers to replace the POLAR STAR and POLAR SEA.

Building only one new polar icebreaker is insufficient for several reasons. First, a single ship cannot be in more than one location at a time. No matter how technologically advanced or efficiently operated, a single polar icebreaker can operate in the polar regions for only a portion of any year. An icebreaker requires regular maintenance and technical support from shipyards and industrial facilities, must reprovision regularly, and has to effect periodic crew changeouts. A single icebreaker, therefore, could not meet any reasonable standard of active and influential presence and reliable, at-will access throughout the polar regions.

A second consideration is the potential risk of failure in the harsh conditions of polar operations. Despite their intrinsic robustness, damage and system failure are always a risk and the U.S. fleet must have enough depth to provide backup assistance. Having only a single icebreaker would necessarily require the ship to accept a more conservative operating profile, avoiding more challenging ice conditions because reliable assistance would not be available. A second capable icebreaker, either operating elsewhere or in homeport, would provide ensured backup assistance and allow for more robust operations by the other ship.

From a strategic, longer-term perspective, two new Polar class icebreakers will far better position the nation for the increasing challenges emerging in both polar regions. A second new ship would allow the U.S. Coast Guard to reestablish an active patrol presence in U.S. waters north of Alaska to meet statutory responsibilities that will inevitably derive from increased human activity, economic development, and environmental change. It would allow response to emergencies such as search-and-rescue cases, pollution incidents, and assistance to ships threatened with grounding or damage by ice. Moreover, a second new ship will leverage the possibilities for simultaneous operations in widely disparate geographic areas

(e.g., concurrent operations in the Arctic and Antarctic), provide more flexibility for conducting Antarctic logistics (as either the primary or the secondary ship for the McMurdo break-in), allow safer multiple-ship operations in the most demanding ice conditions, and increase opportunities for international expeditions. Finally, an up-front decision to build two new polar icebreakers will allow economies in the design and construction process and provide a predictable cost reduction for the second ship.<sup>33</sup>

The position expressed in the NRC report, which is consistent with the report's recommendations, is one perspective on this issue; other perspectives are possible. As mentioned earlier, the Coast Guard, while generally agreeing with the NRC report, is currently studying requirements for future polar icebreakers. It is possible that the Coast Guard's eventual position on required numbers and capabilities of Coast Guard polar icebreakers will differ in some respects from those of the NRC report. It is also possible that third parties might come to positions that differ from those of both the NRC report and the Coast Guard.

## **New Construction vs. Modernization**

A second potential policy issue for Congress is whether requirements for polar icebreakers over the next 25 to 30 years should be met by building new ships, by extending the service lives of the Polar Star and Polar Sea, or by pursuing some combination of these options. In assessing this question, factors to consider include the relative costs of these options, the capabilities that each option would provide, the long-term supportability of older ships whose service lives have been extended, and industrial-base impacts.

Regarding relative costs, as discussed in the "Background" section, the Coast Guard estimates that new icebreakers with a 30-year design life might cost \$800 million to \$925 million per ship, while a 25-year service life extension of Polar Star and Polar Sea might cost about \$400 million per ship. These estimates, however, should be compared with caution. As discussed earlier, the estimate for building new ships depends in part on the capabilities that were assumed for those ships, while the estimate for the service-life-extension option dates to 2004 and might consequently need to be reassessed. Estimates for service-life extension work, moreover, can be very uncertain due to the potential for discovering new things about a ship's condition once the ship is opened up for repair work.

Regarding capabilities provided by each option, the new-construction option would provide entirely new ships with extensive use of new technology, while the service-life-extension option would provide ships that, although modernized and reconditioned, would not be entirely new and would likely make less extensive use of new technologies. Among other things, new-construction ships might be able to make more extensive use of new technologies for reducing crew size, which is a significant factor in a ship's life cycle operating and support costs.

Regarding long-term supportability of older ships, the Coast Guard has expressed concern about the ability to support ships whose service lives have been extended after FY2014, because some contracts that currently provide that support are scheduled to end that year.<sup>34</sup>

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<sup>33</sup> National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, p. 2.

<sup>34</sup> Source: CRS discussion with Coast Guard officials, January 30, 2008.

Regarding potential impact on the industrial base, 25-year service life extensions would likely provide shipyards and supplier firms with less work, and also exercise a smaller set of shipyard construction skills, than would building new ships.

## **Acceleration of Current Schedule**

A third potential policy option for Congress, if it is determined that one or more new ships should be built, is whether to accelerate the Coast Guard's current schedule for building those ships. One option for accelerating the schedule would be to shorten the current phase for studying the requirements for the new ships and move directly to procurement of the first new ship. Another acceleration option, if the Coast Guard contemplates procuring two or more replacement ships, would be to fund a second ship (and any subsequent ships) sooner than the Coast Guard might propose. Both of these options could be combined. In the case of a two-ship procurement, for example, one highly accelerated profile would be to procure both ships as part of the FY2010 budget, rather than the first ship in a year after FY2010, and the second ship one or more years after that.

Advocates of accelerated procurement might argue the following:

- It could reduce the total cost over the next several years of operating the Polar Sea and maintaining the Polar Star in caretaker status by reducing the number of years that those costs would be incurred before the replacement ships enter service.
- Shortening the period for studying requirements for new icebreakers would be acceptable because these requirements are already well understood due to extensive past operational experience, an understanding of current mission demands, and studies on current and potential future demands such as the 2007 NRC report.
- Any remaining uncertainties about required capabilities, such as, perhaps, the extent of the new ships' scientific research facilities, could be addressed in an accelerated program by reserving space and weight in the design for accommodating such facilities.
- Accelerating the procurement of the second ship and any subsequent ships could reduce the total procurement cost of the ships by allowing contractors to achieve better economies of scale in terms of things like ordering materials, manufacturing components, and achieving optimal learning-curve benefits in moving from one ship to the next.

Opponents of this option might argue the following:

- The cost over the next several years for operating the Polar Sea and maintaining the Polar Star in caretaker status is relatively modest, so shortening the period during which these costs are incurred by a year or two will consequently produce only modest savings. These modest savings are not worth the risk that a shortened period for studying new requirements might overlook important issues or considerations that, if left unaddressed, could lead to the construction of new icebreakers that are less operationally effective or cost-effective than they could be.

- Although past operational experience, an understanding of current mission demands, and previous studies can inform an understanding of future mission requirements, that understanding might not be complete, particularly given changing conditions in the polar regions, future NSF decisions on how to acquire icebreaking services to support its research activities, and the need to take the views of U.S. government agencies other than the Coast Guard into account.
- Uncertainties about the ships' required capabilities cannot be completely mitigated by reserving space and weight for certain features, and reserving such space and weight might result in a design that is larger and more expensive than needed.
- Accelerating the program is not necessary to achieve a procurement profile that permits the ships to be constructed in an efficient and manner.

## Nuclear Power

A fourth potential policy option for Congress, if it is determined that one or more new ships should be built, is whether those ships should be nuclear-powered, as are 7 of Russia's 20 polar or Baltic icebreakers.<sup>35</sup> Some interest has been expressed in Congress in using nuclear power on a wider array of U.S. Navy surface ships in the future, and Section 1012 of the FY2008 defense authorization act (H.R. 4986/P.L. 110-181) made it U.S. policy to build certain future classes of U.S. Navy surface combatants with nuclear power unless the Secretary of Defense submits a notification to Congress that using nuclear power for a given new ship class is not in the national interest. The issue of nuclear power for U.S. Navy surface ships is discussed in detail in another CRS report.<sup>36</sup>

Advocates of building new Coast Guard polar icebreakers with nuclear power might argue the following:

- Nuclear power would provide the icebreakers with operational advantages in terms of virtually unlimited cruising endurance at any speed. Such endurance could permit the ships, for example, to make high-speed sprints from one polar region to the other, so as to respond to sudden contingencies, without needing to stop or slow down along the way to be refueled. These operational advantages are one reason why Russia has built some of its polar icebreakers with nuclear power.
- If oil costs in the future remain relatively high, and if the icebreakers consume significant total amounts of energy over their 30-year lives to perform their missions, then much or perhaps even all of the additional procurement cost of nuclear power could be offset over the ships lives by avoided fossil-fuel costs.

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<sup>35</sup> Source: National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, p. 59 (Table 6.4). These figures include a nuclear-powered icebreaker named 50 Let Pobedy that reportedly entered service in early 2007, and two conventionally powered Russian icebreakers that, at the time of the 2007 NRC study, were leased to the Netherlands.

<sup>36</sup> CRS Report RL33946, *Navy Nuclear-Powered Surface Ships: Background, Issues, and Options for Congress*, by Ronald O'Rourke.

- Building icebreakers with nuclear power could improve economies of scale in the production of nuclear propulsion components for U.S. Navy nuclear-powered ships, reducing the costs of those Navy ships, which would further offset, from a national standpoint, the additional procurement cost of nuclear power for the icebreakers.
- Due to the additional up-front costs and increased operational capabilities of building a ship with nuclear power, building U.S. nuclear-powered icebreakers could send a strong signal to Russia or other countries of U.S. commitment to defending its polar interests, particularly in the Arctic.

Opponents of building new Coast Guard polar icebreakers with nuclear power might argue the following:

- Although nuclear power provides operational advantages in terms of unrefueled cruising endurance, conventional power has proven sufficient for performing U.S. polar icebreaker missions. Russia's requirements for its icebreakers differ from U.S. requirements for its icebreakers, so Russia's decision to build some of its icebreakers with nuclear power does not necessarily imply that the United States should do the same.
- Based on data in a 2006 Navy report to Congress on nuclear power for Navy surface ships, building a U.S. icebreaker with nuclear power rather than conventional power might increase its procurement cost by several hundred million dollars.<sup>37</sup> That additional cost might not loom very large for a Navy surface combatant that might cost \$2 billion to \$3 billion even when conventionally powered, but it might increase by as much as two-thirds the procurement cost of an icebreaker that might otherwise cost \$800 million to \$925 million to procure. In a situation of constrained budget resources, such an increase in procurement cost could easily result in the procurement of one replacement icebreaker rather than two. A single icebreaker, even one with nuclear power, might not be enough to meet future U.S. needs.
- The Coast Guard has not operated nuclear-powered ships and consequently does not have a maintenance or training infrastructure in place to support the operation of such ships. The Coast Guard would need to either create this infrastructure (which would require time and money) or pay the Navy to use its infrastructure.
- The U.S. can send a sufficiently strong signal of its commitment to defending its polar interests by building new, highly capable, conventionally powered polar icebreakers.

