Proposal to Build a Heavy Icebreaker for use by the Coast Guard in the Northwest Passage

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Abstract

With the recent opening of the Northwest Passage above the Arctic Coast of the United States and Canada, increased ship traffic from shipping, research, and tourism will increase risk of ships running aground or becoming trapped within the ice in the Arctic Sea. We recognize this risk and propose that a heavy class be built for the United States Coast Guard, because our current ice breaker fleet is small, consisting of only the medium icebreaker *Healy* and the recently refurbished heavy icebreaker *Polar Star*. A new icebreaker is necessary if the United States is to respond to emergencies in the Northwest Passage.

Introduction

In recent years, the sea ice in the Arctic has been receding. As of September 2012, the amount of sea ice in the Arctic in terms of thickness and extent was at an all-time low, dropping from 4.5 million square kilometers to 3.5 million (Figure 1). This change in melting sea ice presents both disadvantages and advantages to the territories around the area. There are multiple disadvantages of the decrease in Arctic sea ice, one being that as the Arctic Sea ice level drops, habitats for species also drop. However, the melting sea ice can provide benefits to many countries that have coastlines in the Arctic such as Russia, Canada, and the U.S. As the sea ice melts, many Arctic shipping routes open—one of which is known as the Northwest Passage (Figure 2; Roach). The Northwest Passage could increase shipping opportunities along Arctic coastlines and serve as a faster, more efficient route by which ships can travel.

Shipping and tourism vessels must be able to navigate shifting sea ice safely. However, on the fringes of the Arctic ice cap, there are many icebergs and ice floes that pose danger to these ships. The primary threat to ships is the mobile ice, which could cause these ships to become trapped. An icebreaker would be needed to provide service to ships in need.

An icebreaker is a ship with the ability to navigate icy waters and clear paths for other ships. They are fairly large ships, at around 400 feet from bow to stern (O'Rourke). Most icebreakers last around 30 years before being refurbished or decommissioned (O'Rourke). There are two different methods of breaking ice: simply running through it or backing and ramming. Backing and ramming is a technique in which the ship backs up and rams the ice to break thicker sheets. Icebreakers are expensive and uncommon, but essential for Arctic navigation.

For our project, we propose that an icebreaker be built for use by the U.S. Coast Guard. The State of Alaska has shown interest in helping to fund this project, but they will not be solely

responsible for finances. It is possible that funding could be acquired from many different parties who would be interested in contributing to a new icebreaker if it would benefit them in their Arctic operations, as was done with the *Sikuliaq* (Castellini). The vessel will be designed to break at least six feet of ice continuously and can be in service for 250 days at minimum so as to maintain a presence in Arctic waters throughout the year. The ship proposed should be maintainable by a crew of about 130, the size of the crew on former heavy icebreakers (O'Rourke). These aspects would greatly increase the ability of the Coast Guard to monitor and keep safe the Northwest Passage.

Shipping

The Arctic sea ice is changing rapidly, and with this comes increased traffic through Arctic regions (DeMarban). Shipping vessels, tourism, oil drilling, and exploration of the Arctic all add to this traffic (Humpert. and Raspotnik). Given the estimated high number of vessels to be passing through the area, the ability to run an effective search-and-rescue mission is critical. Vessels can encounter problems such as icing from sea spray, getting stuck in sea ice, and iceberg collisions. The sheer remoteness of the Northwest Passage also poses a problem, since rescue times could be significantly slower if the passage was frozen (Humpert, and Raspotnik). The U.S. must increase their current Arctic navigational capabilities in order to manage the route. As of now, with only one functioning medium-power icebreaker, we are currently unable to do so. Since traffic in the Arctic region is sure to exponentially increase in the years to come, we must match that with an increased number of icebreakers.

