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MARITIME TRANSPORTATION IN THE ARCTIC: THE U.S. ROLE

(115–46)

HEARING

BEFORE THE

SUBCOMMITTEE ON
COAST GUARD AND MARITIME TRANSPORTATION

OF THE

COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES

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SUBMISSIONS FOR THE RECORD

Report entitled "Maritime Futures: The Arctic and the Bering Strait Region," a report of the CSIS Europe Program, November 2017, submitted by co-author Heather A. Conley, Senior Vice President for Europe, Eurasia, and the Arctic, Center for Strategic and International Studies [1]

[1] This 49-page report can be found online at https://csis-prod.s3.amazonaws.com/s3fs-public/publication/171027__Conley__MaritimeFutures__Web.pdf.

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June 1, 2018

SUMMARY OF SUBJECT MATTER

TO: Members, Subcommittee on Coast Guard and Maritime Transportation
FROM: Staff, Subcommittee on Coast Guard and Maritime Transportation
RE: Hearing on "Maritime Transportation in the Arctic: The U.S. Role"

PURPOSE

The Subcommittee on Coast Guard and Maritime Transportation will hold a hearing on Thursday, June 7, 2018, at 11:00 a.m., in 2167 Rayburn House Office Building to examine U.S. infrastructure needed to facilitate safe and efficient maritime transportation in the Arctic. The Subcommittee will hear from the United States Coast Guard (Coast Guard or Service), the National Oceanic and Atmospheric Administration (NOAA), scientists, and policy experts.

BACKGROUND

The Arctic region is the area north of the Arctic Circle, North Latitude 66.5622°. The Arctic Ocean dominates the Polar region, covering six million square miles (15.6 million square kilometers). Arctic temperatures range from an average winter temperature of -40° F (-40° C) to an average summer temperature just under 32° F (0° C).

The U.S. Arctic, as defined in statute[1], encompasses U.S. territory north of the Arctic Circle and along the Alaskan coast, including the Aleutian Islands. Three Arctic seas - the Bering, the Chukchi, and the Beaufort - border Alaska and these seas have historically been frozen for more than half the year. The U.S. Arctic Exclusive Economic Zone contains 568,000 square nautical miles (SNM), of which less than half is considered by NOAA to be "navigationally significant". NOAA has designated 38,000 SNM of the navigationally significant areas as survey priority locations in the Arctic and estimates that it could take up to 25 years to conduct modern hydrographic surveys in the priority locations, if resources remain at their current level.[2]

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[1] The Arctic Research and Policy Act of 1984, as amended (Public Law 98-373)
[2] NOAA National Ocean Service, https://oceanservice.noaa.gov/economy/arctic/, accessed May 21, 2018.

Currently, most cargo ship traffic is not trans-Arctic; rather it is regional, focusing on the transport of natural resources and general cargo to and from widely dispersed communities. While there has been a recent increase in shipping activity, that increase is more related to a rise in commodity prices than with the melting of Arctic ice.[3] While all areas of the Arctic are seeing increased vessel activity, the Northern Sea Route along the Eurasian Arctic coast continues to account for the bulk of Arctic shipping activity.[4]

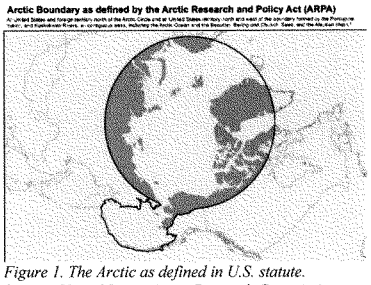

Figure 1. The Arctic as defined in U.S. statute. Source: United States Arctic Research Commission

Vessel traffic between the North Atlantic and the North Pacific through the Arctic requires transit through the Bering Strait, located along the U.S. boundary with Russia. Since 2008, the Coast Guard has been collecting data on vessel transits in the U.S. Arctic and uses the annual transit count as a general indicator of vessel activity in the Arctic.[5] In the past decade, the overall trend is towards increasing maritime activity, although traffic activity differs by vessel type (see Figure 3).

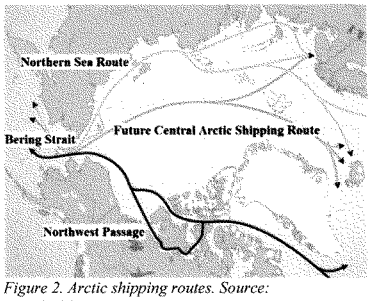

Figure 2. Arctic shipping routes. Source: Modified from The Arctic Institute

The International Code for Ships Operating in Polar Waters (Polar Code) adopted by the International Maritime Organization (IMO) in November 2014 went into effect on January 1, 2017.[6] The Polar Code requirements are intended to improve vessel safety and prevent pollution from vessels in the Arctic, and includes provisions on ship construction, ship equipment related to navigation, crew training, and ship operation. The Code applies to passenger and cargo ships of 500 gross tons or more engaged in international voyages.

International cooperation in the Arctic is largely facilitated through the Arctic Council, which was established in 1996 with the signing of the Ottawa Declaration. The Council is made up of the eight Arctic nations (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the United States). Organizations representing Arctic indigenous peoples also have permanent participant status on the Council. As of May 2018, 13 non-Arctic Nations have observer status on the Arctic Council (France, Germany, Italian Republic, Japan, The Netherlands, People's Republic of China, Poland, Republic of India, Republic of Korea, Republic of Singapore, Spain, Switzerland, United Kingdom).[7] The Council is a consensus based, intergovernmental forum

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[3] Ronald O'Rourke, Congressional Research Service. *Changes in the Arctic: Background and Issues for Congress*. April 24, 2018.
[4] Ibid
[5] U.S. Coast Guard. Port Access Route Study: In the Chukchi Sea, Bering Strait, and Bering Sea. Preliminary Findings. 23 December 2016. Docket Number USCG-2014-0941 and USCG-2010-0833.
[6] http://www.imo.org/en/MediaCentre/HotTopics/polar/Pages/default.aspx, accessed May 21, 2018.
[7] http://www.arctic-council.org/index.php/en/about-us/arctic-council/observers, accessed May 21, 2018

that works to promote environmental, social, and economic aspects of sustainable development in the Arctic.

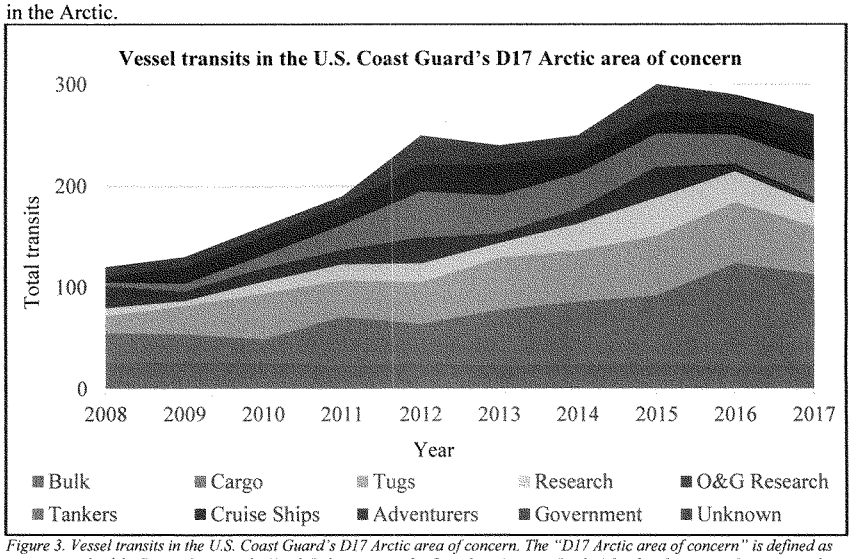

Figure 3. Vessel transits in the U.S. Coast Guard's D17 Arctic area of concern. The "D17 Arctic area of concern" is defined as an area north of the Bering Strait to the North Pole, east into the Canadian Arctic to Banks Island and west into Russia past the Russian port of Pevek. Source: Modified with data provided by the U.S. Coast Guard and from Figure 5 in the U.S. Coast Guard. Port Access Route Study: In the Chukchi Sea, Bering Strait, and Bering Sea. Preliminary Findings. 23 December 2016. Docket Number USCG-2014-0941 and USCG-2010-0833.

The Arctic Council maintains a web-portal, the Arctic Shipping Best Practice Information Forum, where participants share information relevant to operating in accordance with the newly established IMO Polar Code.[8] The Forum facilitates the exchange of information and best practices between participants on specific shipping topics, including hydrography, search and rescue logistics, industry guidelines, and ship systems.

While U.S. agencies have a physical presence and substantial interests in the Arctic, the Coast Guard has experience, material assets, and installations located throughout Alaska, establishing it as a key maritime operational presence in the U.S. Arctic. In Alaska, the Coast Guard maintains the Seventeenth District offices in Juneau and the Service's largest installation in Kodiak.[9] In addition to continuous operations from year-round facilities, the Coast Guard conducts seasonal operations, as part of its Operation Arctic Shield, in locations such as Kotzebue, Nome, and Utqiaġvik (formerly Barrow).[10] With no assets permanently stationed above the Arctic Circle, the Service's seasonal presence includes employing mobile command and control platforms, such as large cutters and ocean-going ice-strengthened buoy tenders, and establishing seasonal air and communications capabilities by deploying and leasing assets and facilities. These mobile and seasonal assets and facilities have proven to be important enablers

[8] https://pame.is/arcticshippingforum, accessed May 21, 2018
[9] The 17th District encompasses over 3,853,500 sq. miles and over 47,300 miles of shoreline throughout Alaska and the Arctic.
[10] https://www.pacificarea.uscg.mil/Our-Organization/District-17/Arctic-Shield/, accessed May 21, 2018

for addressing front-line priorities in the region, including search and rescue operations, maritime border security, critical intelligence gathering, emergency response, and marine environmental protection and law enforcement.