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<sup>37</sup> As discussed in CRS Report RL33946, *Navy Nuclear-Powered Surface Ships: Background, Issues, and Options for Congress*, by Ronald O'Rourke, the 2006 Navy report concluded, among other things, that in constant FY2007 dollars, building a Navy surface combatant or amphibious ship with nuclear power rather than conventional power would add roughly \$600 million to \$800 million to its procurement cost. A nuclear power plant for a polar icebreaker might be smaller and consequently cost somewhat less than the nuclear power plant in the Navy surface combatant.

## Funding Ships in Coast Guard Budget or Elsewhere

A fifth potential policy option for Congress, if it is determined that one or more new icebreakers should be built, is whether the acquisition cost of those ships should be funded entirely through Coast Guard's Acquisition, Construction, and Improvements (AC&I) account, or partly or entirely through other parts of the federal budget, such as the Department of Defense (DOD) budget, the NSF budget, or both.<sup>38</sup> Within the DOD budget, possibilities include the Navy's shipbuilding account, called the Shipbuilding and Conversion, Navy (SCN) account, and the National Defense Sealift Fund (NDSF), which is an account where DOD sealift ships and Navy auxiliary ships are funded.

There is precedent for funding Coast Guard icebreakers in the DOD budget: The procurement of Healy was funded in the FY1990 in the DOD budget—specifically, the SCN account.<sup>39</sup> Advocates of funding new icebreakers partly or entirely through the SCN account or the NDSF might argue that this could permit the funding of new icebreakers while putting less pressure on other parts of the Coast Guard's budget. They might also argue that it would permit the new icebreaker program to benefit from the Navy's experience in managing shipbuilding programs. Opponents might argue that funding new icebreakers in the SCN account or the NDSF might put pressure on these other two accounts at a time when the Navy and DOD are facing challenges funding their own shipbuilding and other priorities. They might also argue that having the Navy manage the Coast Guard's icebreaker program would add complexity to the acquisition effort, and that it is unclear whether the Navy's recent performance in managing shipbuilding programs is better than the Coast Guard's, since both services have recently experienced problems in managing shipbuilding programs—the Coast Guard with the procurement of new cutters under the Deepwater program, and the Navy in the Littoral Combat Ship (LCS) program and the LPD-17 class amphibious ship program.<sup>40</sup>

At the July 16, 2008, hearing on Coast Guard icebreaker needs, Dr. Arden Bement, Jr., Director of NSF, when asked whether he would deem it prudent to contribute capital costs for the building of a new icebreaker, replied, "I think at this point, based on my understanding of the mission space, that the Coast Guard has, especially with the opening up of the Arctic over time, that it would be a prudent course of action."<sup>41</sup>

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<sup>38</sup> For more on the NSF, whose budget is normally funded through the annual Commerce, Justice, Science, and Related Agencies appropriations bill, see CRS Report 95-307, *U.S. National Science Foundation: An Overview*, by Christine M. Matthews.

<sup>39</sup> The FY1990 DOD appropriations act (H.R. 3072/P.L. 101-165 of November 21, 1989) provided \$329 million for the procurement of Healy in the SCN account. (See pages 77 and 78 of H.Rept. 101-345 of November 13, 1989). The NDSF was created three years later, in FY1993, as a fund for procuring DOD sealift ships, among other purposes, and since FY2001 has been used to fund Navy auxiliary ships as well.

<sup>40</sup> For more on the Deepwater, LCS, and LPD-17 programs, see CRS Report RL33753, *Coast Guard Deepwater Acquisition Programs: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke, CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke, and CRS Report RL32513, *Navy-Marine Corps Amphibious and Maritime Prepositioning Ship Programs: Background and Oversight Issues for Congress*, by Ronald O'Rourke.

<sup>41</sup> Source: Transcript of hearing.

## Options for Congress

Potential options for Congress, several of which arise out of the policy issues discussed in the previous section, include but are not limited to those listed below. Some of the options could be combined. The options are as follows:

- approve the Coast Guard’s current plan to study requirements for future icebreakers and then derive an acquisition strategy based on the results of these studies—a plan that might result in an initial replacement icebreaker entering service 8 to 10 years from now;
- hold hearings to solicit additional information on the issue of polar icebreaker modernization; or direct the Coast Guard to provide such information;
- direct the Coast Guard to include the option of nuclear power in its studies of requirements and design options for future icebreakers;
- direct the Coast Guard to pursue a particular acquisition strategy for icebreaker modernization, such as new construction, 25-year service life extension, or some combination of these two approaches;
- accelerate the procurement of new icebreakers relative to the Coast Guard’s current plan by shortening the study period, procuring multiple ships in a single fiscal year, or both;
- fund the procurement of new icebreakers partly or entirely in the DOD budget, the NSF budget, or both, rather than entirely in the Coast Guard’s budget; and
- as a risk-mitigation measure, direct the Coast Guard to reactivate Polar Star and make it ready for either a single additional deployment or for another 7 to 10 years of operations.

## Legislative Activity for FY2010

### **FY2010 Department of Homeland Security (DHS) Appropriations Bill**

The proposed Department of Homeland Security (DHS) FY2010 budget, including the proposed Coast Guard FY2010 budget, was submitted to Congress in early May. The budget does not request any funding in the service’s Acquisition, Construction, and Improvements (AC&I) account for polar icebreaker sustainment, or for acquisition of new polar icebreakers.

### **American Recovery and Reinvestment Act of 2009 (H.R. 1/P.L. 111-5)**

A Senate version of H.R. 1 (amendment in Senate, January 30, 2009) stated, in the section on the Coast Guard’s Acquisition, Construction, and Improvements (AC&I) account, that of the funds provided in the bill for the AC&I account, “\$87,500,000 shall be for the design of a new polar icebreaker or the renovation of an existing polar icebreaker, and major repair and maintenance of



existing polar icebreakers.” The provision was not included in other House and Senate versions of the bill, or in the conference version of the bill, which was signed into law on February 17, 2009.

## **Appendix A. Legislative Activity in 110<sup>th</sup> Congress**

### **FY2009 DHS Appropriations Act (H.R. 2638/P.L. 110-329)**

#### **House**

The House Appropriations Committee, in its report (H.Rept. 110-862 of September 18, 2008) on the FY2009 DHS appropriations bill (H.R. 6947), states:

#### **POLAR ICEBREAKING OPERATING AND MAINTENANCE COSTS AND FUTURE POLAR NEEDS**

The Committee is concerned about Coast Guard's ability to meet its polar operations mission requirements and provide the United States with the capability to support national interests in the polar regions. The Committee provides \$200,000, as requested, to conduct an analysis of national mission needs in the high latitude regions to inform the national polar policy debate.

In fiscal year 2006 the Committees on Appropriations approved an Administration request for the National Science Foundation (NSF), the primary user of the three Coast Guard polar icebreaker vessels, to fund the costs of operating and maintaining these aging vessels. Because it has become more apparent that the national interest in the polar regions extends beyond scientific research, the Committee questions whether this arrangement should continue. Accordingly, the Committee directs Coast Guard and NSF to renegotiate the existing agreement in order to return the budget for operating and maintaining these vessels to Coast Guard for fiscal year 2010. This change is consistent with a new joint plan for Coast Guard support of scientific research by NSF and other Federal agencies, which also is to be included in the 2010 budget request. NSF shall retain responsibility for the contracting of scientific support services that Coast Guard does not have the capability to perform or cannot perform on a cost-competitive basis. The Committee is aware of a \$4,000,000 funding shortfall related to the caretaker status of the POLAR STAR, and directs Coast Guard to address this shortfall within the amounts appropriated for fiscal year 2009. (Page 82)

#### **Senate**

The FY2009 DHS appropriations bill (S. 3181) as reported by the Senate appropriations committee makes available about \$6.28 billion for the Coast Guard's Operating Expenses (OE) account, provided, among other things, "that notwithstanding any other provision of law, \$4,000,000 of the amounts made available under this heading may be available to maintain the USCGC POLAR STAR in caretaker status...."

The Senate Appropriations Committee, in its report (S.Rept. 110-396 of June 23, 2008) on S. 3181, states:

#### **POLAR ICEBREAKERS**

The Committee reiterates its concern with the Coast Guard's ability to meet its current and projected polar operations responsibilities. According to correspondence from the Commandant on May 23, 2008, the Coast Guard will submit a report on polar mission requirements no later than August 31, 2008. The Committee expects this report to address the concerns detailed in the explanatory statement accompanying the Department of

Homeland Security Appropriations Act, 2008. The Committee also expects all costs to operate the polar icebreakers for National Science Foundation [NSF] research, including unanticipated maintenance, will be reimbursed by NSF. However, the Committee notes that the NSF budget request states, “Effective with the fiscal year 2009 budget, NSF will no longer provide funds to maintain the USCGC Polar Star in caretaker status because NSF does not envision current or future use of this vessel in support of its mission.” Due to the changing environmental conditions and increased activity in the polar regions, as well as the Coast Guard’s multi-mission responsibilities in the polar regions that are not science related, the Committee includes statutory language making an additional \$4,000,000 available to maintain the USCGC Polar Star in caretaker status. The Committee also notes that the forthcoming report on Coast Guard polar mission requirements will address the sustainability of the current operations and maintenance cost sharing arrangement between the Coast Guard and the NSF to support both current and projected polar icebreaker operations. (Page 81)

## **Compromise**

The FY2009 DHS appropriations bill became Division D of H.R. 2638/P.L. 110-329 of September 30, 2008, a consolidated appropriations act. H.R. 2638 began as a DHS appropriations act and was then amended to become a consolidated appropriations act that contained that includes, among other things, the FY2009 DHS appropriations act. In lieu of a conference report, there was a compromise version of H.R. 2638 that was accompanied by an explanatory statement. Section 4 of H.R. 2638 states that the explanatory statement “shall have the same effect with respect to the allocation of funds and implementation of this Act as if it were a joint explanatory statement of a committee of conference.”