A rise to 1.5 million tons of cargo has been predicted to pass through the Northwest Passage in the next year (Humpert, and Raspotnik). That number is expected to increase to 40

million tons by 2021, thirty times what it is today (Koranyi). With more shipping vessels going through the Arctic waters, more will be sailing near Alaska (CITE). Traffic in the Arctic Ocean will not only grow due to shipping vessels, but also because of tourism and resource development (DeMarban). Another factor to consider is that as of this year, over 1,000 vessels pass through the Bering Strait each summer, according to Rear Adm. Thomas P. Ostelo, commander of the Coast Guard in Alaska (Bellingston).

Traffic through the Northwest Passage is going to increase greatly in the near future. In order to ensure the safety of Arctic vessels, we must build at least one icebreaker, which will allow us to easily navigate Arctic waters. With only the medium sized *Healy* in working condition, the United States Coast Guard is currently not capable of responding quickly to an emergency in the Arctic.

Icebreakers in the United States

Currently, the nation is in possession of two functional icebreakers: one heavy (the *Polar Star*) and one medium (the *Healy*), but only the *Healy* is currently in operation. There are two others in the country that are privately owned (by the NSF and Shell), but neither can be heavily relied upon to aid in an emergency, as they are both light icebreakers (United States Coast Guard). Other Arctic countries, such Russia and Canada, have upwards of 15 icebreakers, allowing them much more control over Arctic operations. This small number of icebreaking ships has caused the Coast Guard to be unable to fulfill its Arctic missions: to patrol the Arctic North, to perform research in the Arctic West, and make the U.S.'s Arctic bases available (O'Rourke). To fulfill these requirements, the Coast Guard needs, with its current procedures, at least three heavy and three medium icebreakers (O'Rourke). However, because of the budget

limitations, it is only suggested that we build one icebreaker. This will keep the project feasible while still increasing the Coast Guard's Arctic operating capacity. Currently, with only two icebreakers, our country is lacking in polar transport and research capacity.

The Coast Guard's primary icebreaker is the United States Coast Guard Cutter *Healy*. The *Healy* is a medium icebreaker, capable of breaking up to three feet of ice continuously or eight feet backing and ramming (United States Coast Guard). The thickness of Arctic ice and the inefficiency of the backing and ramming technique hinders the *Healy* from being able to clear a path for a major shipping line. Its primary function is scientific research. Most of its research entails studying Arctic marine mammals (United States Coast Guard). While its research is undoubtedly valuable to the scientific community, it does not have the capacity to clear shipping routes for major tankers.

The U.S.'s only heavy icebreaker, the *Polar Star*, was recently refurbished and is currently undergoing testing, estimated to be operable in fiscal year 2014 (O'Rourke). The *Polar Star* is capable of breaking six feet of ice at three knots and 21 feet of ice backing and ramming (Alexander). This is the capability our heavy icebreakers need to fulfill the Coast Guard's missions. However, the fact that the heavy icebreaker was out of commission for over four years is troubling (Restino). If a major Arctic crisis, such as an oil spill, happened during that time, we would be lacking in ability to facilitate cleanup, or even rescue people involved in the accident. Therefore, any accidents that can happen in the Polar Regions are, for now, in the hands of other countries and private icebreakers.

There have been several studies showing that the U.S. would be helpless in the event of an Arctic oil spill. In early September, the *Healy* went on a mission to the waters north of Barrow, equipped with several new tools for detecting and cleaning oil spills (Bourne). Many of

these are ROVs (remotely operated vehicles) similar to, but sturdier than those used to clean up the Deepwater Horizon spill in the Gulf of Mexico in 2010 (Bourne). Though much testing and trial runs have occurred, it is still general consensus among the U.S. National Academy of Scientists and industry leaders that as of today, there is no effective Arctic oil spill response (Bourne). There have been spills in the past (spills are inevitable considering the amount of drilling that occurs on the North Slope) but the vast majority have been small and on land. During a hearing after the Deepwater Horizon spill, General Thad Allen said, "The current condition of the Coast Guard icebreaker fleet should be of great concern to the senior leaders of this nation" (Shumaker). In this, General Allen stated that we are not ready for major Arctic operations at this moment. Another important observation was from Commandant Admiral Robert Papp, saying of the BP oil spill, "If this were to happen on the North Slope of Alaska, we'd have nothing" (Bourne). These two quotes clearly demonstrate how those in charge of coastal safety understand the need for icebreakers.