Since 2012, the Coast Guard has implemented Arctic Shield operations, with the objectives to perform Coast Guard missions, enhance Arctic maritime domain awareness, broaden partnerships, and enhance and improve preparedness, prevention, and response capabilities. The Service deployed a number of assets as part of its Arctic Shield 2017 operations, including Coast Guard Cutter (CGC) HEALY, a medium icebreaker; CGC SHERMAN, a high endurance cutter; CGC ALEX HALEY, a medium endurance cutter; CGC MAPLE, a seagoing buoy tender; and two Coast Guard MH-60 Jayhawk helicopters from Air Station Kodiak, Alaska which were forward deployed to Kotzebue, Alaska. Arctic Shield 2017 included Operation Arctic Guardian, an oil spill exercise near Utqiaġvik, Alaska, engagement with nine remote Alaskan villages, a historic transit of the Northwest Passage by CGC MAPLE and joint operations with the Royal Canadian Navy, as well as the completion of 28 search and rescue cases which resulted in 20 lives saved.

A decade-long effort to provide the United States with the capabilities necessary for assured access to the Arctic has recently found footing in Congress and the Nation's first new heavy icebreaker in more than 40 years is expected to be delivered by 2023. The Coast Guard and Navy have established a Joint Program Office to capitalize on experience and best practices from both Services, and Congress has appropriated over $350 million to accelerate the design process for a new icebreaker. Additional funding is under consideration for Fiscal Year 2019 appropriations.

While much of the Nation's focus regarding the Arctic in recent years has been on the critical need for new icebreakers, new vessels are far from the only need in the region. A report conducted by the Homeland Security Operational Analysis Center identified four major gaps in Coast Guard Arctic Capabilities, including unreliable communications, lack of adequate maritime domain awareness, scarcity of available assets and supporting infrastructure, and institutional difficulty to identify, articulate, and close capability gaps.[11] The report states that if these capability gaps are not closed by the 2030s, the Coast Guard risks facing substantial vulnerabilities in several of its missions in the Arctic, including search and rescue, marine safety, ice operations, marine environmental protection, and ports, waterways, and coastal safety.[12]

Numerous governmental and academic reports have identified infrastructure and operational challenges to maritime transportation in the U.S. Arctic, including limited satellite coverage and architecture to support voice and data communications, the lack of a deep-draft port (accommodating ships with a draft of up to 35 feet), hazardous weather and ice conditions, and the lack of channel marking buoys and other floating visual aids to navigation, which are not possible due to continuously moving ice sheets.[13] In order to ensure safe and efficient maritime

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[11] Homeland Security Operational Analysis Center (2018) *Identifying Potential Gaps in the U.S. Coast Guard Arctic Capabilities*.

[12] Ronald O'Rourke, Congressional Research Service. *Changes in the Arctic: Background and Issues for Congress*. April 24, 2018.

[13] Arctic Council (2009) *Arctic Marine Shipping Assessment*; U.S. White House (2013) *National Strategy for the Arctic Region*; U.S. Government Accountability Office (2014) *Maritime Infrastructure: Key Issues Related to Commercial Activity in the U.S. Arctic over the Next Decade*; Alaska Arctic Policy Commission (2015) *Final Report*; U.S. Committee on the Marine

transportation in the region, it is necessary to conduct surveys to improve nautical charts, improve communications capabilities, improve weather forecasting and modeling, construct a deep-draft U.S. Arctic port, and develop community and regional emergency response networks in preparation for vessel and aircraft accidents and environmental damage related to increased ship traffic and industry.

In addition to known infrastructure requirements, the Coast Guard is exploring the need for the creation of new vessel routing measures to reduce the risk of marine casualties and increase the efficiency and predictability of vessel traffic in the U.S. Arctic.[14] The Coast Guard is also conducting several Arctic-focused research projects including methodologies to minimize environmental damage from spilled oil in extreme cold, enhanced navigational capabilities in the Arctic, establishing exposure limits for Search and Rescue team members in extreme cold, and developing a classification system of ice conditions.[15]

Other efforts to improve Arctic capabilities include the International Arctic Ocean Buoy Program, which maintains an international network of drifting buoys in the Arctic Ocean to provide meteorological and oceanographic data for real-time operational and research purposes. Additionally, legislation has been introduced in the 115th Congress to reauthorize funding for U.S. ocean observing systems, both for the Arctic and other U.S. regions.

Transportation System (2016) *A Ten-Year Prioritization of Infrastructure Needs in the U.S. Arctic*; Council on Foreign Relations (2017) *Arctic Imperatives, Reinforcing U.S. Strategy on America's Fourth Coast*; Center for Strategic and International Studies (2017) *Maritime Futures, the Arctic and the Bering Strait Region*; Homeland Security Operational Analysis Center (2018) *Identifying Potential Gaps in the U.S. Coast Guard Arctic Capabilities*.

[14] U.S. Coast Guard. Port Access Route Study: In the Chukchi Sea, Bering Strait, and Bering Sea. Preliminary Findings. 23 December 2016. Docket Number USCG-2014-0941 and USCG-2010-0833.

[15] U.S. Coast Guard. Acquisition Directorate. Research, Development, Test & Evaluation. *FY18 RDT&E Project Portfolio*. March 2018. Examples: Next Generation Arctic Navigational Safety Information System (proj #6211), Arctic Operations Support (proj #6210), Robust Maritime Arctic Communications (proj #6213), Safety Parameters for ICE Operations (proj #5301), Response to Oil in Ice (proj #4701), Ice Condition Risk Assessment Tool (proj #6512), and Arctic Technology Evaluation 2018 (proj #62101).

WITNESS LIST

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MARITIME TRANSPORTATION IN THE ARCTIC: THE U.S. ROLE

THURSDAY, JUNE 7, 2018

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON COAST GUARD AND MARITIME TRANSPORTATION,
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
Washington, DC.

The subcommittee met, pursuant to call, at 11 a.m., in room 2167, Rayburn House Office Building, Hon. Duncan Hunter (Chairman of the subcommittee) presiding.

Mr. HUNTER. Good morning. The subcommittee will come to order. Thanks for being here. Today, the subcommittee will hear testimony on maritime transportation in the Arctic, and the need for the United States infrastructure to facilitate safe and efficient transportation.

For the first time in recorded history, the Arctic is becoming navigable for large portions each year. Vessel transit through the Bering Strait has increased almost 200 percent from 2008 to 2017. It is critical that we understand current traffic flows and the steps that need to be taken to ensure that both vessels and the environment are properly protected. I am proud to say that we have finally gained the necessary momentum to recapitalize the Nation's heavy icebreaker fleet, which is critical to provide an ensured access to the region.

However, while icebreakers provide important capabilities, there are many other issues that must be addressed to ensure a safe and efficient Arctic navigation. Despite United States vessels patrolling Arctic waters for nearly 150 years, the National Oceanic and Atmospheric Administration, NOAA, predicts that it could take up to 25 years to survey a fraction of the navigationally significant waters in the U.S. Arctic using modern hydrographic methods. This really is the last frontier, the portion of our Nation's waters about which we still have much to learn.

Additional infrastructure and operational challenges to maritime transportation in the U.S. Arctic include: limited satellite coverage and architecture to support voice and data communications, the lack of deep-draft port accommodating ships with a draft of up to 35 feet, unpredictability and flow patterns of icebergs in shipping lanes, and the lack of channel marking buoys and other floating visual aids, which are not possible due to continuously moving ice sheets.

The United States is not alone in our efforts to facilitate safe commerce in the Arctic. We are part of the Arctic Council, along

with other Arctic nations, like Canada, Russia, and the Nordic countries. Working together in this consensus-based, intergovernmental forum allows us to promote environmental, social, and economic aspects of sustainable development in the Arctic. The Council is critical to successfully implementing the International Code for Ships Operating in Polar Waters, the Polar Code.

The potential in the Arctic is hard to fully quantify. For more efficient shipping routes to mineral wealth, and natural beauty to scientific unknowns, the Arctic is a great resource, one for which we must begin making plans today to ensure we can maximize its potential, while also protecting its unique character and importance.

I thank our witnesses for being here today, and I look forward to hearing their thoughts on the issues. I will now yield to Ranking Member Garamendi. You are recognized.

Mr. GARAMENDI. Mr. Chairman, thank you very much for calling this hearing, and for the extraordinary array of witnesses who have depth and knowledge about what is going on in the Arctic. I am going to try to be brief, but I am not sure I can accomplish that. There is no doubt that the Arctic is warming, and the climate is creating new opportunities and significant challenges for the Federal Government, especially for the U.S. Coast Guard.

The retreat of sea ice, the opening of previously impassable Arctic waters, and the insatiable demands of a growing global human population will create tremendous competition and pressure among the Arctic and non-Arctic nations to access and develop the untapped natural resources of this nearly pristine region above the Arctic Circle.

As our country's sole military, maritime law enforcement Service, inevitably, it will fall upon the Coast Guard to protect the U.S. sovereign interests in the Arctic. Moreover, when called upon, I am confident the Coast Guard will do the best it can with the assets and resources available at its disposal. There is no reason to think otherwise, certainly that is the history of the Coast Guard.

What does raise concern, however, is whether the Coast Guard, or for that matter, the entire Federal Government, is adequately prepared for the inevitable. From what I have read in today's testimony, it would appear that the Federal Government is not, neither is the Coast Guard. If anything, the Federal Government appears to have been far too complacent, if not negligent, in establishing a solid foothold for the bona fide Federal presence along what will be a vast and mostly inhospitable fourth U.S. coast.

The challenges cannot and should not be underestimated, nor the days of empty bromides and recalcitrant comments by many simply have to end. The Coast Guard prides itself on being semper paratus, or always ready. At present, however, that motto appears to be more aspirational than operational reality.

Consequently, the hearing provides an opportunity to establish a baseline of information that we can return to and reassess in future hearings. We need answers to several important questions, such as: Is the Coast Guard's recapitalization of its polar icebreaker fleet on schedule? And for that matter, what about the Coast Guard's other capital needs to ensure mission performance in the Arctic, such as ports and facilities?