H.R. 2638 provides \$30.3 million for polar icebreaker sustainment. The funding is provided in a new line item in the surface ships section of the Deepwater portion of the Coast Guard’s Acquisition, Construction, and Improvements (AC&I) appropriation account. The explanatory statement states:

### **Polar Icebreakers**

One of the Coast Guard’s missions is to provide the United States with the capability to support national interests in the polar regions. In a report recently submitted, the Coast Guard stated that the United States will need a maritime surface and air presence in the Arctic sufficient to support prevention and response regimes as well as diplomatic objectives. However, no funding has been requested for the Coast Guard’s aging icebreakers despite its inability to meet current and projected polar operations mission responsibilities. The Coast Guard is directed to follow House report direction regarding the polar icebreaking operating budget. The Coast Guard should work with the National Science Foundation in the coming year to renegotiate the existing polar icebreaking agreement in order to return the budget for operating and maintaining its polar icebreakers to the Coast Guard in fiscal year 2010. The AC&I appropriation includes \$30,300,000 to reactivate the USCGC POLAR STAR for an additional 7-10 years of service life.

## **Coast Guard Authorization Act For FY2008 (H.R. 2830/S. 1892)**

### **House**

Section 422 of H.R. 2830 as passed by the House states:

**SEC. 422. ASSESSMENT OF NEEDS FOR ADDITIONAL COAST GUARD PRESENCE IN HIGH LATITUDE REGIONS.**

Within 270 days after the date of enactment of this Act, the Secretary of the department in which the Coast Guard is operating shall submit a report to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives assessing the need for additional Coast Guard prevention and response capability in the high latitude regions. The assessment shall address needs for all Coast Guard mission areas, including search and rescue, marine pollution response and prevention, fisheries enforcement, and maritime commerce. The Secretary shall include in the report—

- (1) an assessment of the high latitude operating capabilities of all current Coast Guard assets, including assets acquired under the Deepwater program;
- (2) an assessment of projected needs for Coast Guard forward operating bases in the high latitude regions;
- (3) an assessment of shore infrastructure, personnel, logistics, communications, and resources requirements to support Coast Guard forward operating bases in the high latitude regions;
- (4) an assessment of the need for high latitude icebreaking capability and the capability of the current high latitude icebreaking assets of the Coast Guard, including—
  - (A) whether the Coast Guard’s high latitude icebreaking fleet is meeting current mission performance goals;
  - (B) whether the fleet is capable of meeting projected mission performance goals; and
  - (C) an assessment of the material condition, safety, and working conditions aboard high latitude icebreaking assets, including the effect of those conditions on mission performance;
- (5) a detailed estimate of acquisition costs for each of the assets (including shore infrastructure) necessary for additional prevention and response capability in high latitude regions for all Coast Guard mission areas, and an estimate of operations and maintenance costs for such assets for the initial 10-year period of operations; and
- (6) detailed cost estimates (including operating and maintenance for a period of 10 years) for high latitude icebreaking capability to ensure current and projected future mission performance goals are met, including estimates of the costs to—
  - (A) renovate and modernize the Coast Guard’s existing high latitude icebreaking fleet; and
  - (B) replace the Coast Guard’s existing high latitude icebreaking fleet.

**Senate**

Section 917 of S. 1892 as reported in the Senate states:

**SEC. 917. ICEBREAKERS.**

(a) **IN GENERAL**—The Secretary of the department in which the Coast Guard is operating shall acquire or construct 2 polar icebreakers for operation by the Coast Guard in addition to its existing fleet of polar icebreakers.

(b) **NECESSARY MEASURES**—The Secretary shall take all necessary measures, including the provision of necessary operation and maintenance funding, to ensure that—

(1) the Coast Guard maintains, at a minimum, its current vessel capacity for carrying out ice breaking in the Arctic and Antarctic, Great Lakes, and New England regions; and

(2) any such vessels that are not fully operational are brought up to, and maintained at full operational capability.

(c) **REIMBURSEMENT**—Nothing in this section shall preclude the Secretary from seeking reimbursement for operation and maintenance costs of such polar icebreakers from other Federal agencies and entities, including foreign countries, that benefit from the use of the icebreakers.

(d) **AUTHORIZATION OF APPROPRIATIONS**—There are authorized to be appropriated for fiscal year 2008 to the Secretary of the department in which the Coast Guard is operating such sums as may be necessary to acquire the icebreakers authorized by subsection (a), as well as maintaining and operating the icebreaker fleet as authorized in subsection (b).

The Senate Commerce, Science, and Transportation Committee, in its report (S.Rept. 110-261 of February 5, 2008) on S. 1892, states:

Section 917 would require the Secretary to acquire or construct two new polar icebreakers for operation by the Coast Guard. It also would instruct the Coast Guard to maintain their existing polar icebreakers and return them to operational status, if not operational already. This section would authorize such sums as are necessary to carry out this section. Currently, the Coast Guard's icebreaker fleet is funded by the National Science Foundation. However, the funding for these vessels has been inconsistent, allowing the Polar Star to fall behind on the maintenance necessary to keep the vessel in operating condition. With some climate models predicting an ice-free Arctic summer in the future, more international expeditions will be headed to the region to examine newly revealed oil and gas reserves and other natural resources. Canada, Russia, and other countries will begin to compete with the United States over jurisdiction and, without a strong polar icebreaker fleet, our Nation will suffer a severe disadvantage. A recent 2007 report by the National Academy of Sciences found that the United States needs to maintain polar icebreaking capacity and construct at least two new polar icebreakers. This provision follows those recommendations. (Page 29)

In presenting the CBO's estimate of the cost of Section 917 of S. 1892 as reported, the report states:

Assuming appropriation of the necessary amounts, CBO estimates that the USCG would spend about \$1.4 billion over the next five years to purchase two icebreakers. (Costs to operate and maintain the two new vessels would total about \$50 million a year beginning in 2013.) We estimate that an additional \$50 million would be spent over the 2008-2010 period to recondition an existing USCG icebreaker, which is currently out of operation. Operating and maintaining that vessel would cost about \$10 million in 2010 and about \$25 million annually thereafter. This estimate is based on information provided by the Coast Guard regarding the cost of constructing, operating, and maintaining such vessels to agency specifications. (Page 8; see also pages 6 and 7)

## **FY2008 Consolidated Appropriations Act (H.R. 2764/P.L. 110-161)**

FY2008 funding for the Department of Homeland Security (DHS), which includes the Coast Guard, was provided in the FY2008 Consolidated Appropriations Act (H.R. 2764/P.L. 110-161 of December 26, 2007). The explanatory statement for H.R. 2764/P.L. 100, which is intended to be the equivalent of a conference report for the bill, states the following in its discussion of Division E (the FY2008 DHS appropriations act):

### National Interests in the Polar Regions

The Committees on Appropriations are concerned about Coast Guard's ability to meet its polar operations mission requirements and provide the United States with the capability to support national interests in the polar regions. These mission requirements include, but are not limited to: global reach to the North and South poles; monitoring of U.S.-bound vessel traffic transiting international waterways in the far north; support of the International Ice Patrol; and support of other governmental and scientific organizations in pursuit of marine and atmospheric science activities in the polar regions. The Committees on Appropriations are specifically concerned whether Coast Guard's aging polar icebreaking fleet can meet current mission performance goals and whether this fleet and the service's small cadre of specialized polar operations personnel are capable of meeting projected mission performance goals in light of changing environmental conditions and increased activity in the polar regions. The National Academy of Sciences made several recommendations in this regard in September 2006, but the Administration has taken no action to implement those recommendations.

Therefore, the Commandant is directed to submit a comprehensive polar operations report that fully assesses the Coast Guard's ability to meet current and projected polar mission requirements and includes an evaluation of how Coast Guard's current capabilities and resources must be adapted or enhanced to account for changing environmental conditions and increased activity in the polar regions. This report is to include an analysis of the need for any permanent, forward operating presence in the polar regions in order to meet mission requirements and an assessment of the Coast Guard's ability to meet the requirements of partner agencies operating in the polar regions, such as the National Science Foundation (NSF) and the Departments of Commerce and Defense, under current and projected environmental conditions. Finally, this report should include an appraisal of the sustainability of the current operations and maintenance cost sharing arrangement between the Coast Guard and NSF to support both current and projected polar icebreaker operations.

## Appendix B. Funding Arrangement with NSF

This appendix presents additional discussion of the current arrangement under which the NSF funds the operation and maintenance of Coast Guard polar icebreakers.

### Excerpts from 2007 NRC Report<sup>42</sup>

The 2007 NRC report discusses the origins and features of the funding arrangement as follows:

Budget base transfers in the 1970s and 1980s placed annual funding resources in the budgets of agencies with programs benefiting from icebreaker support in that era, including the Department of Defense, National Science Foundation, and Maritime Administration. Memoranda of Agreement (MOAs) implemented these budget transfers to the U.S. Coast Guard by providing for incremental reimbursement of deployment-related expenses (primarily fuel and other consumables) back to the U.S. Coast Guard. Although the U.S. Coast Guard retained a budget base for icebreaker crews, maintenance, training, and other support to ensure that ships were ready for operations, it did not have budget authority to specifically deploy icebreakers in support of U.S. Coast Guard mission responsibilities. Changes in programs and levels of user agency funding resulted in the decommissioning of older icebreakers in the late 1980s, and some changes were made in the reimbursement formula, but the general concept of agencies “buying” operational icebreaker days continued until 2005.

In preparing the President’s budget for fiscal year 2006, the Office of Management and Budget (OMB) transferred budget authority for the polar icebreakers from the U.S. Coast Guard to the National Science Foundation (NSF), while the U.S. Coast Guard was to retain custody of the polar icebreakers and continue to operate and maintain this fleet. Congress enacted this one-time transfer of \$48 million from the U.S. Coast Guard to NSF, which was intended to offset all direct costs associated with the polar icebreaking program, including personnel, training, operation, and maintenance. These funds constitute the U.S. Coast Guard’s entire noncapital budget for polar icebreakers. This amount, however, was essentially less than two-thirds of the \$65 million to \$75 million... that the U.S. Coast Guard estimated it would cost to maintain the ships. Congress finalized the transfer of funds in Conference Report H.Rept. 109-272 between the House and Senate Appropriations Subcommittees that are responsible for NSF.

According to briefings received from OMB budget examiners (October 7, 2005), this action was based on the fact that the vast majority of icebreaker ship time has been employed for scientific research. The availability and readiness of the polar icebreakers to address other national needs such as law enforcement, marine pollution response, search and rescue, providing a U.S. presence, and defense operations was not cited as a factor in the decision to transfer the ships to NSF.