Currently, the U.S. Coast Guard is lacking in ability to respond to a major Arctic emergency. This lack of ability is dangerous, as an Arctic oil spill has become "inevitable" in the eyes of some organizations (Bourne). Our current tools for cleaning up spills are being tested, but researchers do not know how effective they will be (Bourne). Also, we are unable to support oil facilities off the North Slope, except in Deadhorse and Prudhoe Bay (Shumaker). Therefore, with our current icebreakers, it is impossible to support the infrastructure of our Arctic regions.

Recent Needs for Icebreakers

The U.S.'s Arctic operations have been important to the nation's security and economy many times. Past missions of icebreakers were key in helping to protect Alaska and even some key northern locations during World War II (Canney). During WWII, the ice breaker Mackinaw was built to break ice on the Great Lakes shipping lanes to sustain the shipment of millions of tons of iron and other materials for war-time production of steel (Historical Naval Ships Association).These missions are examples of when U.S. needed ice breakers in the past and why we need them in the present and the future.

Tourism is also another area where icebreakers were needed. For example, in January of 2009, a cruise ship carrying 300 passengers was stuck in thick ice in the St. Lawrence River and was in need of icebreaker help. Luckily, the Canadian Coast Guard was able to respond and they sent out an icebreaker to help free the cruise ship. (Noronha) Another incident where an icebreaker was used for rescue was in 2010. A cruise ship, named the Clipper Adventurer, in Nunavut's Coronation Gulf crashed into a rock and became stranded. This cruise ship was completing a 15 day Arctic Expedition before it ran aground. (CBC News) The ship's 118 passengers and crew were all safe an unharmed by the time the Canadian Coast Guard icebreaker Amundsen arrived to rescue them (CNN Wire Staff). The Canadian icebreaker had to travel over 500 miles from its base in Quebec City to rescue the passengers and transport them to a nearby town called Kugluktuk (CNN Wire Staff). It reached the stranded passengers in just about two days. These instances help show that increased tourist traffic in icy waters could potentially lead to even more cruise ship crashes in icy waters.

In early 2012, the *Healy* plowed the way for a shipment of fuel to Nome; the only shipment the city would receive all year (Ahlers). The shipment is one of the only non-research missions the *Healy* has ever had. It was due to a length of bad weather that Nome couldn't get its fuel, and the *Healy* and a Russian icebreaking tanker called *Renda* had to deliver the fuel (Ahlers). The two ships left from Dutch Harbor, 300 miles south of Nome (Ahlers). They arrived on Saturday, January 14th (Yardley). Without the fuel shipment, Nome would have run out of fuel by March (Yardley). The icebreaker was not the only way to ship the fuel into Nome (it could have been flown in) but it was by far the cheapest, as gasoline is already six dollars per gallon in the city (Yardley). This example proves that the U.S. is in need of icebreakers, and while the *Healy* came through in that instance, it may not be able to in a future incident.

There are also many instances today that icebreakers are being used. On September 4, 2013, the French catamaran Babuska was stuck in ice in the Arctic when it was traveling from Alaska to Greenland (ITAR-TASS). The Russian icebreaker Admiral Makarov rescued the two-man vessel overnight and dropped them of at the Port of Pevek in Chukotka, Russia on September 6 (ITAR-TASS). Without the help of the icebreaker, the two men would have had a smaller chance of survival.

In January 2013, a British Naval Vessel rescued an Antarctic cruise ship. The Icebreaker *HMS Protector* was escorting the Norwegian cruise liner *Fram,* the cruise liner hoping to safely follow the icebreaker through the ice-filled waters of the Antarctic (Baker). However, the boat got trapped by large chunks of ice completely surrounding the vessel and prohibiting any movement (Baker). It then took the icebreaker *Protector* over two hours to crack through the 13-foot-thick ice that surrounded the *Fram* (Baker). If the *Protector* hadn't been escorting them, the passengers aboard the *Fram* most likely would have had to wait days before another ship could

assist them in getting out of the ice, due to the extremely few number of icebreakers in that region (Baker).