Has the Coast Guard begun the process of revising its concept of operations in the Arctic to address all mission needs, especially the Maritime Domain Awareness, search and rescue, and oil spill response? Moreover, are the other Federal agencies, particularly NOAA and the U.S. Army Corps of Engineers, aggressively moving ahead with plans to ensure the availability of deepwater ports, accurate navigational tools, and telecommunications in the Arctic?

These are just a few of the many questions that we have. Let me conclude by saying that we cannot afford to ignore what is unfolding in the Arctic. As a maritime power and Arctic State, the United States must embrace this challenge, for if not, rest assured, other nation states, friend and foe alike, will fill the vacuum. I don't see Mr. Graves here yet. He held a very important meeting yesterday, and I want to thank him for putting that meeting together.

The result of that meeting is that the U.S. Navy, specifically, is not prepared to deal in what is really an ocean, although often covered by ice. Mr. Chairman, I yield back.

Mr. HUNTER. I thank the ranking member. Today we are going to hear from Admiral Charles Ray, who we welcome today in his new position as the four-star Vice Commandant of the Coast Guard. Welcome, Admiral Ray. And my favorite flag officer pilot, I would say—pilot. We look forward to working with you and Commandant Schultz over the next 4 years to support the Coast Guard and its servicemembers.

Also on the panel we have Mr. David Kennedy, Senior Arctic Advisor at the National Oceanic and Atmospheric Administration; Ms. Heather Conley, senior vice president for Europe, Eurasia, and the Arctic, Center for Strategic and International Studies; Dr. Lawson Brigham, faculty and distinguished fellow at the University of Alaska Fairbanks; Ms. Molly McCammon, executive director at the Alaska Ocean Observing System; and Rear Admiral David Titley, professor of practice in meteorology at Pennsylvania State University.

Admiral Ray, it is an honor to have you here. Congratulations again, and you are now recognized for your statement.

TESTIMONY OF ADMIRAL CHARLES W. RAY, VICE COMMANDANT, U.S. COAST GUARD; DAVID KENNEDY, SENIOR ADVISOR FOR THE ARCTIC REGION, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION; HEATHER A. CONLEY, SENIOR VICE PRESIDENT FOR EUROPE, EURASIA, AND THE ARCTIC, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES; LAWSON BRIGHAM, PH.D., FACULTY, INTERNATIONAL ARCTIC RESEARCH CENTER, UNIVERSITY OF ALASKA FAIRBANKS, AND FELLOW, CENTER FOR ARCTIC STUDY AND POLICY, U.S. COAST GUARD ACADEMY; MOLLY MCCAMMON, EXECUTIVE DIRECTOR, ALASKA OCEAN OBSERVING SYSTEM; AND REAR ADMIRAL DAVID W. TITLEY, U.S. NAVY (RET.), PROFESSOR OF PRACTICE IN METEOROLOGY, DEPARTMENT OF METEOROLOGY AND ATMOSPHERIC SCIENCE, PENNSYLVANIA STATE UNIVERSITY

Admiral RAY. Thank you, Mr. Chairman. Good morning, Chairman Hunter, Ranking Member Garamendi, distinguished members of the subcommittee, I appreciate the opportunity to testify before

you today, and ask that my written statement be entered into the record.

Mr. HUNTER. Without objection.

Admiral RAY. On behalf of Commandant Admiral Schultz, and the entire Coast Guard, I would like to express my gratitude to this committee's support for your Coast Guard. The Coast Guard is the Nation's visible maritime presence in the Arctic. We have been operating there since 1867. And as you all know, it is a region with a tremendous volume of resources.

The estimates are that the oil and gas resources north of the Arctic Circle total approximately 13 percent of the world's undiscovered oil, and 30 percent of the undiscovered gas. Over the past decade, the Arctic has become increasingly accessible. It is evolving in the actions and intentions of Arctic and non-Arctic nations which are shaping the security environment.

Our two nearest peer competitors, Russia and China, have both declared the Arctic a strategic priority, and they continue to aggressively develop the capability, capacity, and expertise to exert influence and seize opportunities in the region. With your continued support, I am pleased to report that the Coast Guard is making progress, operationally and strategically, to achieve year-round access in the Arctic.

I would like to highlight just a couple of those successes. At that operational level, we conduct a yearly America's Arctic Shield Operation. In 2017, we deployed ships and aviation assets to the Arctic. In just a 4-month period, we completed 28 search and rescue cases, saving 20 lives, conducted joint ice-diving exercises with the Navy, hosted an oil spill seminar, visited 41 remote villages, and trained over 4,000 citizens in boating and water safety, and participated in exercises along with DoD, other Federal, State, local, travel, and international partners.

At the strategic level, as the chairman mentioned, for the United States to lead in the Arctic, we must maintain a physical presence to exert national security and protect our sovereign rights. For the Coast Guard, the foundation of this presence is U.S. icebreakers, whose purpose is to provide assured year-round access to operate in the polar regions.

To this end, reconstituting our Nation's icebreakers is one of the Service's highest priorities. And we are the closest we have been in 40 years to realizing the first step in recapitalizing the heavy polar icebreaker fleet. And I thank this committee specifically for your efforts in that.

As human activity in the Arctic continues to increase, the Coast Guard must maintain annual access to protect our citizens who sail and live on these waters and protect our sovereign interest. In 2017, there were three cruise ships with over 2,400 passengers sailed just off the north shore of Alaska's North Slope in waters where mass rescue and pollution response efforts were challenging.

This last September, the Chinese icebreaker, *Xue Long*, closed a close aboard to Nome, Alaska, and requested a medevac for one of their people. So we boarded the *Xue Long* and took their crewmember off there and transferred him for treatment. The point is, we are not alone up there in the approaches to our Nation.

Finally, we continue to work collaboratively with international bodies like the International Maritime Organization and Arctic Coast Guard Forum to shape governance and mitigate risk and assure our Nation's influence.

In conclusion, with the continued support of the administration, this committee, and the Congress as a whole, the Coast Guard will continue to lead across the national and international landscape to protect our interests.

I thank you all for your unwavering support, and for your efforts to ensure that Coast Guard women and men have all the tools they need to safely do their operations. I appreciate the opportunity to testify and look forward your questions.

Mr. HUNTER. Thank you, Admiral. Next, we have Mr. David Kennedy, Senior Arctic Advisor of the National Oceanic and Atmospheric Administration, NOAA.

Mr. KENNEDY. Good morning, Chairman Hunter, Ranking Member Garamendi, and members of the subcommittee. Thank you for inviting me to testify today on our work to support safe and efficient maritime transportation in the Arctic. The Arctic is a vast, extreme, complicated, rapidly changing place. The issues and challenges there are multilayered, and require extensive collaboration. To this end, NOAA cooperates with academic, regional, State and indigenous stakeholders. We also rely on the support of our Federal partners in the Coast Guard, NASA, Navy, Interior, Energy, and others.

The dedication of over half the U.S. Coast Guard cutter *Healy*'s recent schedule to NOAA operations is an example of that collaboration. For our part, NOAA was glad to support the Coast Guard and their Arctic Port Access Route Study, and the Department of Homeland Security as they develop their Arctic strategy. Since less than 3 percent of the Arctic Circle lies within Alaska, international cooperation is also a key to success in the Arctic.

NOAA participates in the Arctic Council and its working group, such as the Protection of the Arctic Marine Environment Group and the Arctic Monitoring and Assessment Program. NOAA is also a member of the Sustaining Arctic Observing Networks and the Arctic Regional Hydrographic Commission.

NOAA's Arctic work began in 1870 when the Coast and Geodetic Survey schooner *Yukon* began surveying Alaskan waters. Today, NOAA is working to increase its presence in the Arctic. I will touch broadly on NOAA's services, but highlight our navigation services to support transportation and infrastructure.

NOAA supports transportation and infrastructure in the Arctic with marine navigation products, weather forecasts, oil spill hazard assessments, preparedness and response, and environmental stewardship. These efforts support Arctic residents by improving their decisions, health, economic growth, and cultural vibrancy. NOAA is also working to increase our Arctic security, emergency response, and environmental prediction capabilities.

Alaska Native coastal communities rely on subsistence hunting for their nutritional, cultural, mental, and spiritual wellness. NOAA is working with the Arctic Waterways Safety Committee to ensure research vessel traffic is minimally disruptive to subsistence hunting. Vessel traffic through the Bering Strait is predicted to in-

crease five-fold by 2025, raising the risk of oil and other hazardous material spills.

NOAA supports the Coast Guard response by providing oil spill modeling, tools, and data management. Last summer, NOAA participated in a mutual aid deployment exercise on Alaska's North Slope, and with interagency partners, provided oil spill response training for North Slope communities. NOAA's navigation, observation, and positioning services, especially nautical charts, are essential to moving goods and people safely and efficiently in the Arctic.

Nautical charts are built upon core NOAA competencies and responsibilities: positioning, tides and water level data, shoreline mapping, and hydrographic services. NOAA provides accurate positioning through the National Spatial Reference System. To increase the accuracy in the system, NOAA is collecting airborne and gravity data initially planned to reach 95 percent coverage of Alaska.

Along the coast, NOAA's national water level observation network provides long-term observations to inform the decisions of increasingly vulnerable Arctic communities. In cooperation with the Alaska Ocean Observing System, which you are going to hear from later, NOAA is developing portable low-cost systems to fill water level gaps in the Arctic.

Last year, NOAA delivered over 700 miles of Arctic shoreline data. This data maintains charts and enables mariners to pinpoint their locations relative to the coast. Less than 5 percent of the U.S. maritime Arctic has been surveyed to modern international navigation standards. Over the past 3 years, NOAA and contract partners acquired 1,500 square nautical miles of Arctic surveyed data.

In 2018, we have seven projects in Alaska and the Arctic covering 2,066 square nautical miles. To continue our progress, NOAA will keep asking our stakeholders to inform our survey priorities. Our Federal advisory committee, the Hydrographic Services Review Panel, will meet in Juneau this August for just that purpose.