With this transfer, NSF assumed control of the polar icebreaker program, and an MOA between the U.S. Coast Guard and NSF regarding polar icebreaker support and reimbursement was established in August 2005. The purpose of this MOA is to “implement the [then proposed] budget base transfer for use of the U.S. Coast Guard icebreakers for

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<sup>42</sup> National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007. 122 pp.

scientific and operational support for all planned U.S. Coast Guard operations for FY 2006 and beyond.”

Under the 2005 MOA, NSF agrees to consider all national priorities and maintenance requirements when allocating the limited budget. In addition, NSF will identify icebreaker mission needs for the succeeding fiscal year to the U.S. Coast Guard. The responsibilities of the U.S. Coast Guard under this agreement are scheduled on an annual basis by NSF. The U.S. Coast Guard has agreed to provide support staff and services necessary to operate and maintain the polar icebreaker fleet and to inform NSF of secondary polar icebreaker missions as they occur. These missions include the traditional U.S. Coast Guard missions of the polar icebreakers (search and rescue, enforcement of laws and treaties) that were conducted as needed and funded from the base funding. Under this agreement, the U.S. Coast Guard will continue to perform these missions (as needed), and NSF will continue to fund these missions from the program base that was transferred to NSF in FY 2006. In addition, if a situation arises that requires long-term polar icebreaker involvement (major marine pollution or humanitarian relief efforts), then funding and scheduling impacts will be coordinated between the U.S. Coast Guard and NSF.<sup>43</sup>

In commenting on this funding arrangement and making recommendations for the future, the report states:

The recent transfer of budget authority for the polar icebreaking program by the Office of Management and Budget (OMB) from the U.S. Coast Guard to NSF did not address the basic problem of underfunding routine maintenance or providing funds for U.S. Coast Guard non-science icebreaker missions. The transfer has increased management difficulties by spreading management decisions related to the polar icebreakers across two agencies.

The NSF now has fiscal control over all direct costs associated with the polar icebreaking program, including personnel, training, operation, and maintenance costs. Under a Memorandum of Agreement negotiated between the U.S. Coast Guard and NSF, the U.S. Coast Guard must submit a yearly plan for approval by the NSF. The NSF is now fiscally responsible, and making decisions, for missions outside its core mission and expertise. Without budget authority, the U.S. Coast Guard has been put in a situation in which it has the role of operating a ship for which it does not have full budget and management control.

The committee believes that the total set of U.S. Coast Guard icebreaking missions transcends the mission of support to science, despite the fact that the majority of icebreaker usage at the current time is to support research. The U.S. Coast Guard should have the funds and authority to perform the full range of mission responsibilities in ice-covered waters of the Arctic. There is strong evidence that national need for polar icebreaking in the Arctic will increase over the next several decades. Orders for commercial ice-strengthened tankers will double the worldwide fleet of these vessels. Most are slated to operate in the western Arctic along the Northern Sea Route, but expansion of hydrocarbon development activities to the Alaskan North Slope and Canadian Beaufort Sea is proceeding. With this added human presence, a robust U.S. Coast Guard polar icebreaker fleet will be needed for regular patrols of our coastal waters to increase U.S. presence in international Arctic waters. This will require resumption of regular patrols of coastal waters and an increased U.S. presence in international Arctic waters by the nation’s multimission icebreaker fleet. It is not sufficient to provide funds to only maintain the fleet; it is necessary to provide funds to operate it effectively. The committee strongly believes that management responsibility should be aligned with management accountability.

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<sup>43</sup> Ibid, pp. 14-15. Bracketed material as in original.



When NSF, NOAA, or another “user” agency employs a U.S. Coast Guard icebreaker to support some directed activity, the user agency should pay only incremental costs associated with direct mission tasking. This arrangement has worked well for decades, although it would be useful for the financial arrangement to be clarified and reasserted by the administration. If the U.S. Coast Guard is funded to operate a vessel, then direct tasking reimbursement would typically include the cost of fuel for extended transit beyond patrol, and on-ship engineering and habitation costs that derive from research activities. The committee distinguishes between direct mission tasking of a science voyage and science of opportunity where scientists or educators are aboard at the invitation of the U.S. Coast Guard on voyages planned for Coast Guard patrol missions. The committee encourages the U.S. Coast Guard to invite researchers and educators on planned patrols to conduct science of opportunity. Only direct tasking should result in reimbursement to the U.S. Coast Guard above its congressionally appropriated operational funds.

Recommendation 6: The U.S. Coast Guard should be provided sufficient operations and maintenance budget to support an increased, regular, and influential presence in the Arctic. Other agencies should reimburse incremental costs associated with directed mission tasking.<sup>44</sup>

## Excerpts from July 16, 2008, Hearing

### Coast Guard Testimony

The prepared statement of Admiral Thad Allen, Commandant of the Coast Guard, for the July 16, 2008, hearing on Coast Guard icebreaker needs stated in part:

#### **Funding Arrangement with the National Science Foundation (NSF)**

In 2006, the Department of Homeland Security’s Appropriations Act transferred the Coast Guard’s \$47.5 million in budget authority for Polar icebreaking to NSF. Through a Memorandum of Agreement (MOA), NSF later funded a total of \$55.2 million in FY 2006 and \$52.1 million in FY 2007 for the vessels. The FY 2008 appropriation to NSF is \$57.0 million.

While Polar-class icebreakers primarily provide support to NSF and other agency’s research missions, the current Coast Guard-NSF MOA gives the Coast Guard a reasonable ability to divert these vessels to search and rescue, oil spill and other missions to respond to emergencies and threats to maritime safety and security. We are working closely with NSF and the Administration to ensure preservation and efficacy of our Nation’s critical icebreaking capabilities and competencies. To prepare for the impacts of changing Arctic conditions on multiple agencies and their missions, the Administration has undertaken an Arctic policy review in which the Coast Guard is an active participant.<sup>45</sup>

During the question-and-answer portion of Admiral Allen’s testimony, the following exchange occurred:

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<sup>44</sup> Ibid, pp. 101-102. Similar passages appear on pages 10 and 111.

<sup>45</sup> Department of Homeland Security, U.S. Coast Guard, Statement of Admiral Thad W. Allen, Commandant, on Coast Guard Icebreaking, Before the Subcommittee on Coast Guard and Maritime Transportation, Committee on transportation and Infrastructure, U.S. House of Representatives, July 16, 2008, p. 6.

**Representative LaTourette:** Relative to the Polar icebreakers and this issue of the National Science Foundation—and, again, in my opening remarks, I mentioned the contract that they’ve entered into with the Swedes—did you have an observation or an opinion as to what the impact of having the National Science Foundation basically have the budget authority for the icebreakers does to the service relative to dollar impact, administration, running of the ships?

**Admiral Allen:** Well, I’ve said on several occasions and in prior hearings, and I will restate it here, the current situation, while well-intended when it was created, is somewhat dysfunctional in regards to how we have to manage this, because it puts a huge, enormous management burden on the National Science Foundation, that puts almost an evidentiary responsibility on the Coast Guard to demonstrate what we intend to do with the vessels, so they can certify what the funds are being used for and they’re adequately being spent.

And I don’t begrudge them a bit for doing that, but it is very, very cumbersome.

**Representative LaTourette:** If they, in fact, had not entered into the agreement with the Swedes [for the use of an icebreaker], would those have been funds available to the Coast Guard for the use of your assets?

**Admiral Allen:** At the start of every year, we come up with an operating plan. And there’s a certain base amount of money that is provided in the National Science Foundation budget, and I’ll let Dr. Bement speak to that. We provide them a plan. They approve the plan. And that is the source of the funds that are transferred from the National Science Foundation to the Coast Guard.

And it varies from year to year based on the amount of operations we’re conducting and the maintenance required on the ships.

**Representative LaTourette:** And do those funds in that budget that you lay out at the beginning of the year, are those funds always sufficient to the cost incurred by the Coast Guard for those missions?

**Admiral Allen:** Well, there’s been an ongoing issue about whether or not, as ships get older—and this is not just to do with icebreakers, it could be any ship you’re talking about—they become more expensive as they get older.

There probably is an added issue of an inflation factor and the ability to keep up with the demands for maintenance on the ships.<sup>46</sup>

Later in the question-and-answer portion of Admiral Allen’s testimony, the following exchange occurred:

**Representative Larsen:** I understand that Polar Sea completed a deployment to the waters in April and May, primarily for the purpose of renewing the crew’s qualifications. Can you tell us what sort of missions the Polar Sea performed, what it accomplished and whether or not the crew was able to fully renew their qualifications?

**Admiral Allen:** Sir, we moved out into the—through the Gulf of Alaska through the Aleutian Chain up into the Bering Sea. We did fisheries patrols, did what we would call

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<sup>46</sup> Source: Transcript of hearing.

Arctic Domain Awareness—just up there sensing what’s going on, an idea for the amount of vessel traffic.

We did science of opportunity. We did some—got into the very, very light ice areas there.

It was good. We needed to do it. I’m glad we did it. I appreciate the National Science Foundation support on doing that.

I wish we could have done more. I wish we could have got deeper into the ice and spent a longer time there, because these competencies atrophy over time, and I am concerned that at a certain point, there won’t be a baseline level of competency to operate these ships, which we’re going to need to do in the future.

But there are constraints put on the operation of Polar Sea by the agreements with the National Science Foundation. We did what we could.

**Representative Larsen:** What constraints are on it?

**Admiral Allen:** Well, we pre-negotiate how much we’re going to use the ship. There’s a matter of risk, if you get into the ice and you have some wear and tear, or you have issue with the propeller, or things that need to be done, number one, that increases cost or the risk that the vessel might not be available next year when it’s going to be in standby for the contracted icebreaker for the McMurdo breakout.

**Representative Larsen:** So then, when the crew’s not able to fully renew their qualifications, in your view?

**Admiral Allen:** Well, they atrophy at a time—we’re OK right now, but that’s the reason I’m trying to press forward with a sense of urgency. We kind of have to get this resolved. Otherwise, we’re going to lose our seed corn.