Cruise ships getting stuck in Arctic waters aren't the only problem. Similarly, many shipping vessels also get stuck in the ice. In fact, Russian icebreaker *Vladivostok* was sent to rescue a Russian shipping vessel *Mikhail Somov* ("New York Times"). The *Somov* had been used to deliver supplies and relief crews to the Soviet Union's scientific bases on Antarctica ("Christian Science Monitor"). The *Somov* was stuck in the Amundsen Sea for four months, from late April to when the *Vladivostok* rescued it in early August. The ice surrounding the *Somov* was around 12 feet thick ("Christian Science Monitor"). The rescue mission took from early June to early August, which, had Russia not sent one of their bigger icebreakers, would have taken much longer ("New York Times").

There have been numerous incidents involving shipping freighters getting stuck the sea ice and having to be saved by icebreakers. One of these include when the Nordvik, a tanker transiting over 5,000 tons of arctic diesel fuel to Khatanga, Russia (MAREX). When the ship attempted to plow through the ice, it suffered a hole on the port side of the ship (MAREX).

The primary mission of the USCGC Healy is scientific support (Elliot). With this mission in mind, the Healy has been taking annual summer trips to the Arctic West since 2001. These trips are purely scientific and have different goals with each trip. In 2008, the Healy had two scientific missions that were part of the National Science Foundation's Bering Ecosystem Study and the North Pacific Research Board's Bering Sea Integrated Ecosystem Research Program (Elliot). Their goal was to study the "ecological processes as the sea ice retreats… Healy scientists will launch a comprehensive suite of studies to provide insights about how marine microorganisms, plants and animals, including fish, marine mammals, and birds, as well as local

human communities, will be affected by the on-going changes in the region" (Elliot). The Healy was in the Bering Sea for the first Arctic West Summer deployment from March 6th to May 17th (Elliot). The ship traveled over 8000 nautical miles and managed to perform 1,100 individual science evolutions (Elliot). The Healy still continues these expeditions today. On July 11, 2013, the Healy began their most current four-month deployment (Follmer). Without the Healy, many of the science done in the Arctic West would not be possible. The ice out there is dangerous even in the summer, but with the Healy it is possible to safely travel in the ice and research the sea ice and ecosystems in that area. The Healy is perfectly equipped to accomplish all the research, with multiple labs, two oceanographic winches, open working decks, staging areas for science operations, cranes, science freezer and refrigerator, etc, and is dedicated to performing these operations (U.S. Coast Guard). Devoid of the Healy, we would not have the research we have on sea ice and Arctic West habitats and we would not be able to continually perform the scientific missions without it.

The size of our icebreaker fleet today is much smaller than it has been in the past. The need for the ships, however, will soon increase. The increase in Arctic shipping will make instances like Nome's fuel problem much more common, and with only the *Healy* to deal with them, we won't be able to help every ship and town or respond easily to emergencies.

Potential Future Needs

The U.S. is currently incapable of speedy or effective response to a major Arctic crisis. We have relied on other foreign icebreakers to help with rescues and other emergencies in the past. If a new icebreaker were built to replace the Polar Star, they would give us a great advantage in working in the Arctic waters that would allow increased dependency on the

icebreakers for any need of assistance. It will also allow us to become more involved politically and economically in Arctic interactions. Our icebreakers could be used more widely and clear more ice, providing an opportunity for scientists to do more research and work in Arctic areas. The acquisition of more icebreaking ships would increase the effectiveness of U.S. operations in the Arctic regions. Currently, the two major icebreakers are able to break through the ice, assist in scientific research, defend and monitor U.S. territorial waters, and take part in other missions as needed by the Coast Guard (O'Rourke). Considering the increase in shipping, we will need the icebreakers to create passages allowing ships to travel through the Arctic seas. The icebreakers will play a huge role in protection and security for shipping and recreational vessels. Our Coast Guard needs another icebreaker, and there are certain expectations to which it needs to live up.