Thank you again for the opportunity to testify today, and I appreciate the subcommittee's time and attention, and look forward to your questions. Thank you.

Mr. HUNTER. Thank you, Mr. Kennedy. Ms. Heather Conley is now recognized, senior vice president for Europe, Eurasia, and the Arctic at the Center for Strategic and International Studies. You are recognized.

Ms. CONLEY. Mr. Chairman, thank you. Ranking Member Garamendi, and distinguished members of the subcommittee, thank you for this opportunity to speak to you today. Nearly 8 months ago, CSIS completed an extensive research project that examined our maritime capability needs in the Bering Strait region, which makes this discussion even more timely.

With your permission, I would like both my written statement and this report, entitled "Maritime Futures: The Arctic and the Bering Strait Region," to be included in the congressional record.

Mr. HUNTER. Without objection.

[The 49-page report entitled "Maritime Futures: The Arctic and the Bering Strait Region," is available online athttps://csis-prod.s3.amazonaws.com/s3fs-public/publication/171027__Conley__MaritimeFutures__Web.pdf.]

Ms. CONLEY. Thank you. I will just make a few brief points, and then cede the remaining time for discussion. Here is the bottom line: While trans-Arctic shipping and destination shipping may be muted today in the Arctic, we anticipate an increase in maritime traffic through the narrow Bering Strait, particularly as LNG [liquefied natural gas] carriers from the Russian Arctic make their way through the narrow Bering Strait to Asian energy markets.

Transits through the Bering Strait have more than doubled over the past decade. These increased transits over time will stretch and expose our thinly resourced and outdated capabilities until they are simply no longer able to respond to a major environmental accident or mass casualty incident.

It is clear the United States needs a proactive, long-term plan to protect the United States coast line in Alaska, patrol U.S. territorial waters in the North Pacific, the Bering, Chukchi, and Beaufort, as well as enforce our 200-mile exclusive economic zone, as well as our maritime demarcation border with Russia. These tasks are critical to the future prosperity, safety, and national security of the United States.

The United States Coast Guard is inadequately resourced to execute this mission in the Arctic, and we, therefore, are not in a position to sufficiently safeguard U.S. territorial waters, and the EEZ [exclusive economic zone] when foreign-flagged vessels traverse the narrow Bering Strait. This is an even more pressing issue as Russia and China have both declared the Arctic to be an economically and militarily strategic region, and their policies both seek influence beyond their coast lines to secure their future national interests.

Both countries are making substantial economic investments in the Arctic, while Russia is reasserting itself militarily. Simply put, American sovereignty in the Arctic can only be ensured by our maritime presence. But what concerns me the most is that the United States is placing one very big bet that the Arctic will remain of limited strategic value, and that our current, mostly seasonal approach, will be sufficient. And because Russia and China take such a dramatically different and long-term view, Russia and China view the Arctic over the next half century, we view it in the next budget cycle. The United States must assess our national security and strategic implications if Russia and China pursue their strategic interests and we do not.

So here are some of the questions that we need to ask ourselves: Could the United States lose access to portions of its maritime Arctic in the future? What are the implications if America's Arctic resources are exploited and infrastructure is constructed by Chinese firms rather than American firms? What if, in fact, Russia and China are simply overextending themselves economically and militarily in the Arctic? Is it the right approach to allow them to do that while the United States husbands its resources? Which nation has the Arctic's future right?

If the United States is incorrect about the Arctic, we will be placed at a great strategic disadvantage with significant military and economic implications for both the North Atlantic and the North Pacific. Prudence would suggest the United States must ensure an enduring and credible maritime presence in the Arctic.

America's current posture does not yet meet this requirement. Thank you very much.

Mr. HUNTER. Thank you, Ms. Conley. I would like to now introduce the former chairman of this committee, the full committee, and the "Dean of the House," Mr. Don Young, to introduce our next two witnesses.

Mr. YOUNG. Thank you, Mr. Chairman, I do appreciate that, for letting me say words about our Alaskan witnesses. First, we have Dr. Brigham here representing the University of Alaska, my university. Dr. Brigham has a distinguished career. He served in the Coast Guard for 25 years, retiring with the rank of captain, having served in command of four Coast Guard cutters, including the *Polar Star* sailing in Alaska, Arctic and Antarctic waters.

Dr. Brigham has participated in over a dozen Arctic and Antarctic expeditions. In 2008, when Captain Brigham was the signer of the American Geographical Society's Fliers' and Explorers' Globe, this signing was in recognition of *Polar Star*'s voyages of 1994, becoming the first ship in history to the reach the extreme ends of the global ocean, at the North Pole and the Ross Sea. Antarctica is the closest navigable portion of the South Pole.

Dr. Brigham's three decades of research have focused on the Soviet Russian maritime Arctic issues, which are all interesting, Arctic climate change, maritime transportation, sea ice remote sensing, Arctic environmental protection.

Ms. Molly McCammon is the executive director of the Alaska Ocean Observing System, which is a coalition of Government, academic, and private partners, working to access and integrate coastal and ocean data to give users the ability to package the information and data into usable products for the stakeholders.

Ms. McCammon has been involved early in the effort to get legislation enacted to support the national and regional ocean observing networks, and each year she continues the community's efforts to keep supporting Congress on ocean observing systems.

And I want to welcome both of my Alaskan witnesses, I look forward to their testimony, as all the rest of the panel. This is an issue which I have a great interest in, so welcome.

Mr. HUNTER. I thank the gentleman from Alaska. And the gentleman from Alaska, Dr. Brigham, is recognized to give your statement.

Mr. BRIGHAM. Thank you for that kind introduction, Congressman Young. Good morning, Mr. Chairman, and Ranking Member Garamendi, and distinguished members of the subcommittee. I am honored to testify today before you regarding the roles of the United States in Arctic marine transportation, and specifically, some very narrow but important marine infrastructure requirements.

I am a researcher at the International Arctic Research Center, but also a fellow at the Coast Guard Academy's Center for Arctic Study and Policy. No discussion on this topic can be made without review of the Arctic Council's Arctic Marine Shipping Assessment, which was released, amazingly enough, 9 years ago, but still has great relevance. The United States was a lead country in this effort with Canada and Finland. All the eight Arctic States contributed data and information. This study could be looked at in three per-

spectives: a baseline assessment, the first historic snapshot of all the traffic in the Arctic Ocean; a strategic guide to a host of Arctic stakeholders and actors, both Arctic and non-Arctic stakeholders and actors; but importantly, a policy document, as the 17 recommendations of AMSA, the Arctic Marine Shipping Assessment, were vetted, negotiated, and approved by the Arctic ministers of the eight Arctic States. The recommendations, the 17 recommendations I won't list here, but were divided into three interrelated themes. Enhancing Arctic marine safety, protecting Arctic people and the environment, and most importantly, building the Arctic marine infrastructure.

There is no Arctic marine infrastructure in the Arctic today except for that along the coast of Iceland, the northern coast of Norway, and northwest Russia. Really, in the rest of the place, there is no salvage, SAR, environmental response, environmental monitoring—a whole list of infrastructure that are required for safe navigation, of course, and protection of the environment, but particularly for facilitating efficient and safe marine transportation.

The AMSA report did point out that the changes in the Arctic and the future of Arctic marine transportation are certainly related to sea ice, greater marine access; extraordinary change, profound change in Arctic sea ice, will allow longer seasons of navigation. But the priority issue is this: It is important that the economic factors of Arctic natural resource development, the connection to global markets and global commodity prices, are the primary drivers of the future of Arctic marine transportation. This can be seen today in the Russia north, offshore Norway, and potentially in offshore Alaska.

It is really all about economics. It is about international security and global geopolitics, but it is economics driving the "train" for Arctic marine transportation. There is a general lack of infrastructure, as I mentioned. A recent study of the Council on Foreign Relations did highlight, the "Arctic Imperatives" study released last March—March 2017, a number of deficiencies of the United States in its Arctic infrastructure.

Particularly one fact was highlighted about data from NOAA that only 4.7 percent of the United States maritime Arctic is charted to modern international standards, 4.7 percent, maybe 5 percent now. But nonetheless, we have charts for the whole region. I should add that the hydrographer of the United States would say, but only 4.7 percent, a low percentage is charted to modern international standards.

This serious gap in infrastructure is related to human security, economic, and environmental implications for the United States. Let me, in the last minute, list the needs: hydrography is the highest priority. Certainly, NOAA's budget requires more funding for the marine frontier of Alaska; implementation and enforcement of the IMO Polar Code; additional funding and support to the Coast Guard to make sure that all of the requirements of this seminal governance regime are applied by the Coast Guard in U.S. Arctic waters.

I would specifically mention the Arctic port to be developed at Nome in the near term; dredging Nome to 35 feet plus; building an outer breakwater dock—breakwater dock to allow for the mooring

and support of large ships in all seasons. This development will provide for the port presence, and, essentially, provide the physical presence—maritime presence of the United States in its maritime Arctic.

Icebreaking capacity, of course; Arctic waters monitoring; the surveillance of marine traffic; search and rescue and environmental response; the Seward Marine Center and the polar ship, *Sikuliaq*, require continued Federal support; and finally, communications and aids to navigation.

Thank you, Mr. Chairman, for the opportunity to testify before you today.

Mr. HUNTER. Thank you, Dr. Brigham. Ms. McCammon, you are recognized.

Ms. MCCAMMON. Chairman Hunter, Ranking Member Garamendi, Congressman Young, and members of the subcommittee, my name is Molly McCammon, and I have been executive director of the Alaska Ocean Observing System for the past 15 years, based in Anchorage, Alaska. Thank you for you inviting to me participate, and I hope my written testimony will be entered into the record.

As part of the national Integrated Ocean Observing System, my program is mandated by Congress to work with Federal agencies, local and State governments, and private industry to facilitate and enhance coastal and ocean observing. I think we all know that the Alaska Arctic is a challenging environment for obtaining observations, especially in realtime: due to lack of power, few roads, often primitive communications. Yet, this information is essential to meeting the needs that we find now in the Bering Strait region and in the Arctic.