**Representative Larsen:** And so, it sounds to me like they weren’t able to fully renew their qualifications.

**Admiral Allen:** We would have liked to have done more. Yes, sir.

**Representative Larsen:** So, what does it take to do more?

**Admiral Allen:** Well, I think we need to continue to work on the management issues associated with it, and arrive on a consensus on how we can sustain the current fleet and the competencies in the Coast Guard and still meet the requirements of the National Science Foundation. It’s going to have to be a collaborative effort, sir.

**Representative Allen:** It sounds like you need a collaborative effort, but it also sounds like those limitations are preventing you from achieving your mission.

**Admiral Allen:** I’m concerned about our readiness eroding. Yes, sir.<sup>47</sup>

Still later in the question-and-answer portion of Admiral Allen’s testimony, the following exchange occurred:

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<sup>47</sup> Source: Transcript of hearing.

**Representative Coble:** As I understand it, Mr. Chairman, in 2006, Congress transferred budget authority for polar icebreaking to the National Science Foundation. And they, in turn, reimburse the Coast Guard for operations.

It is furthermore my understanding that the NSF has begun to contract with foreign icebreaking companies to fulfill their needs in the Arctic. And I want to ask you a couple of questions in a just a minute, Admiral.

But to conclude, Mr. Chairman and my colleagues, I have a keen interest in icebreaking. And I'm subjectively involved, because I used to be stationed aboard a Coast Guard cutter. I'm sure, Admiral, she's long been decommissioned. I don't know where she is now.

But I would like to encourage our committee, Mr. Chairman, to continue to review the shared responsibilities between the National Science Foundation and the Coast Guard with regard to polar icebreaking. While I support the mission of both agencies, I question whether the current funding mechanisms best fit the respective needs of the two organizations.

And Admiral Allen, what I want to do, I want to put a three-part question to you. And I'm going to probably have to abruptly leave to go back to Judiciary. But my questions to you, Admiral, are:

Has this procedure that I just described affected your operations and readiness of the polar icebreaking fleet, A?

B, does the current funding arrangement with the National Science Foundation allow for adequate maintenance of the polar icebreaker fleet, B?

And C, what are the long-term implications of continuing this funding arrangement?...

**Admiral Allen:** There is an issue with current readiness, and it's not a—let me say it up front here. I have all the respect in the world for Dr. Bement [of the NSF], and we're good friends and we're colleagues. I think we're both in a really tough situation here.

Any time you have one of the three icebreakers that this country operates through the Coast Guard that have been validated by an external study by the National Research Council in a commission special status, you have a readiness problem.

So, is there a readiness problem? Yes, there is, sir.

That vessel [Polar Star] is tied up. It's got a caretaker crew on it. We're making sure the machinery could be brought back in a year or so, if it was needed.

But we've had divers down looking at the hull. We have problems with the zinc anodes that are on there that protect against corrosion. There's marine growth on it.

So, even the readiness of the vessel that's laid up continues to be an issue with us.

Is this adequate in the long term? Obviously, it's not. We need three polar icebreakers to operate in this country, and one is laid up.

And in the long term, my goal is to stabilize what's going on right now and make sure we keep the Polar Star where it's at pending the policy resolutions that will lead us to a long-term solution.

But our readiness now is not what it should be. I don't believe it's adequate, and we have to have a long-term fix, sir.<sup>48</sup>

Still later in the question-and-answer portion of Admiral Allen's testimony, the following exchange occurred:

**Representative Cummings:** And so, when you say long range—you said maybe we ought to have a long-range plan—I guess what I'm trying to get to is that, in the short range, right now, we do have a problem then.

**Representative Allen:** Yes, sir. And it's because the effort and the money that's being transferred is sized to support the science mission, not all the missions we need to do, sir.

**Representative Cummings:** I see. And...

**Admiral Allen:** I think Dr. Bement would tell you we're just fine where we're at, and I understand where he sits on that. But I've got other things I have to do out there.

**Representative Cummings:** You'd rather not be sharing any efforts with the National Science Foundation.

**Admiral Allen:** No, I'd rather be supporting them completely without any money transfers...

**Representative Cummings:** Right.

**Admiral Allen:** ... and giving him what he needs, and then, with the capacity that I have, in addition to the science, be creating presence where we need to, based on the evolving mission, sir.<sup>49</sup>

Still later in the question-and-answer portion of Admiral Allen's testimony, Representative Richardson asked Admiral Allen if he agreed with certain findings of the 2007 NRC report. When Representative Richardson asked whether he agreed with a finding that "the U.S. Coast Guard should be provided sufficient operations and maintenance budget to support an increase in regular and influential presence in the Arctic," Admiral Allen replied:

Well, that's a two-part question, because currently, the maintenance money resides with the National Science Foundation. Without prejudice, I believe the money should be in the Coast Guard base [budget], and we should operate it. But that's a policy decision to be made.<sup>50</sup>

## **NSF and U.S. Arctic Commission Testimony**

The July 16, 2008, hearing on Coast Guard icebreaker needs also included testimony from Dr. Arden Bement, Jr., Director of the NSF, Mead Treadwell, Chair of the U.S. Arctic Commission, and James Weakley, President of the Lake Carriers' Association and Vice President of the Great Lakes Maritime Task Force. During the question-and-answer portion of their testimony, which followed Admiral Allen's testimony, the following exchange occurred:

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<sup>48</sup> Source: Transcript of hearing.

<sup>49</sup> Source: Transcript of hearing.

<sup>50</sup> Source: Transcript of hearing.

**Representative Cummings:** I want to first of all go to you, Mr. Bement, and to you, Mr. Treadwell, regarding the Polar Sea's most recent mission to the Arctic. Can either of you comment on why the vessel did not go further north than it did?

**Dr. Bement:** Yes. Our procedure in working with the Coast Guard to allocate the—or not to exceed budget that we get from the Congress, which this past year was of the order of \$54 million—is that we provide to the Coast Guard a set of requirements, operating requirements.

They, in turn, take those requirements and give us an operating plan, plus costs, for O&M [operation and maintenance] costs as well as normal operating costs. We negotiate that plan and finally come up with a settlement, which then gets transferred to the Coast Guard for operations.

In the case of the Polar Sea and operating in the Arctic, most of those operations were to requalify crewmen for certification for operations.

We felt at the time of our negotiations with the Coast Guard—and we came to agreement—that taking the Polar Sea into deep ice was risky, because of the possibility of serious damage, so that it seemed to be more prudent to transfer crewmen who needed to be certified for ice operations to the Healy, since the Healy was operating in deep ice.

Those crewmen did achieve their service on the Healy. They did get certified. So, as an alternative set of conditions, that seemed to be the best decision we could arrive at, at that time.

**Representative Cummings:** So the—basically, because the Polar Sea is old, you were concerned?

**Dr. Bement:** Well, we usually have the Polar Sea for backup service. And in many cases, you need two ships, because it's hard enough from season to season how thick the ice is going to be. And if the ice is sufficiently thick, you need a backup vessel. Also, if one of the ships gets damaged, you need the backup vessel to take over the operation.

If the Polar Sea, operating on its own in the Arctic, had gone into deep ice and had undergone serious damage that required lengthy maintenance, that would almost knock out all capability for icebreaking in the Antarctic for another year, or perhaps longer.

So, we've been trying to not only deploy our assets, but also to protect our assets in the most prudent way, by not putting them in risk where other alternatives would serve. So, that was the basis for our decision.

**Representative Cummings:** Did you have a comment, Mr. Treadwell?

**Mr. Treadwell:** I—we've talked to the Coast Guard and we've talked to the National Science Foundation, and I have no contradiction with what Dr. Bement has said.

What I will say is that, if we're in a situation where we can't put our Polar Class icebreaker into the ice, because we're afraid we'll break it, that's probably prima facie evidence that we need a new icebreaker. And because we probably should have two backing it up, I think that particular episode is a very good piece of evidence for Congress to take action on this issue.<sup>51</sup>

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<sup>51</sup> Source: Transcript of hearing.

## Appendix C. NSF Use of Coast Guard vs. Other Polar Icebreakers

This appendix presents excerpts from the July 16, 2008, hearing on Coast Guard icebreaking needs that relate to the question of the NSF's use of Coast Guard polar icebreakers versus other polar icebreakers to support its research activities.

### Excerpts from NSF Statement for July 16, 2008, Hearing

The prepared statement of Dr. Arden Bement, Jr., Director of the NSF, for the July 16, 2008, hearing on Coast Guard icebreaker needs stated in part:

NSF responsibilities in the Arctic and in Antarctica take somewhat different forms, and with the Committee's indulgence I'll explain briefly how they differ with respect to icebreaker requirements. *But in both cases the question of how best to meet those responsibilities boils down to consideration of three factors: cost, performance, and policy.*

#### NSF REQUIREMENTS IN THE ARCTIC

NSF supports research on the Arctic Ocean, atmosphere, and land areas, including marine and terrestrial ecosystems and their relationships to the well-being of local populations. In addition to research in individual disciplines, support is provided for interdisciplinary approaches to understanding the Arctic region, including its role in global climate. Over the last decade, changes have been measured in the distribution of polar ice cover, in atmospheric composition, Arctic Ocean conditions, some terrestrial parameters, as well as in northern ecosystems. Residents of the North are seeing these environmental changes affect their lives. It is important to determine whether these changes correlate to a short-term shift in regional atmospheric or ocean processes or whether they are the result of longer-term global change.

In the Arctic, science on land and in coastal areas tends to be based at a few sparsely distributed, remote outposts, and in many cases access by ship is the most advantageous means, even for projects that are not inherently oceanographic. In its few years of service, the Coast Guard icebreaker *Healy* has supported research in a variety of areas including biology, sea ice, marine geology and geophysics, cartography, physical and chemical oceanography and atmospheric science.

As research has advanced and become more technologically sophisticated, NSF has increasingly relied on coordinated international multi-ship expeditions to access the Arctic region and laboratory facilities. For example, while the USCGC *Healy* does have the capability to work alone in the deep Arctic during summer, any vessel by itself is more risky, making multi-ship arrangements necessary in lieu of an icebreaker research platform with more robust capabilities. The USCG *Polar Sea* and *Polar Star* have sufficient icebreaking capability to operate in the deep Arctic, but they have limited research capabilities, by design, and have been needed in the Antarctic. International collaborations also have become necessary, as the demands for research aboard the *Healy* have intensified. Recent international partnerships with Sweden involving their icebreaker, the *Oden*; and with Germany and their icebreaker, the *Polarstern*; have been highly successful, as have collaborations by NSF, National Oceanic and Atmospheric Administration (NOAA) and other agencies with various Canadian, Chinese, Russian and other ships.