Proposal

The ship outlined in our proposal is a heavy icebreaker, capable of breaking the thickest ice the Northwest Passage has to offer. The icebreaker must be able to spend at least 250 days at sea in one stretch, though over 300 would be recommended. These three factors are important to the functionality, fiscal feasibility, and efficiency of the icebreaker program.

Funding is always one of the primary factors in any project, be it scientific or economic. The state of Alaska has expressed interest in helping to fund a new icebreaker. No clarification was provided as to how much or what kind of help the state could provide. Also, Jim Hemsath, director of the Alaska Industrial and Development Authority has suggested that his agency could be involved in analyzing a market for a potential new icebreaker. For instance, Shell may

possibly rent the icebreaker for oil exploration in the Arctic, though a spokesman has stated that it is too early to say whether the company is considering this (DeMarban).

A new heavy icebreaker could cost approximately $852 million according to the Coast Guard (O'Rourke). However, this is an estimate for a heavy icebreaker, akin to the *Polar Star*. By contrast, it is estimated it would cost approximately $500 million to refurbish both the two Polar-class icebreakers for another decade (O'Rourke).

The most recent addition to the NSF's (National Science Foundation) fleet is the *Sikuliaq*. The construction process started ten years ago. Many universities and research foundations got together to create a proposal for the NSF to build the *Sikuliaq*. Several different research groups provided funding for the $200 million project (Castellini). The primary purpose of the ship will be research; it is the only icebreaking vessel designed solely for this purpose (Castellini). Though it is owned by the NSF, it will be operated by the UAF School of Fisheries and Ocean Sciences (Castellini). The vessel will be used to research the effects of the opening of the Northwest Passage and changing sea ice on the ecosystems in the Arctic, and will also study the ecosystems that change with the new open ocean that was previously covered in ice (Castellini). The icebreaker's construction cost was covered primarily by funding from the American Recovery and Reinvestment Act (Walker). The design study cost $1 million and was funded by Congress (Walker). It is possible to acquire some funding from the Coast Guard's budget, but most of the money will have to come from other sources.

The nation's new icebreaker should be similar to or better than the older models, so the capabilities of the former ships should be taken as a minimum when outlining the new ship's abilities. Therefore, the ship should be able to break six feet of ice with ease, and more than twenty feet backing and ramming. The thickness of the Arctic sea ice necessitates this. The

thickness of ice varies throughout the Arctic, so the ship must be capable of breaking extremely thick ice so as to be ready to clear a path through any route necessary. Since no highly defined trade routes have been established through the Northwest Passage, there is no specific region to which we can pay attention; therefore, the icebreaker must be able to adapt to wide varieties of situations, and a high icebreaking capacity is essential to this.

The capacity to spend 300 or more days at sea at a time would also be highly beneficial to the ship's mission. The Arctic sea ice is thick all year, so the ship must be on duty all the time. Also, the icebreaker should be able to carry cargo. This ability would make an event like the recent fuel crisis in Nome much easier to resolve, and would also allow the government to rent out the icebreaker for commercial purposes such as shipping oil or other goods. The new icebreaker could also help in providing more fuel or more frequent shipments to cities like Nome along the Bering and Chukchi Seas, lowering the fuel price and therefore increasing quality of life in those regions. These three factors are critical in making our icebreaker both able to fulfill its missions and to carry out the omnipresent mission of supporting people's livelihoods.

Conclusion

The United States most definitely needs at least one new icebreaker. The Coast Guard cannot fulfill its mission of making Arctic waters safe without at least four more ships (O'Rourke). There is also an increased demand for ships that can navigate Arctic waters as the Northwest Passage opens and shipping increases. Even with the opening of the Northwest Passage, travel by that route isn't entirely safe due to drifting sea ice. Shipping will also increase the chance for a need for capable search-and-rescue teams in case of a crash. In the past, the U.S. had many needs for icebreakers, and there is no reason to suspect that we won't in the

future. Even with the refurbishing of the *Polar Star*, our Coast Guard needs more icebreakers, and a new ship with more advanced technology could make their mission much easier to fulfill.