So to meet these needs, my program, AOOS [Alaska Ocean Observing System], is partnering with a host of agencies, the University of Alaska, and private industry to help identify and fill observing gaps, demonstrate new observing technologies and infrastructure and develop data products and applications. We can't depend on the old way of doing things any longer.

These include things like high-frequency radars to measure surface currents in realtime, for navigation, search and rescue, emergency response. Alaska has three radar sites on the North Slope, none in the Bering Strait. Congress added funds this past year to allow us to install two new radars in the Bering Strait, and those will go in next year.

X-band sea ice radars. We have one on the North Slope that is in regular use, but the equipment is old, needs replacing. Wave buoys. How many do we have in the Arctic? Zero. But with congressional support this year, we are putting one outside the Port of Nome later in July/early August, for the first time, that will be done operationally.

Real-time freeze-up detection buoys. We are trying to keep assets in the water as long as possible before freeze-up, and we have been piloting the use of these buoys. They show a lot of success and could be used throughout the Arctic. Accurate water levels are needed for safe navigation, mapping and charting, storm surge forecasting, informed emergency response. Over our entire west

and north coasts, we have four Federal tide gauges throughout those entire coasts; more are needed.

But these don't work everywhere and they are expensive and hard to maintain. So we have been working with the State, NOAA, and several private companies to test a number of cheaper alternatives. Of particular interest is the use of GPS reflectometry techniques that have been pioneered by the space weather companies that require less power and are easier and less expensive to install and maintain.

The use of AIS—automatic identification system—vessel tracking stations. We are expanding those and putting weather sensors on those stations so they can have dual purpose, and provide local, tailored, wind conditions alongside vessel tracking information. There are now eight of these in the Arctic with two more planned for this summer.

We are also using the AIS data to work with the Coast Guard and with NOAA to help prioritize hydrographic services, so we can really focus on what are the key essential areas that need to be surveyed immediately.

A key element of national security and marine domain awareness is an understanding of a changing marine ecosystem. So we are working with partners to establish a network of state-of-the-art ecosystem moorings, and the use of autonomous gliders to observe underwater conditions in near realtime, and track marine mammals, especially those that may be threatened or endangered, especially near a lot of activity that is happening offshore.

And, lastly, AOOS is now operating a NOAA-certified regional data assembly center with web-based analytical and visualization tools and products to help the Coast Guard, NOAA, and others integrate observing data, and do their jobs better.

How can Congress help? First, as the Arctic continues to become more accessible and receive greater attention and use, the United States needs to invest in additional observing assets in the region to ensure that we have the marine domain awareness to manage that usage, respond to potential emergencies, and provide for the Nation's security.

Second, all the activities I have described here all depend on substantial partnerships and leveraging of resources. These need to be fostered and enhanced with additional mechanisms for the ability to transfer and share funds among Federal agencies with the private sector. And, third, many of these activities do depend on our integration within the national Integrated Ocean Observing System program. H.R. 237, sponsored by Congressman Young, would reauthorize that program, and it is now before the House Natural Resources Committee, and I urge its passage and adequate funding for that program.

In conclusion, I appreciate the opportunity to speak to you today about the United States role of ocean and coastal observing in the emerging Arctic, and look forward to answering your questions.

Mr. HUNTER. Right on time. Wow, Ms. McCammon, we thank you. Go Alaska. All right. Admiral Titley, you are recognized.

Admiral TITLEY. Thank you. I feel like although everything is being said, not everybody has said it. Thank you, Chairman Hunter, Ranking Member Garamendi, and distinguished members of

the subcommittee for the opportunity to present today. I am David Titley, and I currently serve as professor of practice in meteorology and professor of international affairs at the Pennsylvania State University.

I had the privilege of serving in the United States Navy for 32 years, and retired in 2012 as the Oceanographer and Navigator of the Navy, and Director of U.S. Navy Task Force Climate Change. I serve in an advisory capacity on numerous Arctic and climate-related think tanks, including the Center for Climate and Security. Basically, though, I am really just a recovering weather forecaster.

In the Navy, we have a saying: Just give me the bottom line upfront, or BLUF. So here is my BLUF for today's hearing. The Arctic's physical environment is changing faster than any other place on Earth today. Today's Arctic climate continues to warm at the rate twice that of the rest of the world. These changes in temperature cause the Arctic sea ice to change in two ways: It is not only decreasing in extent, but also rapidly thinning.

These changes combined lead to a much more variable, dynamic ice pack that will make maritime transportation more tempting, more feasible, and paradoxically more hazardous, due to rapidly changing and less predictable conditions.

Two, our rivals are paying close attention to the changing Arctic, even if we are not. The Russians are actively monetizing their Northern Sea Route and rebuilding their Arctic military capabilities albeit from very low post-Cold War levels.

China declares itself to be a near Arctic State, and intends to jointly build a "Polar Silk Road" as the northern flank in its Belt and Road Initiative. China also continues to court the Nordic States and Greenland.

Three, we need to address the Arctic by taking a "system of systems" approach. We need to address our security, economic, scientific, and social issues in the Arctic, while simultaneously understanding the motives and intentions of Russia and China, and reassuring our friends and allies.

In keeping with the topic of today's hearing, I would highlight some of the key Arctic shipping issues. The old Facebook status said it best, "It's complicated." Although the temperatures are warming in the Arctic and the ice is melting at unprecedented rates, it can still be very cold. At minus 30 degrees, it doesn't matter if it is Celsius or Farenheit, it is cold. And it can be foggy in the summer, which reduces visibility, and impairs the safety of transportation.

There is still much work to do charting safe passages and routes for the Arctic. If you get in trouble, you may be on your own. The current routes available for navigating across the Arctic have significant draft limitations for modern commercial shipping. And today's business model of the container fleet stresses both reliability of delivery date and shipping very large number of containers to reduce fixed costs. But we should always be aware of the potential for disruptive change. The liquefied national gas, or LNG carrier, *Christophe de Margerie*, set a transit speed record for commercial shipping across the Northern Sea Route last August.

Another ship in its class transited the Northern Sea Route this past February with no icebreaker assistance. While there are good

technical reasons to believe these are "one of" events, many revolutions are not recognized until they are well underway.

So what should we do? Similar to many plans in the military, I recommend we take a risk-management approach and hedge for the unknown. It is important that we step back and consider the obvious. We have never been in a position in the modern world where access to an entire ocean opened up within a matter of decades.

We must update our Nation's Arctic strategy in response to the changes in our National Security Strategy and National Defense Strategy. We should use all our sovereign assets, Navy, Coast Guard, and NOAA, to develop a coherent and sustainable presence in the Arctic, it will demonstrate long-term commitment to our sovereign interests, reassure our allies, and send an unmistakable message to our great power rivals.

I recommend we direct and resource the National Science Foundation to set up a permanent research presence on Svalbard, the Norwegian island. Both the Russians and Chinese have robust presence on that island, the United States does not. Develop and resource a plan in conjunction with State, Native Alaskan corporations, allied private sector interests, and build out the foundation of an infrastructure that can support U.S. objectives for an ice-free Arctic.

My written testimony contains details of such a strategy. And commit to ratification of the U.N. Convention of the Law of the Sea. UNCLOS is the governing structure for the world's oceans, including the Arctic Ocean. Accession to UNCLOS, among many other advantages, would allow the U.S. to file a claim for seabed resources north of Alaska for an area nearly the size of California.

In closing, our country is dealing with a significant change in the world's climate, and nowhere is the climate changing faster than in the Arctic. As I stated in my TED Talk, the ice doesn't care who is in the White House or who controls the Congress, it just melts. We can either proactively adjust and shape our Arctic objectives to maximize the U.S. interests, or we can passively sit back and watch others grab the initiative.

Thank you very much for your time and attention, I look forward to taking your questions.

Mr. HUNTER. Thank you, Admiral. We are now going to recognize Members for questions, starting with myself. I think the first thing I would like—I think it was Dr. Brigham was talking about 4.7 percent of the Arctic is charted to modern standards. If it weren't for Congressman Young here, it would be closer to zero percent, because on the Natural Resources Committee, he passed the Hydrographic Services Improvement Act in 1998, when I was still in college, which enabled us to get to 4.7 percent over zero. So again, thanks to the Dean of the House.

I guess my first question, Admiral Ray, how would you align our Arctic strategy with what General Mattis has talked about the Arctic in our National Defense Strategy? That is a trick question. Think about it.

Admiral RAY. Thanks for the question, Mr. Chairman. As I am pretty sure you are aware, we have a long-lasting relationship with the Navy in terms of working these issues. We got a fleet mix

board that meets its—it is a longstanding, many years, and it has got an Arctic Working Group to work together on that.

Our intelligence communities work together on assessing the Arctic situation. We work together in multiple exercises. I think the staff told me about 700 in the last couple years, tabletops and other things like that. So we have got these longstanding processes where we work with the Navy. And then this summer, the Alaskan Command is hosting a symposium in 2 months, in August, where we will all sort of be—the military and other Federal agencies will fall in up in Alaska and we will work together to address specific strategic concerns and kind of assess the situation to see what we are doing.

And, finally, as you know, we have got tremendous support from the Navy with regard to icebreaker recapitalization. Our integrated product team, if it weren't for the Navy, I mean, they are the experts in building unique types of ships. So they have been a real help for us the whole course of the way. So I would say that we are lockstep with the Navy when it comes to both tactical operation and strategic issues, sir.

Mr. HUNTER. Sir, I mean, we established a Joint Program Office out of this committee and the Armed Services Committee. The reason I asked the question, the Arctic isn't mentioned in the National Defense Strategy at all. So to all of you, General Mattis talked about everywhere on Earth basically, except for the Arctic. And it seems really myopic and shortsighted that we do this all the time as a Nation, and that is why we are sitting here trying to hurry up and build icebreakers that weren't in the game at all.