### **Arctic Requirements: Ship Cost and Reliability**

According to information provided by the Coast Guard, over the past decade NSF has typically used approximately 90 percent of the 185-200 days current USCG deployment standards allow *Healy* to spend at sea. Science programs are limited by the ship time available on the USCGC *Healy* and also by the number of berths available for science. *Healy* can accommodate up to 50 scientific personnel in addition to its operational Coast Guard crew of about 80. Other nations' research icebreakers with comparable icebreaking capability typically operate with crews half the size of *Healy*'s, with comparably greater numbers of scientist berths.

The *Healy* also faces limitations in its icebreaking capacity, especially during the spring when the ice coverage north of Alaska has been thick enough in some years (2004, 2005) to beset the ship for several days.

Under the current arrangement, NSF is responsible for funding *Healy* operations and maintenance while the Coast Guard is responsible for operating the ship and carrying out its maintenance program. Coordination between the two agencies is arranged under an MOA in which NSF provides the Coast Guard with a set of operational requirements annually based on an interagency call for icebreaker needs and the Coast Guard responds with an operational plan and cost estimate based on those requirements. Total *Healy* costs are approximately \$24 million annually, or about \$130,000 per day at sea in 2007.

I will return to the issues of cost, availability and policy shortly.

Plans have been underway for several years to construct a new ice-strengthened ship that could support scientific studies in the waters around Alaska. NSF has assigned high priority to building this ship, the Alaska Region Research Vessel (ARRV), and construction funds were included in the President's FY08 budget request for acquisition planning. It is estimated that it will take 2.5 years to construct and deploy the ship once a shipyard contract has been issued. The ship will be operated by the University-National Oceanographic Laboratory System (UNOLS) which operates a number of research vessels. The ARRV, which will replace the *Alpha Helix*, will be designed to work in up to 3 feet of ice. The ARRV will thus be able to conduct research cruises year round in the Gulf of Alaska and the southern Bering Sea; and in the summer, as far north as the Chukchi and Beaufort Seas during minimum ice cover. During heavy ice periods in the Bering Sea, the ARRV would probably need the assistance of the *Healy*. Estimated operating costs are about \$20K—\$30K/day. Arctic sea ice has diminished significantly since the ARRV design was established and thus ARRV's reach now extends farther into the Arctic Ocean than had been anticipated, making the ship even more valuable to the research community.

Finally, we need better access to the deep ocean in the Arctic. Options for supporting research in the deep Arctic should be integral to any study of future icebreaker needs.

In conclusion, the *Healy* is a capable and relatively new ship that can be the mainstay of U.S. Arctic Ocean research for years to come. However, under the current operational model the operating costs are significantly higher than non-military research icebreakers and its capability as an all-seasons deep arctic research platform is also limited.

### **NSF REQUIREMENTS IN ANTARCTICA**

NSF provides approximately 85 percent of the U.S. funding for fundamental research in the Antarctic and the southern ocean. This research addresses a wide array of topics across many disciplines. For instance, researchers are studying topics as wide-ranging as the evolution of the ozone hole; the impact of extreme environments on gene expression; the effects of



ultraviolet radiation on living organisms; the relationship between changes in the ice sheet and global sea level; global weather, climate, and ocean circulation; the role of Antarctica in global tectonics and the evolution of life through geologic time; and the early evolution of our universe, as well as its current composition.

This research requires access to ships serving *two quite different functions*: multi-purpose icebreakers that can operate in the Southern Ocean as research platforms that also resupply our coastal Palmer Station on the Antarctic Peninsula; and heavy-duty icebreakers that can open a resupply channel through fast ice to McMurdo Station. From McMurdo, supplies are transferred to the U.S. research station at the South Pole and to temporary remote field stations at various points on the continent. These two requirements are met in quite different ways.

### **Antarctic Ship-Based Research Platforms: Ship Cost, Availability and Policy**

U.S. Antarctic Program ship-based research and Palmer Station resupply depend primarily on two privately-owned vessels, the *Laurence M. Gould* (LMG) and the *Nathaniel B. Palmer* (NBP).

The NBP is leased by NSF's prime contractor, currently Raytheon Polar Services Company (RPSC), from the Louisiana-based shipping company, Edison Chouest Offshore (ECO). The vessel was built to specifications developed on the basis of input from the science community. The ship is an ABS A2 icebreaker capable of breaking 3 feet of level ice continuously at 3 knots, with 13,000 shaft horsepower and a displacement of 6,800 long tons. It is outfitted with all of the winches and A-frames necessary for deploying and retrieving oceanographic instrumentation. The vessel is fully outfitted with on-board oceanographic instrumentation and a networked computer suite, including multi-beam sonar, and has 5,900 ft<sup>2</sup> of lab space and 4,076 ft<sup>2</sup> of open deck space for oceanographic work and staging and a helicopter pad and hanger.

The NBP averages 300 days a year underway in support of science.

As is the case for the NBP, the *Laurence M. Gould* is leased by Raytheon from Edison Chouest Offshore (ECO). Also like the NBP, the vessel was designed and built on the basis of input from the science community. The ship is smaller than the NBP and has less ice breaking capability, as it was designed to operate in the more benign ice regions surrounding the Antarctic Peninsula. The ship is an ABS A1 ice-strengthened vessel with 4,600 shaft horsepower and a displacement of 3,400 long tons and can break one foot of level ice at a continuous 3 knots. It is fully instrumented with on-board oceanographic instruments and a networked computer suite. The LMG has the dual purpose of supporting oceanographic science and providing re-supply to Palmer Station, located on the Antarctic Peninsula. It should be noted, however, that the LMG will soon be at the end of its service contract. NSF recently issued a request for proposals to procure a replacement for the LMG.

The LMG averages 320 days a year underway in support of scientific research and associated logistics.

Annual costs for the NBP and LMG in 2007 were \$16.3M and \$7.5M, respectively, resulting in respective day costs of \$54.3K and \$23.4K for these ships.

### **Antarctic Station Resupply: Ship Cost, Reliability and Policy**

As noted above, the resupply of the McMurdo and South Pole Stations, as well as of temporary remote field stations in Antarctica, depends on gaining access to the McMurdo pier through the ice in McMurdo Sound. Since 1988 the channel was opened by one U.S.

Coast Guard Polar Class vessel (either the *Polar Star* or the *Polar Sea*), but more recently two icebreaking vessels have been needed due to extreme ice conditions and concerns about the reliability of the aging Polar Class vessels.

After opening the channel, the icebreaker escorts two resupply vessels, a government-owned tanker and a chartered freighter, to and from the ice pier at McMurdo. These resupply vessels are ice-strengthened vessels under the operational control of U.S. Transportation Command's (USTRANSCOM) Component Command, Military Sealift Command. (Military Sealift Command utilizes commercial contracts for construction, maintenance and staffing of vessels. As a result, MSC operates a fleet of cargo ships and tankers that are contractor-owned and operated or government-owned and contractor-operated.)

In FY05, acting on advice from the Coast Guard that a second icebreaker should be brought in to assist the *Polar Star* due to extreme ice conditions in McMurdo sound, NSF chartered the Russian icebreaker *Krasin* for the purpose. The Coast Guard's *Polar Sea* was undergoing repairs and no other U.S. icebreakers were available, as the *Healy* was needed in the Arctic to support research. It also lacks both the maneuverability and performance for the McMurdo break in. In FY06 the *Polar Sea* was undergoing extensive repair. NSF again chartered the Russian icebreaker *Krasin* and held *Polar Star* in reserve (and eventually brought it in to assist in the final stages of the break-in). The situation was similar in FY07. *Polar Sea* was ready for duty but the Coast Guard recommended that a backup vessel again be employed due to continuing extreme ice conditions. NSF therefore arranged to use a Swedish research icebreaker (the *Oden*) under the auspices of the U.S. - Sweden S&T Agreement, both to open the channel to McMurdo Station and to host a joint U.S. - Swedish research expedition aboard the ship in the Southern Ocean. *Polar Sea* assisted with the final stages of the McMurdo break in. Based on the excellent performance of *Oden* in FY07 and the success of the joint research program, NSF elected to use the *Oden* again in FY08, this time as the primary icebreaker, holding the *Polar Sea* in reserve where it could also respond to any needs for its services in the Arctic. The *Polar Sea* deployed to the Arctic in FY08 in order to maintain crew proficiency.

The USCG has performed its icebreaking mission in Antarctica with distinction for many decades, but with increasing difficulty in recent years. Its two Polar Class icebreakers are nearing the end of their estimated service lives and are becoming increasingly difficult and costly to keep in service. According to the USCG, there are several years of service life in the *Polar Sea*, but the *Polar Star* has now been placed in caretaker status per agreement with USCG in view of the decreasing need for her services and the high cost of putting her back into service. The need to rely, first on the *Krasin* and then on the *Oden* has already been mentioned as has the need to keep the *Polar Sea* available to meet the needs in the Arctic and perhaps as occasional backup for the annual McMurdo Station break-in. Given this state of affairs, NSF has given careful consideration to how best to meet the needs of the scientific community over the long-term.

Under the current arrangement between NSF and the Coast Guard, NSF provides all the funding for USCG icebreaker operations and maintenance in support of scientific research, and the Coast Guard carries out those duties. NSF provided just under \$54M for operation of the USCG polar class icebreakers in 2007. In addition, NSF provided approximately \$7.5 million out of its base budget for fuel and charter of *Oden*. When chartering commercial vessels such as the *Krasin* and the *Oden*, NSF pays only for the time that the ships are under charter.

#### **USE OF COMMERCIAL SHIPS AND MODELS/MODES OF OPERATION**

As noted above, NSF has met the research community's need for research platforms in the Southern Ocean through long-term contracts with private firms for ice-strengthened ships

and icebreakers and through partnerships that provide access to other country's research vessels. For resupply of McMurdo and South Pole Stations, NSF has depended until recently entirely on U.S. Coast Guard icebreakers secured through reimbursement arrangements, and on chartered Military Sealift Command capabilities. More recently, NSF has had to arrange for chartered vessels to complement USCG capabilities. In the Arctic, NSF has relied on the Coast Guard's *Healy* and on partnerships with other countries. Once constructed and commissioned, the Arctic Regional Research Vessel (ARRV) will significantly increase the capacity for ship-based research in the coastal Arctic regions and where ice cover is relatively thin.

