

## Polar Icebreakers in a Changing World: An Assessment of U.S. Needs

The United States has enduring national and strategic interests in the Arctic and Antarctic and the importance of these regions is growing with time. In the north, the United States has territory and citizens above the Arctic Circle, creating significant national interests. In the south, the United States maintains three year-round scientific stations to assert U.S. presence and assure U.S. leadership among the nations that are signatories to the Antarctic Treaty. Repeated high-level policy reviews have reaffirmed the importance of this U.S. presence and leadership in the polar regions.

To achieve national purposes in both polar regions, the nation needs to be able to access various sites throughout these regions at various times of the year, reliably and at will. Assured access to the polar region requires polar icebreaking ships capable of operating in a variety of challenging ice conditions. Over the past several decades, the U.S. government supported its polar interests with a fleet of four icebreakers. The current sea-going U.S. fleet of four ships includes three multi-mission ships operated by the U.S. Coast Guard (POLAR SEA, POLAR STAR, and HEALY) that support U.S. Coast Guard missions as well as science and one single-mission ship operated by the National Science Foundation that is solely dedicated to scientific research (PALMER). Today, two of the multi-mission ships, the POLAR STAR and the POLAR SEA are at the end of their service lives. Over the last decade, some routine maintenance on these ships has been deferred due to a lack of funds and no major life extension program has been planned; as a consequence, U.S. icebreaking capability is now at risk of being unable to support national interests in the north and the south.



### Future Needs for Icebreaking Capabilities

In the Arctic, economic activity is expected to increase as the southern extent of the Arctic summer ice pack thins, providing opportunity for ice-capable ships to travel through these regions. Greater human activity will increase the need for the United States to assert a more active and influential presence in the Arctic to protect not only its territorial interests, but also its presence as a world power concerned with the security, economic, scientific, and international political issues of the region. Icebreakers will play a critical role in supporting

U.S. interests as the sea ice margin does not retreat uniformly or predictably, which may create difficult ice conditions in these waters. Possible U.S. ratification of the U.N. Convention on the Law of the Sea will require the United States to collect data to extend its economic zone and/or counter territorial claims by other Arctic nations. Icebreakers will be needed to provide access to ice-covered waters to acquire this necessary data.

In the Antarctic, multiple national policy statements and Presidential Decision Directives have reaffirmed the importance of an “active and influential” U.S. presence in Antarctica and U.S. leadership in the Antarctic Treaty governance process. The U.S. presence at McMurdo and South Pole Stations cannot be assured without reliable icebreaking support to allow resupply of fuel, food, and cargo. At some point in the near future it may be possible to store enough fuel and supplies to skip a resupply in a given year, but even then the United States will need the ability to break a channel and resupply McMurdo Station by ship in most years. Reliably-controlled icebreaker capability that can be assured over decades is therefore vital to U.S. interests in the Antarctic. For the purposes of the single mission of resupplying McMurdo Station, the icebreakers do not necessarily need to be operated by the U.S. Coast Guard, but to best meet mission assurance requirements they should be U.S. flagged, U.S. owned, and U.S. operated. Without specific design proposals, it is not possible to evaluate the cost-effectiveness of specific approaches or explore the possibility that other nations might partner to invest in a polar-class icebreaker with the United States.

Polar research has brought, and will continue to bring, tangible societal benefits. The success of

polar research is intimately linked to the availability of appropriate infrastructure and logistical support to allow scientists to work in these natural laboratories whose unique settings enable research on fundamental phenomena and processes that are feasible nowhere else. Access to the polar regions, and thus availability of adequate ice-breaking capability, is essential if the United States is to continue as a leader in polar science.

## **Renewal of the Nation’s Polar Ice-breaking Fleet**

Based on the current and future needs for icebreaking capabilities, the Committee concludes that the nation continues to require a polar ice-breaking fleet that includes a minimum of three multi-mission ships and one single-mission ship. The Committee finds that although the demand for icebreaking capability is predicted to increase, a fleet of three multi-mission 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 class icebreaker is insufficient for several reasons. First, a single ship cannot be in more than one location at one 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, regular provisioning, and periodic crew change-outs. 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



back-up 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 assured back-up 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 re-establish 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 (such as concurrent operations in the Arctic and Antarctic), provide more flexibility for conducting Antarctic logistics, 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.

For the purposes of the single mission of resupplying McMurdo Station, the icebreakers do not necessarily need to be operated by the U.S. Coast Guard, but to best meet mission assurance requirements they should be U.S. flagged, U.S. owned, and U.S. operated. While that ship might be leased commercially through a long-term lease/build arrangement, from a total fleet perspective it may be more cost-effective if science mission users only pay incremental costs and if the U.S. Coast Guard provides McMurdo resupply support from the multi-mission icebreaker fleet. Lease arrangements do not assure that the United States could assert its foreign policy will at times and places of its choosing.

The Committee concludes that the research support mission and other U.S. Coast Guard missions can be, in many cases, compatibly performed with a single ship. The Committee believes that it is advantageous to configure the U.S. Coast Guard ships



with appropriate science facilities as well as for the U.S. Coast Guard's more general missions. In the long run, constituting the nation's icebreaking fleet as a single fleet of complementary ships will yield more capability and should be more cost-effective than if each agency independently acquires icebreaking ships. This approach is in line with the long held belief that the nation can gain the greatest economy from the sharing of assets across agencies and programs when appropriate and feasible and those users should share in the incremental increase in cost associated with directed usage of national assets.

## Transition to a New Fleet

Given the length of time needed to program, budget, design, construction, and test a new ship, it is expected that the new polar icebreakers will not enter service for another 8 to 10 years. During this time the nation needs a transition strategy to assure a minimum level of icebreaker capability. A continuing maintenance and repair program for the POLAR SEA, building on the work recently completed, is needed to keep it mission capable until at least the first new polar ship enters service. The cost to keep the POLAR SEA mission capable will be much less than a full service life extension program. The resulting capability, an upgraded POLAR SEA together with a fully capable HEALY, is less than the nation needs, but a cost-effective strategy should emphasize new construction rather than maintenance of aging ships. The Committee also advises that the POLAR STAR continue to be kept in caretaker status, indefinitely moored at the U.S. Coast Guard pier. If the POLAR SEA has catastrophic problems, the POLAR STAR could be reactivated and brought back into service. The



nation may need to charter supplemental ship services during the transition to new ships. This transition strategy carries risk, but due to the long lead-time for new ships there are no alternatives.

## Conclusions and Recommendations

The 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 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 assure 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 assure 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.
- 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 assure adequate national icebreaking capability into the future, a Presidential Decision Directive should be issued to clearly align agency responsibilities and budgetary authorities.

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### Committee on the Assessment of U.S. Coast Guard Polar Icebreaker Roles and Future Needs:

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**For more information**, contact the National Research Council's Polar Research Board at (202) 334-3479 or visit <http://dels.nas.edu/prb>. Copies of *Polar Icebreakers in a Changing World: An Assessment of U.S. Needs* are available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; [www.nap.edu](http://www.nap.edu).