I guess that was the point to the question. How can you formulate what the Coast Guard is going to do in the Arctic without a joint strategy from the Navy and the Coast Guard, which Mr. Garamendi and I have mandated now in the National Defense Authorization Act. You got Senator Sullivan is going to carry that, too. So that is going to—by September of this year, we are going to require both this committee and the Armed Services Committee, a Navy-Coast Guard joint plan on what the strategy is because right now, there is nothing written down.

And we know, from being in the military, at least you and I, unless it is written down, especially at your rank, and it is documented 1 million times and put in a bunch of PowerPoint slides, it doesn't exist. So right now, no matter what you say, and there is a Joint Program Office for the acquisition side, what is the strategy side? No one has talked about that, because it is not in the NDS, so there is no way you even have to align the Coast Guard strategy with the National Defense Strategy because there is no National Defense Strategy for the Arctic. Does that make sense?

You cannot align with the National Defense Strategy in the Arctic because there is no National Defense Strategy in the Arctic, which is a huge lapse in what the Office of the Secretary of Defense put out. We are going to fix that by asking you and the Navy to come back and tell us what your strategy is, if you have a joint strategy, does that help the Coast Guard? I mean, if you have a strategy from the Department of Defense that says, here are our goals in the Arctic, here is what we want to do over the next 30 years, here is our plan, I would think that that would inform the

Coast Guard massively, and NOAA and everybody else here, on what kind of equipment you are going to have, the accessibility, what is going to be in the region, all those kind of things. That is my question.

How do you know what the Coast Guard is supposed to do if there is no joint strategy between you and the other ocean Service?

Admiral RAY. Well, sir, we have been up there for a while. And so we have assessed the situation over the last 150 years, and we have had four Commandants in a row that have talked about this fourth ocean that you talked about in your opening comments. And so, I think we have done a pretty decent job of assessing the situation, and we have got this longstanding 200-year relationship with the Navy. So I certainly am not disagreeing with you, I will just say that we are not operating independently. And so we are ready to roll up our sleeves and work the Navy as the direction comes out, sir.

Mr. HUNTER. OK. I would just say, long term—the reason we are asking you to come back in 3 months is to present a strategy, because there isn't one. That's it. So we can build the ships, and we are doing that now, finally. The icebreakers are going to be built, there needs to be a strategy to go along with that. And if OSD is not going to do it, which they haven't done it, I would recommend that you do it. The Coast Guard should come up with your strategy. What is your strategy? Because the Navy doesn't want to be in the Arctic.

Remember, oil right now is at 65 bucks a barrel. You can bet $1 million that as soon as it goes up to $80, $90, $100 a barrel, all the big oil companies are going to be back in the Arctic again. There is only one reason they are not in the Arctic, only one, because oil is cheap right now—cheap-ish. Once that changes, they are all going to be there again. And it is going to be a mad-dash rush to how do we support all this activity in the Arctic, because they are going to be there as soon as it goes up again. Boom, they are all going to be there. With the stuff that they have put down when oil went down under $100 again, they just left everything sitting there, and they are going to be out again. It would be great to have a strategy for what our plans are and how you are going to incorporate the icebreakers as a service before all that happens. And then it has got to be done within days as opposed to the time we have now and the luxury of time.

With that, I thank you all for being here again. I yield to the ranking member.

Mr. GARAMENDI. Mr. Chairman, I want to thank you and the Dean of the House for bringing an extraordinary panel before us, raising a critical issue. The language that is in the House version of the NDAA [National Defense Authorization Act] should give the Department of Defense a swift kick to deal with the Arctic Ocean. You are quite correct, Mr. Chairman, when you said that the Navy has no interest.

Yesterday's meeting that Mr. Graves put together was shocking in that the Navy simply has abandoned the Arctic Ocean, other than submarines, no surface interest at all. And if I am wrong, I am ready to have the Navy come and tell me that I am wrong in my assessment of yesterday's meeting.

I think my question is one that—I don't expect a response, but I would like it in writing. First of all, the Coast Guard will, with the passage of the NDAA, and I hope before the NDAA, work with the Navy on developing the answer to the requirement that there be a strategy. And I asked the Navy yesterday to proceed ahead of the law to get on with the question.

So my issue really goes to the other witnesses here, and that is, each of you have made recommendations. I don't expect the Department of Defense, since they totally ignored the Arctic in the National Defense Strategy, to come up any time soon with a proposal, but each of you have made recommendations. When taken together, you have, in fact, developed at least a major part of an Arctic strategy.

So I would ask each of you to put an estimate of the cost of your recommendations together with the recommendation. You can simply submit the recommendations and add another paragraph, another sentence. This strategy to map the coast requires X personnel, equipment, and the cost is about this amount. I think this committee is, and certainly under the chairman and his staff, and my staff, is ready to develop an Arctic strategy, since the whole of Government has ignored it. And I think we are ready to do that in the various opportunities we have in appropriations as well as in authorization. So if you would do that for us, it would then, I think, lead to at least a major part of it.

The Coast Guard is doing much of that, specifically with the icebreakers, but there is more to it that than. So if the Coast Guard would also carry out putting numbers and personnel and equipment with each of the recommendations that have been put forth today, we will be along the way.

With regard to the U.S. Navy, there are those of us that are on the Seapower and Projection Forces Subcommittee, two of which are sitting next to each other here, that I suspect will have conversations with the U.S. Navy about its withdrawal from the Arctic Ocean, other than submarines. So I am going to let it go at that. And so, if you would all provide us the information, that will be the foundation for an Arctic strategy that I think this committee will put together. I thank you. I yield back.

Mr. HUNTER. I thank the gentleman. I now recognize the former chairman of the full committee, a man who stands behind you over—in front of an un-iced Alaska in the background here that looks at us every day, the Dean of the House, Mr. Young.

Mr. YOUNG. Thank you, Mr. Chairman. I want to thank the panel. We are all saying the same thing. I am pleased with the panel. No one is really saying anything contradictory of what should be done in the Arctic. As the only person that lives in the Arctic—by the way, I live above the Arctic Circle, there is no ice there in that picture, but I do, and we do have a changing climate. I think for the better. I have to say that. We have a new opportunity.

I was just thinking, you know, a good thing about Captain Cook. This is not a new idea, I mean, he was trying to find a Northwest Passage, it took him 3 years and 10 days to get to the inlet into Anchorage. And to show you how things can happen, he thought he had found it, and he went down one arm of that inlet, and he

got to the end of it and he said, turn it again. So he turned it around, and that is where he got Turnagain Arm. I want you to know—how do you like that for a story?

But my interest is that we have got to have a plan, and may I thank all of you—if Congress writes a plan without your input, we are going to screw up. So we need to have—I would say, Mr. Chairman, one of the good things we could do, maybe we ought to have an Arctic czar, because every agency is willing to work with one another, but no one is really figuring out how to do it.

And maybe we ought to have an Arctic czar because this is where the future is of the Nation, or the world, is above the Arctic Circle. That is where the mineral resources are, that is where the oil is, that is where the fish are going to be. That is where the action is going to be 100–200 years from now. And give China and Russia credit for that because they recognize it, we do not.

And, Ms. Conley, I liked your statement because if we don't get to this and recognize it for the importance of it, we are going to end up with another Wrangel Island. If any of you don't know where Wrangel Island is, that belongs to the United States of America. But we didn't pay any attention to it and Russia settled it, now they have a huge settlement there. And I get people writing me letters, why don't we get our Wrangel Island back? Well, we would have to go to war to get it. But it was extremely valuable.

So, Mr. Chairman, I like what I hear. I just think we ought to have a collusive group, and maybe come to the suggestion of us—and, Ms. McCammon, and would thank you for your statement, you and my Alaskan witnesses. Let's have a plan. Give us your plan how it could be done so we can make some pretty sound decisions when we have a chance to do that, because we are going to have to do it.

I mentioned yesterday at our meeting that Mr. Garret Graves put on, the general public doesn't understand the Arctic yet. They are sort of out there, that is the Arctic. And we have to understand it until we can raise the attention of this. But we have to do it, otherwise the public—I go to Members on the floor, and I said, what about the resources in the Arctic? Where? How about the new shipping channels? What? Do you know any navigational aids because the other countries are going to use it. And what is going on up there, you know, how many things—they don't have any idea.

So, Mr. Chairman, I think our challenge is to listen to the witnesses, and they are all agreeing. Let's see if we can put something together, with your information, and then I think the chairman ought to introduce, with the ranking member, a future piece of legislation that creates the Arctic—I call it symposium, but has one person in charge, and I know maybe someday when someone is not sitting on this committee, they might want to be the czar of the Arctic. I need a new job maybe, you never know.

But I just—you know, I love what you are saying, and thank you. And let's just see, maybe you all are going to get together after this meeting, and maybe you ought to do that, Mr. Chairman, tell them to do it and come back to us and see what we can do. Thank you. Yield back. That was a statement, that wasn't——

Mr. HUNTER. We could have an Arctic czar that even sits on the Joint Chiefs, it would be called the Commandant of the Coast Guard. That would be a great Arctic czar.

Mr. Lowenthal, you are recognized.

Mr. YOUNG. Chairman, just 1 second.

Mr. HUNTER. Yes, sir.

Mr. YOUNG. We talk about icebreakers. Icebreakers are great and I support icebreakers and I want icebreakers, but that is not all of it, it is the infrastructure. We have no ports up there. We don't have the communication. We did have quite a bit when they were looking for oil and they withdrew, but we don't have that anymore. We are sort of out in the middle of La La Land right now, and that is where our job is.

Mr. HUNTER. I thank the gentleman. Mr. Lowenthal, again, recognized.

Dr. LOWENTHAL. Thank you, Mr. Chairman, and thank you to all the members of the panel for being here and educating us on the infrastructure and the needs that are definitely needed in the Arctic. This question is for Mr. Kennedy and Admiral Ray. You know, as you know, the National Ocean Policy includes important goals and policies to enhance maritime transportation and security in the Arctic. As part of the policy, the Coast Guard, NOAA, and other partners were asked to coordinate the oil spill prevention, the containment, and the response efforts, including the development of new tools, to improve our modeling and responses to these incidents.

Can you fill us in on how this collaboration is working? How it is going on? And what progress you have made towards these goals?