A variety of models have been and are being used by the U.S and other countries for meeting polar icebreaker needs. The U.S. Coast Guard and the Chilean and Argentinean Navies operate their icebreakers using military personnel. Some countries build their ships to meet military specifications and others do not. The German research icebreaker, the *Polarstern*, is owned by the government but operated by a private contractor. The Swedish government's operational arrangements for the *Oden* are similar to the German model. Both the *Oden* and the *Polarstern* are able to operate more than 300 days annually as a consequence of ship design and mode of operation. The Arctic Regional Research Vessel (ARRV) will be operated by civilian crews under contract to the University-National Oceanographic Laboratory Systems (UNOLS).

As noted above, NSF employs a contractor to operate and maintain the privately-owned *Laurence M. Gould* and *Nathanial B. Palmer*. The ships were built under a long-term lease agreement between the ship-owners and the Federal government, such that the construction costs are partially amortized over the duration of the lease (with the ship reverting to the owner at the government's option at the end of the lease). These ships also operate more than 300 days annually.

Finally, and as noted previously, the Military Sealift Command meets its needs (and those of NSF's for transport to McMurdo Station) either through commercial charters for ships and crews, or through government-owned, contractor-operated arrangements.

## **MEETING FUTURE NEEDS**

International cooperation to provide icebreaker research platforms is expected to increase, both in arranging multi-ship expeditions and in sharing platforms. Certainly as Germany and the European community move forward in constructing the planned *Aurora Borealis*, NSF will work to establish mutually beneficial partnerships.

NSF's commitment to polar research and its responsibility for management of the U.S. Antarctic Program remains constant and therefore perpetuates the need for an icebreaker to open the shipping channel through the Ross Sea to enable resupply of the McMurdo and South Pole stations. Because opening the channel to McMurdo requires only a fraction of the time a modern icebreaker can operate annually, there may be interest among shipbuilders in providing icebreaker services to NSF under a contract in which the builder can lease the ship to others (other countries or private firms) during the remainder of the year.

An interagency working group co-led by the Department of State and the National Security Council is currently reviewing U.S. Arctic policy, and icebreaking needs will likely figure into the new policy. Clearly, the economics and efficiencies of the various acquisition and operating models merit further study and will depend on the suite of validated requirements put forth in the policy review. For research in the Arctic, the *Healy* should be a mainstay for many years to come, though its utility is restricted by its 200-day operational limitation. The *Healy's* inability to access the deep Arctic during periods of heavy ice cover is another

limitation. These limitations, combined with a military deployment mode, make the *Healy* as currently operated, a very expensive way to meet the needs of the research community.

And as noted above, once in service the *ARRV* will be a valuable additional resource for Arctic research.

For Antarctic research the issues are different. The two existing Coast Guard Polar Class ships are at or close to the end of their service life. The *Polar Star* is in caretaker status, and the *Polar Sea* is expensive to maintain relative to the costs for the use of foreign, non-military ice breakers over the past several years such as the Russian *Krasin* and Swedish *Oden*. The overriding question is how to open the channel through the ice to *McMurdo Station* so that year-round operation of the nation's *McMurdo* and *South Pole* stations can continue. This year-round occupation is central to demonstrating the "active and influential presence" which is the cornerstone of U.S. policy in Antarctica as articulated in Presidential Memorandum No. 6646 on U.S. Antarctic Policy and Programs (February 5, 1982). Other factors contributing to this presence are the 600 days annually that NSF's research vessels, the *LM Gould* and the *NB Palmer*, operate in Antarctic waters; the approximately twenty C-17 Air Force flights annually that fly passengers and cargo between New Zealand and *McMurdo*; and the more than 400 Air National Guard LC-130 flights annually that provide transportation for people and equipment throughout the continent. Furthermore, NOAA charters the Russian *R/V Yuzhmorgeologiya* approximately 100 sea days per year in support of its Antarctic program. This program focuses on living marine resources at the Antarctic Peninsula in support of U.S. interests at the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) to which the United States is signatory.

In considering how best to insure the continued annual resupply of *McMurdo Station* and to meet our responsibility for the entire U.S. Antarctic Program, NSF operates in accordance with U.S. Policy and the instructions contained in Presidential Memorandum No. 6646, that "Every effort shall be made to manage the program in a manner that maximizes cost effectiveness and return on investment."

The Arctic policy review will certainly help inform future icebreaker discussions, but even if a decision were made today to build or refurbish an icebreaker, it would be years before the ship got underway. Accordingly, to meet its ongoing requirements in a cost-effective means, NSF has made arrangements to lease an icebreaker from Sweden (NSF signed a 5-year agreement with Sweden for a joint research program in the Southern Ocean with Sweden additionally providing break in services for the USAP.). NSF sees a need to keep the USCGC *Polar Sea* available to meet needs in the Arctic and perhaps as occasional backup for the break-in to *McMurdo Sound*. This, however, is clearly only a short-term solution. With an eye looking to the long-term, and after consultations with officials in OSTP and OMB, I wrote on May 31, 2006, to the chair of the NAS/NRC icebreaker study, Dr. Anita Jones, as follows: "Given the rapidly escalating costs of government providers for icebreaking services and the uncertain availability of USCG icebreakers beyond the next two years, it is NSF's intention to ... [seek] competitive bids for icebreaking services that support the broad goals of the USAP. This competition will be open to commercial, government, and international service providers." The request for proposals will not be for ships but rather for services and we would expect the service providers to use their ships for other purposes when not in service to meet NSF needs. Thus the cost to the Foundation could be substantially reduced.<sup>52</sup>

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<sup>52</sup> Testimony of Dr. Arden L. Bement, Jr., Director, National Science Foundation, Before the House Committee on Transportation and Infrastructure Subcommittee on Coast Guard and Maritime Transportation, July 16, 2008, pp. 2-8. Italics as in original. This excerpt constitutes the majority of Dr. Arden's 8-page prepared statement.

## **NSF Spoken Testimony at July 16, 2008, Hearing**

During the question-and-answer portion of Dr. Bement's testimony, the following exchange occurred:

**Representative Cummings:** Mr. Bement, are the vessels currently available to the National Science Foundation, from the contract community and from foreign sources, capable of handling current ice—Europe agencies—current icebreaking needs to support research in the polar regions?

**Dr. Bement:** We believe so, but we haven't fully tested that.

Two years ago, we put out a Request for Information [RFI]. And as a matter of fact, it was through these RFIs that brought us the *Krasin* from Russia and the *Oden* from Sweden. And I should point out parenthetically, these are not agreements between the National Science Foundation and a private contractor. It's a government-to-government agreement.

And in the case of the Swedish *Oden*, it also carries with it a science agreement. It's a science exchange, because the *Oden* is capable of doing science, and there's a very active, collaborative activity between U.S. scientists and Swedish scientists in working the Southern Ocean. And so, the *Oden*, while it's deployed in the Southern Ocean, is also there for science, as well as a break-in.

I think that if we were to put out an RFI and ask those questions, based on the responses we got in the past, we would probably find expressions of interest, even private interest, that would build-to-lease icebreaker services over a period of time.

**Representative Cummings:** So, is it fair to say that NSF doesn't care where it gets its icebreaking services?

**Dr. Bement:** Our only—our only mandate, by presidential directive, is to operate in the Antarctic and in the logistics support of the Antarctica Program in the most cost-effective way possible. And, of course, the most cost-effective way carries with it a lot of conditions and a lot of options. So, we explore all those options in determining how we can operate under least cost.

**Representative Cummings:** But you mentioned Sweden and Russia, did you say?

**Dr. Bement:** Yes.

**Representative Cummings:** Were they—were they cheaper?

**Dr. Bement:** Four years ago, we did have the problem where the *Polar Sea* was out of operation. As a matter of fact, since that time, we have invested \$29 million in extraordinary maintenance in order to get the *Polar Sea* back into operation. And that's why we call it a fragile resource.

Now, at that time, it was agreed by the Coast Guard that we needed a backup vessel. And it was then that we put out an RFI and discovered that the *Krasin* was available. And so, we contracted with Russia. The *Krasin* is a GOCO vessel. It's government-owned, contractor-operated, as is the *Oden*. The *Oden* is also GOCO. It's government-owned, contractor-operated.

So, for two seasons, we backed up the Coast Guard with the Krasin. And then, two years ago we shifted to the Oden, because there was an expression of interest on the part of Sweden to enter into a U.S.-Swedish science exchange in return for also using the icebreaker for break-in services. And that was a very generous offer that we took advantage of.

So, that gave us the adequate primary break-in capability, and it allowed us to use the Coast Guard as the backup. And so, that's the way we've operated for the last two seasons.

**Representative Cummings:** Before we go to Mr. Oberstar, let me just ask you this. Is the—you said you spent \$29 million? And over how much—over what course of time?

**Dr. Bement:** It's over four years.

**Representative Cummings:** How long?

**Dr. Bement:** Four years.

**Representative Cummings:** Four years.

**Dr. Bement:** About four or five years. But I can give you more detailed information for the record, to give you all the details.

But if you go back about 4.5 years ago, the Polar Star was operational. The Polar Sea was not fully operational. It required extensive maintenance. So, we invested in getting the Polar Sea back into operational capability.

And at that time, the Polar Star then underwent some damage. And so, it was then that we put Polar Star in caretaker status. And it was the expectation, based on the repairs that we had made in the Polar Sea, that it was good for another seven or eight years, as long as we used the resource prudently.

**Representative Cummings:** And would you deem it prudent to contribute capital costs for the building of a new icebreaker?

**Dr. Bement:** I think at this point, based on my understanding of the mission space, that the Coast Guard has, especially with the opening up of the Arctic over time, that it would be a prudent course of action.

But my estimate or judgment would be that, even if the funds were approved tomorrow, it'd take about eight years to complete the construction of the vessel and make it operational. And we still have to—we still have to plan our course of action for the next eight years, and that's where we need flexibility.<sup>53</sup>

Later in the question-and-answer portion of Dr. Bement's testimony, the following exchange occurred:

**Representative Oberstar:** The Finns built the first nuclear-powered icebreaker. They had to give it to the Soviet Union as war reparations after World War II. And then they continued to build the class of vessels. And they also build a standard, that is non-nuclear vessel, the most powerful of which is the Urho, built at the Wartsila shipyards in Helsinki.