Arctic shipping is becoming more and more prevalent, and as a major world power, the United States needs to have control over who and what passes through our national waters. Given the amount of goods traded from Europe to Asia, there are bound to be more foreign ships traveling via the Northwest Passage, and we need to be able to manage that influx of trade. Building a new icebreaker or icebreakers is the best way for the Coast Guard to complete their missions. As long as the Coast Guard can fulfill its mission, the Northwest Passage will be more profitable and more efficient; but above all, a safer route of trade.

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Figure 1- The Extent of Arctic Sea Ice

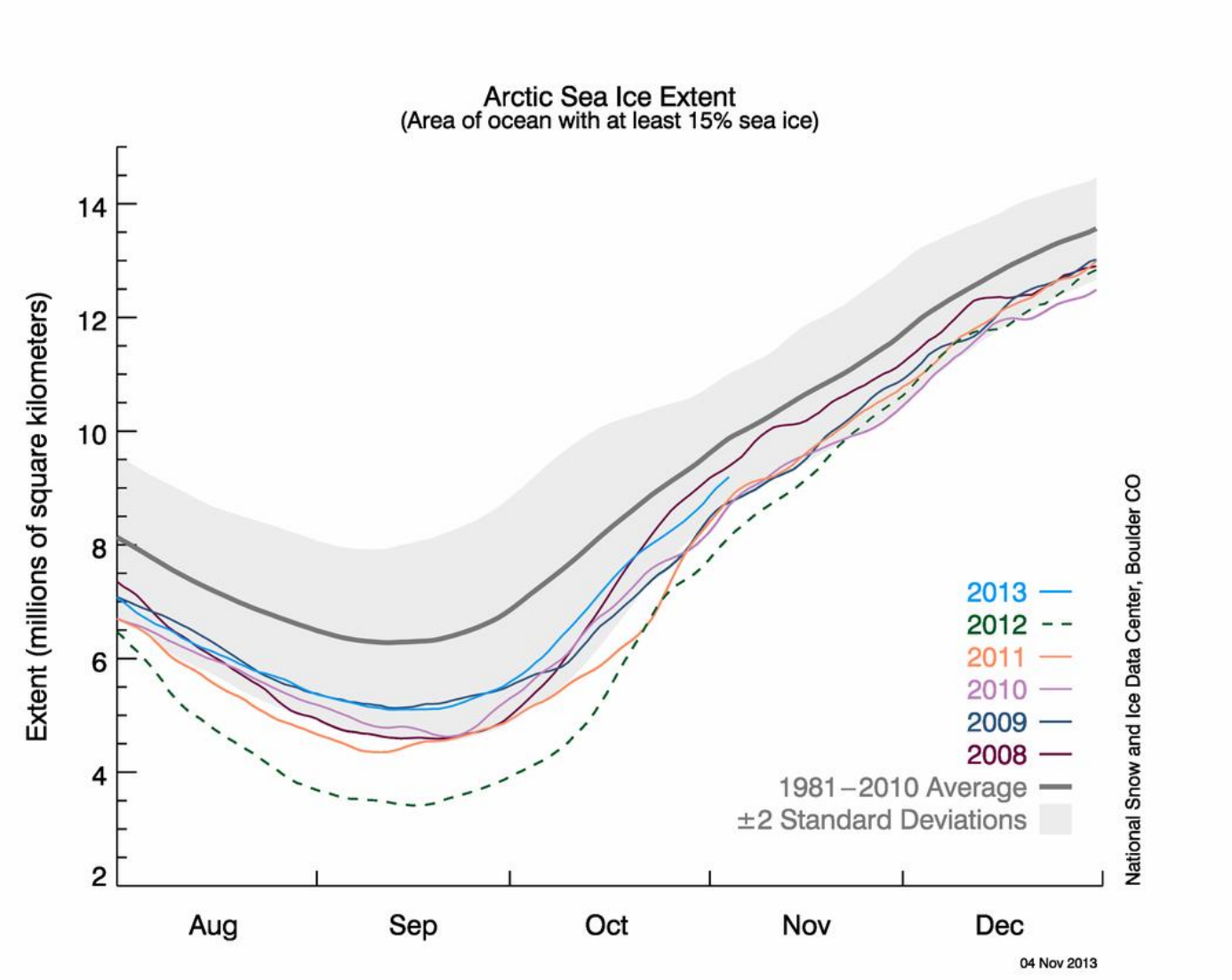

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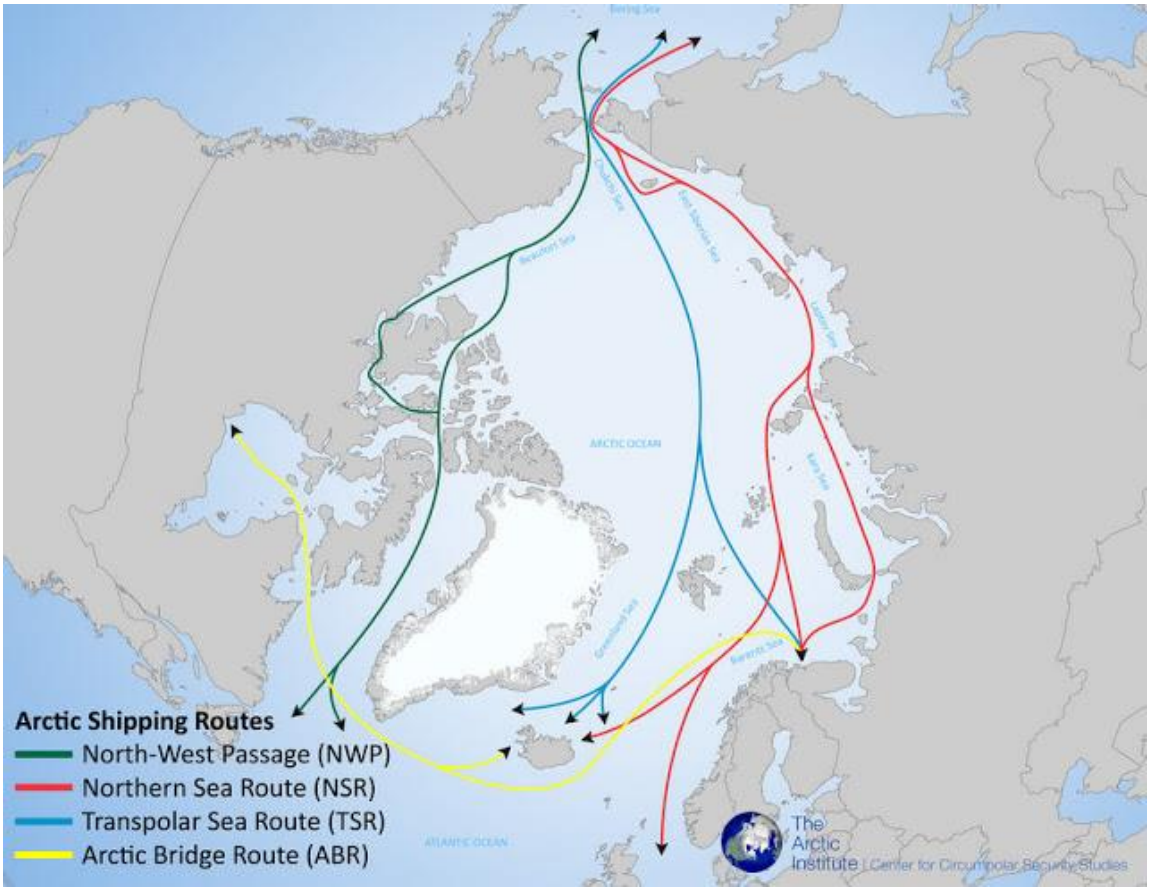
Figure 2- Arctic Shipping Routes



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