Admiral RAY. Sir, I will talk about the response side of it, the modeling obviously is in the expertise of NOAA. With regard to response, every summer when we go up on Arctic Shield, at least for the last several years, we send research and development projects to see what we can do to improve our capability to respond to oil spills and ice waters, waters on the edge of the ice pack, waters—in fact, it is different, a lot different than the Gulf of Mexico. And I will just be quite frank, we are not where we need to be yet when it comes to responding. We are still pushing it, we work with NOAA, and across the interagency to get the ideals that we go up and test every summer. But I don't—I don't think we are where we need to be yet when it comes to responding to a significant oil spill in the Arctic.

Dr. LOWENTHAL. Thank you. Mr. Kennedy.

Mr. KENNEDY. I agree with Admiral Ray. We are working hard to try and do better. We have spills, drills. There was an oil spill technology workshop in March in Anchorage, looking at Arctic and Alaska technology and where we are and where we need to go. As you heard from the different panelists, that place is far, far away. And we have logistics issues, we have communication issues, and the science is not all there yet. Very clearly, it isn't there. And with the dramatic changes, it is pretty hard for us to keep up the research to stay on top of those changes and how they relate to responding to a spill and any other sort of hazardous issue. So we're

not there. We are working on it. There is a lot of focused interest and attention, but I would not—we are not there yet.

Dr. LOWENTHAL. I want to follow up, and this again is for Mr. Kennedy and Admiral Ray on these, where we are going in terms of the policies and where we are. You have indicated that we are really not there in implementing what we really need to do.

So I would like to know how we are engaging all the stakeholders as we plan for this ocean future. And so I am wanting to know how NOAA and the Coast Guard are implementing the marine planning in the Arctic. What are the key data sets and the needs that you have identified that we need to ensure safety and coordination between the ocean stakeholders? Can you elaborate at all on that—what you are looking at and what we need to look at ourselves? I know we are not there yet, but maybe you can tell us a little bit more about—as we move towards increased development, how all the stakeholders are participating?

Admiral RAY. Sir, we have got captains at the port. In Alaska, we have got one in Anchorage that actually covers all the way out to the western part of Alaska and up north. And we have got standing committees that include all the—by design, they include all the stakeholders from the local communities. And so, they convene on a regular basis and talk about the issues. As we go up north there, as I think you may recall from my opening statement, we engaged in about 40 different coastal villages in Alaska in the summer.

Dr. LOWENTHAL. Uh-huh.

Admiral RAY. So when we go there, we—kind of the way you interact with the folks up there is they like to say—you kind of talk about these issues, you bring them up, and it is really human interaction is how we work through some of these things when you are talking about responding in waters that they traditionally fished in and hunted in and done—so that is the primary tool that the Coast Guard uses. It is a similar arrangement that we used in Miami or L.A., it is just a different—and it is tailored to the nature of the stakeholders in the region.

Mr. KENNEDY. Sir, NOAA has regional coordinators in Alaska. Their primary responsibility beyond providing the Coast Guard and whoever else the data and information that we generate to support a response, their job is to try and reach out to all aspects of the communities that might be involved in response. So that includes down to and including, as Admiral Ray said, the indigenous folks. I think I mentioned in my testimony, we have actually gone out and done a training in some of the villages. But that also includes academics. The State of Alaska is a very, very strong partner, we interact with them on a regular basis, as well as the Coast Guard, I mentioned in my testimony, again, several other Federal agencies, Department of the Interior, BOEM [Bureau of Ocean Energy Management], in particular, I spent a lot of time working with them.

And, so, that is—oh, industry, I want to make sure to include industry, because when something happens and you have got a response, industry is going to be kind of helping manage that, and you got to understand where they are coming from, you got to be

familiar with who they are, how they think, and what they bring to the table. So all of that, in terms of integration.

In terms of what information do we need that we don't have, you have heard from this panel: observing of all different kinds. So that is everything from all of the oceanographic data from currents to temperatures to, you name it, to the whole biological communities. As this change is occurring, there is dramatic change in where species are. And, again, we are having trouble keeping up with all of that, but it is absolutely essential for us to understand that. There is permafrost issues, there is sea ice, I could go on. But there are the three or four categories of data and information that we don't have enough of that we are working collaboratively with other partners to try and gain.

Dr. LOWENTHAL. Thank you. And I yield back, Mr. Chair.

Mr. HUNTER. I thank the gentleman.

Mr. Graves, you are recognized.

Mr. GRAVES OF LOUISIANA. Thank you very much.

I appreciate all of you being here.

Admiral Ray, I want to follow on the questions that I think the Chairman Young and Congressman Hunter asked, and Congressman Garamendi asked. I think you are seeing a theme here that there is strong concerns about lack of integration between the Coast Guard and the Navy.

I fail to understand why we continue to have separate documents, separate strategies, all these people talking about playing together, but at the same time, we are missing opportunities for efficiency.

To try to dissect or tease out the Navy mission as opposed to the Coast Guard and the Arctic is very difficult for me to understand. And I want to commend Congressman Hunter, the subcommittee chairman, for his work in the NDAA bill. I think you are aware of an amendment that he added that forces a joint strategy.

But, quite frankly, that is not something that Congress should have to step in and do. That is something that is common sense, and I think there is a great bit of frustration on both sides of the aisle that that is not happening already. And I just wanted to get your feedback on that and help me—I guess, maybe give us some comfort and help us understand why we continue to see these silos.

Admiral RAY. Thanks for the question, Congressman.

I won't speak for the Navy. What I will tell you is that there is no air gap between the Navy and the Coast Guard from the top to the bottom. I mean, we just had staff talks a couple months ago—or it has actually been about 3 months ago with Admiral Zukunft to the CNO. And the Arctic and what we were doing there was part of our discussions.

We work at my level and all the way down to the, you know, the deck play level. I concede, obviously, that we don't have a national strategic document that is authored by both. I think the last similar document was a 21st-century seapower document that is probably about 10 years old now that had to kind of prescribe that we would work together and develop Arctic policies and procedures or, you know, kind of strategies.

So as I told the chairman, we are certainly, you know, willing to fall in and work on this process with the Navy. But I want to as-

sure you that I don't—absent the strategy, which you all can see, there is no big air gap between the Coast Guard and the Navy. I mean, it was a conscious effort to transmit the icebreaking surface mission to the Coast Guard after World War II, and we have been doing that since the 1940s.

Mr. GRAVES OF LOUISIANA. Admiral, what does Russia and China and Norway, what do all these other Arctic nations know that we don't in regard to the fact that they have exponentially more Arctic capabilities than the United States does?

Admiral RAY. Well, I won't speak for a lot of the other countries. My assessment is that, for instance, with Russia, they have 60 percent of the Arctic coastline. I think it is over 50 percent of the Arctic coastline. And it is a significant part of their GDP, and Ms. Conley can attest to that.

So if petrochemicals or petroleum products are the biggest part of the GDP of Russia, then the North Slope or their northern coast is the biggest part of that. So they have obvious economic interest, but what they are doing goes way beyond economic activity. We observe that and are aware of that.

The other nations—you know, there are eight Arctic nations, and so each one of them has got a little different cut on this. Some of them are primarily fisheries, and they are trying to protect those stocks. That is more on the Atlantic side. We are not fishing north of Alaska right now except for subsistence. There is no commercial fishing.

So each country has their own perspective, but I will tell you, they are collectively demonstrating an interest to the event that they can to being able to operate up there. And that is what we have been talking about for several years, we, the Coast Guard, that you have got to be able to operate up there. You know, virtual presence is absence, and so we need to be present there, and that is what we have been—with the help of this committee, we are the closest we have been in 40 years.

Mr. GRAVES OF LOUISIANA. Well, I certainly agree with that. But I think I would share the concern of virtually everyone up here about the lack of polar capacity and the implications that is going to, I think, continue to have on our Nation.

I am going to violate my own advice. Dr. Brigham, I just want to—I don't know the answer to this question, but Dr. Akasofu, how is he doing? And don't answer that question——

Mr. BRIGHAM. I think he still comes into the office and does his science.

Mr. GRAVES OF LOUISIANA. Yeah, OK. All right. Well, in a previous life, I had the opportunity to work with him. An extraordinary amount of time we lost contact. Please, pass on my best to him. He was an amazing resource for us in regard to climate change science and Arctic ice coverage and other things and enjoyed working with him. So thank you.

I yield back.

Mr. HUNTER. I thank the gentleman.

Mr. Huffman is recognized.

Mr. HUFFMAN. I want to thank the chair and the witnesses for a very interesting conversation about policy and American leadership in the Arctic. And I totally understand the national security

implications for why we need to have a greater and a safer presence in the Arctic.

I am also hearing a lot of interest in safety for shipping. It makes perfect sense. But a lot of this has to do with mineral development, fossil fuel development, and other things that raise questions about environmental standards and environmental protection.

And I am wondering, before we get too far into the massive costs of all of these things, if anyone is thinking about what American leadership looks like in the Arctic when it comes to protecting the unique natural resources of the Arctic and the ecological values.

Is this just a rush to exploit things from the Arctic, or is American leadership also attempting to project our standards and environmental values into this conversation? And I would open that up, certainly, to any of the witnesses that want to speak to it, because I haven't heard much about that.

Mr. BRIGHAM. Yes, Congressman.

The United States, through the Arctic Council, has been a leader in all things related to environmental protection and sustainable development. This Arctic Marine Shipping Assessment, which I mentioned in my testimony, is really an overview of—and a strategy for how to protect people and the environment.

So I think we have been there. I think the State Department, through the Arctic Council, representing us there and all the agencies, including the Coast Guard, and at the Arctic Council, have been world leaders in environmental protection, marine safety, and this question of infrastructure that relates to all of that.

Mr. HUFFMAN. Anyone else want to add to that? Yeah.

Ms. CONLEY. Congressman, I would also add, I think there are some exciting opportunities. You look at the five Arctic coastal States, plus five major fishery States joining together in placing a moratorium on fishing in the central Arctic, the high seas. That is a preemptive diplomatic effort to make sure the science is there before the fish arrive. And so I think that is a good example.