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<sup>53</sup> Source: Transcript of hearing.

And that had—that has—it's still in operation—65,000 shaft horsepower capability. And they also developed the air skin around the vessel to slip more readily through the ice and the ability to ship 400, 500 tons of water from one side to another, to roll through and crush, as well as break ice.

Did you give any consideration to working with the Finns on...

**Dr. Bement:** Well, let me...

**Representative Oberstar:** ... icebreaking needs?

**Dr. Bement:** Thank you for bringing up that information. It turns out that the Oden was built by the Finns. So, it could be a sister ship to the one you're describing.

**Representative Oberstar:** Oh. Oh, well, very good. They're the master ship—icebreaker...

**Dr. Bement:** That's right.

**Representative Oberstar:** ... icebreaking ship builders.

**Dr. Bement:** The difference—a major difference between the Oden and the Polar Sea—and the Polar Star, for that matter—is that the Oden can use fresh water for ballast.

The Polar Sea uses fuel for ballast. That fuel has to come out of our McMurdo stock whenever the Sea or the Star operates in McMurdo, so there's a million gallons. And with the price of fuel, even at the pump, that's \$4 million. And you can use your imagination what fuel costs after you get it all the way down to McMurdo.

And that's an incremental cost that we pay to the Coast Guard that's over and above the appropriated funds that we provide them for readiness to serve and for operation and maintenance.

So, that's where the difference really comes in, in using the Oden versus the Polar Sea or the Polar Star.

The other big difference is that, because the Coast Guard icebreakers are military ships and have multiple missions, they have a much larger crew strength. Their manning is about 134 crew, officers and crew, compared with 18 on the Oden.

And it's important to keep in mind that, as a contractor-operated vessel, these people are career icebreakers. They've served for years, so they are highly professional. And that's in comparison with the crew on the Polar Sea, where the Coast Guard has to spend an enormous amount of time and effort to continually requalify crew, because of the turnover in the manning of the icebreaker.

Now, there are many other differences that make the Oden a very good bet for the taxpayer. First of all, it has much more scientific berthing for scientists, and it also has abundant laboratory space and full instrumentation for oceanographic research. And that's a reason why it's of great interest to us as a science vessel.

So, we not only get the service of the Oden—on a fixed-price basis, incidentally—if anything breaks on that ship, or any maintenance has to be done, or if there are any other operating expenses that weren't anticipated, it's all covered under the fixed price, under the contract. We don't have to pay that additional cost.

**Representative Oberstar:** What you're really saying is, you don't really need to have an NSF-owned icebreaker. It's probably lower cost and more efficient...

**Dr. Bement:** Well, the only...

**Representative Oberstar:** ... to (inaudible) with the current arrangement.

**Dr. Bement:** The current arrangement is a good one, because we're only paying for the time we use. In other words, if it's only in use for two months, we only pay for two months of the use of the vessel.

That's much better than owning a vessel for a short season down in the Antarctic. And that's a reason why having flexibility to look at various types of icebreaking providers—and in many cases we'll have to fall back on the Coast Guard, there's no doubt about it, if the need arises and we can't get other bidders.

But when we can get other bidders, it—it's much better than the current arrangement where we have to pay for the entire year, for the vessel, for the maintenance, the crew costs, the operation—I mean, the training of the crew, the readiness to serve—when we're only using it for a relatively short season.<sup>54</sup>

Still later in the question-and-answer portion of Dr. Bement's testimony, the following exchange occurred:

**Representative Richardson:** I'd like to build a little bit upon what our Chairman Oberstar was just referencing, regarding the foreign-flagged ships.

You know, someone taught me an old saying. They said, if you have to make a decision, do the old-fashioned Ben Franklin, and do a positive and a negative.

And I was just a little curious of why were we supporting really another country's being able to build up their fleet, and have, as Mr. Oberstar has shared, you know, can do it all, when we clearly have a fleet that is not adequate? Why wouldn't we be putting the money into our own fleet?

**Dr. Bement:** Well, I'm very sensitive to that point of view. And I don't take any issue with the question. I just don't have a very good answer for it.

**Representative Richardson:** Well, I'd like to suggest that we may want to consider, when I was referencing the kind of Ben Franklin pros and cons, the contractor idea, you know, sure, you might save a few bucks.

But for me, the plus and minuses for the Coast Guard, number one, we have better security, because from what I understand on our ships, we have more people who are actually on the vessel. And by having the Coast Guard, they're not only doing the icebreaking, but they're taking care of other tasks.

And if we were to pay for those independently, and you include the cost of icebreaking, it actually ends up costing us more.

The second point is jobs—I mean, if we're actually building these.

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<sup>54</sup> Source: Transcript of hearing.



Third would be a faster response, if we have a national disaster. This gentleman just talked about the fact that, you know, it was said, help is coming.

Well, I've got to tell you. If someone in Finland or Sweden has to choose between their issue and ours, and we have a national disaster, they're going to their home first. They're not coming to us.

And then, the whole building and maintenance of our own fleet. We need to maintain some of our own independence, because God forbid, we don't want to be stuck with having no fleet, or a fleet that's not really appropriate, if we unfortunately come into a time of war. And maybe now we no longer have that relationship, and they're not willing to work with us.

So, Mr. Chairman, I would just like to really push back that, as we consider—and I've been listening to the thoughts of the discussion of the hearing thus far today. It seems like there is a will to have these additional fleets on our end.

But I'd just like to really push the point for the reasons that I just gave. We need to be more self-dependent, independent ourselves, and not relying upon some other country to bail us out.

I don't think that that's what America is about. And I don't think, if you had a choice, that would be probably where you would want to go.

Do you have a comment on that?

**Dr. Bement:** Well, I think, again, that's a matter of national policy. And the National Science Foundation is probably the last agency that ought to be involved in those kind of determinations.

Our focus is to carry on frontier science and to do it in the most cost-effective way possible.

And I think you rightly pointed out that the mission space for icebreaking is suddenly expanded. If I look at the Congressional Research Service report, they had five particular missions—five specific missions for icebreaking—and we were bullet number one. But there were four bullets underneath. And those are totally out of the scope of the National Science Foundation.

So, that's the only way I could answer your question. But again, I'm very sympathetic to your point of view.

**Representative Richardson:** Well, not only sympathetic. We might make a little money, because then we could contract ourselves. That would be a novel idea for us.

**Dr. Bement:** And I might point out, incidentally...

Representative Richardson: I'm sorry?

**Dr. Bement:** And I might point out, incidentally, that the National Science Foundation is not the only federal agency leasing ships from the Swedish.

**Representative Richardson:** Oh, I understand.

**Dr. Bement:** The Department of Defense is leasing—they've leased a submarine and they're leasing a merchant vessel from the Swedes to help in their operations in the Middle East.

So, it's—you know, the military in-service sealift command is also involved in leasing vessels from other countries in the world, and...

**Representative Richardson:** Sir, I've down to 30 seconds. I didn't mean to insinuate that you're not the only agency that's doing it. It's just—it's something I don't particularly happen to agree with, and would prefer to see us doing less of.

Mr. Chairman, would you allow me 30 seconds to hear Mr. Weakley's comments on that question?

**Representative Cummings:** Yes.

**Representative Richardson:** Thank you, sir.

**Mr. Weakley:**<sup>55</sup> May I? There's no question, I represent American sailors. I think we have a proud tradition. We have a proud tradition, not just of going to sea, but I think we build the finest ships in the world. I think the U.S. Merchant Marine and our shipbuilding capability won World War II.

I'd be happy to take that mission. I think the labor unions that I work with sitting behind me would welcome the opportunity to man those ships. If it's a mission that the Coast Guard can't handle and it's seen as more of a private sector, we're ready to step up and meet that challenge.<sup>56</sup>

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<sup>55</sup> James Weakley, President of the Lake Carriers' Association and Vice President of the Great Lakes Maritime Task Force, who was another witness at the hearing.

<sup>56</sup> Source: Transcript of hearing.

## Appendix D. Memorandum for Chairman of Joint Chiefs of Staff from DOD Combatant Commanders

This appendix reprints the text of a May 21, 2008, memorandum for the Chairman of the Joint Chiefs of Staff on the topic of icebreaker support signed by three DOD combatant commanders, each a 4-star general or flag officer.<sup>57</sup>

MEMORANDUM FOR CHAIRMAN, JOINT CHIEFS OF STAFF

FROM: CDR USPACOM / CDR USTRANSCOM / CDR USNORTHCOM

SUBJECT: Icebreaker Support

1. The United States has enduring national, strategic, and economic interests in the Arctic and Antarctic. In the north, the United States is an Arctic nation with broad and fundamental national security interests. In addition to the essential requirements for homeland security and maritime domain awareness, the effects of climate change and increasing economic activity require a more active presence in this maritime domain. In the south, the United States maintains three scientific stations. While the mission of the stations is largely scientific, their presence secures the United States' influential role in the Antarctic Treaty decision making process and maintains the balance necessary to maintain our position on Antarctic sovereignty.

2. To assert our interests in these regions, the United States needs assured access with reliable icebreaking ships. Today, however, two of the three Coast Guard icebreakers are nearing the end of their service lives, with one relegated to caretaker status. Over the past 10 years some routine maintenance has been deferred and there is no service life extension program for these ships. As a result, the nation's icebreaking capability has diminished substantially and is at risk of being unable to support our national interests in the Arctic regions. An example of our reduced icebreaking capability is last season's McMurdo Station resupply mission where USNS GIANELLA spent 50 hours in pack-ice awaiting escort from a leased Swedish icebreaker.

3. In summary, icebreakers are essential instruments of United States policy in the polar regions. We therefore recommend Joint Chiefs of Staff support for the following:

—A program for the construction of new polar icebreakers to be operated by the Coast Guard.

—Coast Guard funding to keep existing icebreakers viable until the new ships enter service.

—Sufficient Coast Guard operations funding to provide increased, regular and reliable icebreaker presence in the polar regions.

[signed]

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<sup>57</sup> Memorandum for Chairman, Joint Chiefs of Staff, from CDR USPACOM / CDR USTRANSCOM / CDR USNORTHCOM, Subject: Icebreaker Support. The Navy Office of Legislative Affairs provided CRS with a copy of the memorandum on September 11, 2008.

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