We know there is going to be work to look at biodiversity beyond national jurisdiction. That is looking at the high seas area, again, to ensure that we have strong biodiversity. The Arctic is front and center at that conversation.

We also have, even in the business community, the Arctic Economic Council which is very focused on making sure that any investor, any business practices in the Arctic have the highest standards. It takes extraordinary stewardship to make sure that any economic activity is done at the highest level, but this is something that we do have practice with, but we have to ensure it.

So I think there is actually some very good news on that front, marine-protected areas, but it does require continued vigilance.

Mr. HUFFMAN. All right. I appreciate that very much.

I want to, if I can, ask specifically about black carbon. And Mr. Kennedy, I know that the United States is trying to make some progress. The International Maritime Organization, it is my understanding, is moving fairly slowly on addressing emissions pollution, particularly black carbon.

Current targets by the Arctic Council nations to reduce black carbon emissions, many people believe need to be strengthened, and we need a more active U.S. role in leading that change. So I

would like to ask you if you think it is true that the Arctic is particularly sensitive to black carbon for maritime emissions and the implications of that.

Mr. KENNEDY. It is certainly true that black carbon is a contributing factor, and NOAA is not a leader in the discussion about black carbon. I can say what I just said because I have been in many conferences and sessions where EPA, for the most part, has led the discussion about black carbon and——

Mr. HUFFMAN. That is not very reassuring right now, but please continue.

Mr. KENNEDY. So I can't claim to be an expert, but, yes, indeed, it is an issue. Everybody from the Arctic Council to science ministerials have been discussing it, and it has been a little bit of a slog to——

Mr. HUFFMAN. Would you agree that without adequate international regulations that address these maritime emissions, rising Arctic maritime transportation because of this will actually accelerate the already alarming trends we see in the Arctic?

Mr. KENNEDY. I don't think I can be the one to make that statement, but I think, logically, if you have additional activities going on there, carbon is going to be an issue, and it is an issue.

Mr. HUFFMAN. Thank you.

Mr. HUNTER. I thank the gentleman.

Mr. Garamendi is re-recognized.

Mr. GARAMENDI. Thank you, Mr. Chairman.

Mr. Titley, your work at Penn State covers a variety of issues, some of which you have spoken to. First of all, is there any doubt that the climate and the Arctic is warming and that there is going to be an opening of the sea channels?

Admiral TITLEY. Thank you, sir, for the question.

I think there is extremely high confidence the Arctic will continue to warm, and the only question on a seasonally ice-free Arctic is not if, but when. Reasonable people can disagree.

When I started the Navy's Task Force on Climate Change, the consensus was in the 2060s, 2050s and 2060s. I was telling the Navy probably the 2035 or so. I would still say 2035, which is coming up very soon. By the time we get to 2020, that is going to be next decade. So we have 15-ish years to prepare for when we have seasonally ice-free Arctic.

Now, it is going to freeze up in the winter, probably for everybody's life in here and our children's life. But over time, by the time we get to the latter part of the 21st century, we will start seeing weeks and even months of ice-free conditions, and I think that is what the Russians and Chinese are——

Mr. GARAMENDI. I wanted to get that on the record, because that is foundational for everything that we have been talking about here.

Also you have spoken to Russia and to China. Why is China interested in the Arctic?

Admiral TITLEY. I think China is interested—well, first, Heather Conley down at the other end of the table here is really the expert on this. But as I understand this, China is looking at this primarily from an economic perspective. If you look at their Belt and Road Initiative, this really encircles, actually encircles Eurasia. And the

so-called "Polar Silk Road" is the northern component of that encirclement.

So I think they see this as if you put China as the hub of the late 21st-century, early 22nd-century world, they want to ensure they have resources. They also look at their fossil fuel resources.

I am sure you are aware that the Chinese are very concerned about the Strait of Malacca. They think the United States could interdict their supply of energy through the strait; whereas, if you are bringing it across the top of Russia, which is at least their friend for now, and through the Russian waters on the side of the Bering Strait, I believe if you are in Beijing, you see that as a more assured access along with land lines through Russia for energy.

Mr. GARAMENDI. Earlier today, I was at a meeting in which it was stated that the critical importance of being on the key committees, China is imposing itself on the Arctic Council, and, as I understand it, seeking a position at the committee level, and, therefore, will be in a position to direct or to influence the decisions. Is that correct, Ms. Conley and Dr. Brigham? Jump in.

Mr. BRIGHAM. No, I think the eight Arctic States have control over the Arctic Council. There is no question about it. They have non-Arctic State observers, like China and India, Italy, 13 non-Arctic States. And so they observe, they participate, but minimally. It really is the eight Arctic States in the Arctic Council which is a consensus body in a governmental forum with nonbinding, generally, decisions.

So it is a weaker body, but nonetheless, focused on environmental protection, sustainable issues. China has a voice with other non-Arctic States, but I would argue not an overwhelming voice there. But they are at the table.

Mr. GARAMENDI. Mr. Kennedy, you jumped in, and Ms. Conley, you both kind of sat up in your chair when I raised that question.

Ms. CONLEY. Thank you. Just on China's role in the Arctic Council, I think what we are seeing is a growing confidence since they became observers in 2013. They are managing their way through the working groups. It is their funding and their scientific presence and activity. They are opening new scientific research centers in northern Iceland, their presence in Greenland. They believe they have a valid role. Their environment is impacted by the changes in the climate, although there is some scientific dispute whether mid-latitude countries are impacted. So they think they have a science presence. And the funding of indigenous groups and elsewhere are building that credibility and that voice.

The Arctic Council has an observers manual. They have to follow those procedures. But I would say, their funding, their presence, their visibility, not unlike that we have seen in Antarctica with their growing science presence, science is presence. Presence ensures that sovereignty.

Just to follow up with Admiral Titley, we have had a longstanding—in fact, Lawson came with us—a track 2 dialogue with China's Arctic scholars for the last 3 years that looks at China's interest in the Arctic.

I would absolutely say it is shipping, it is the diversity of those shipping routes, absolutely from the Straits of Malacca, but it shortens by up to 30 percent east/west transit for Chinese goods.

It is absolutely an energy requirement, mineral resources, rare earth, which is why they are particularly interested in Greenland, potentially Iceland, and the mining capabilities, as well as the LNG and their participation in Yamal.

The protein, the fishing stocks, which I think is an undervalued issue that Beijing is quite interested in, which is why they wanted that seat at the table to be part of that 5 plus 5 dialogue that I mentioned to you.

Tourism, believe it or not, you are going to continue to see a wave of Chinese tourism in the Arctic. We are already seeing that in Finland and elsewhere. Their commercial presence then allows their tourism presence to come.

So it is going to be a comprehensive presence over time. They are investing the high-level diplomacy, the economic diplomacy, and then we know many of the commercial ventures that China produces has a PLA PLN component to it. We have to understand and research the strategic implications of what a greater Chinese infrastructure presence and science presence means to our interest.

So, for instance, if China builds an air base or an airstrip, or airport very close to Thule Air Force Base in Greenland, does that have strategic implications for the United States and our missile defense radar system?

Does a growing surface-to-air missile presence on Wrangel Island in Russia, does that impact our missile defense architecture at Fort Greely, Alaska? Those are the types of questions we have to really start asking. That is the strategic look ahead that has been missing, in my view, from all of our Arctic documents that we have produced over the last several years.

Mr. GARAMENDI. I thought you were going to mention Djibouti rather than Iceland, but——

Mr. KENNEDY. I have nothing to add to that. That was a very comprehensive answer.

Mr. GARAMENDI. Admiral.

Admiral TITLEY. Yeah. I would only add to Ms. Conley's statement, in addition to the resources, I think another reason China is looking so hard at Greenland, at Iceland, Norway, they are looking for an eastern terminus for a transpolar route. We don't even think of a transpolar shipping route.

We have—just like 9/11, we have a failure of imagination. We don't think about that ice-free—seasonal ice-free Arctic, or an ice-free Arctic with only—or an ice-covered Arctic but with first-year sea ice, but with ships that can transit unassisted through that sea ice.

They are looking at how to connect the Pacific and the Atlantic over the top. And, you know, sometimes we laugh at how they do it. It is a little clumsy from time to time, but less and less each day. So this is not only a twofer, but multiple things: Everything that Ms. Conley talked about, plus how do they control, how do they have first say in the strategic Atlantic port for the Arctic for that over-the-top route.

Mr. GARAMENDI. I think your answers to the question I raise make my point, is that China is a major player, and it is using its economic power and political power to influence the policies in the Arctic. I think that is underway.

If I might, Mr. Chairman, our task is to make choices. We are in the process of choosing to spend $717 billion this year on the Department of Defense. If we took $1 billion of that, which is one-thirteenth thousandth of that money, $1 billion, and spent it on the Arctic, just did a quick calculation here, we would have $700 million a year available to build icebreakers. In other words, we could build the six that are said to be required over the next decade.

We could have $50 million a year for shore facilities for the Coast Guard and science. You have $50 million a year for communications, $50 million for domain awareness, $50 million a year for mapping, $50 million for research, and another $50 million for whatever else you want to do; $1 billion, of the $717 billion that we intend to spend on the Department of Defense this year. Food for thought. And that is why I asked each of you to put numbers and material and people, whatever, behind each of your recommendations, because our task is to make choices. And talking to our colleagues here, we may very well want to do an Arctic strategy piece of legislation.

I yield back.

Mr. HUNTER. I thank the ranking member.

This is probably the best panel we have had on the Arctic since I have been the chairman, which has been 6 years now. This is the best panel. Everybody always disagrees on stuff and that is fine, but I think you all agree on two things: The Arctic is opening rapidly, and it could be even faster than we think, and technology allows our competitors to move there faster than we might think. People always do what we—we have never been right about where the next war is, never. Never. We always prep for the wrong place, always, and that is just a fact of life. And I think the Arctic is one of those places.

And I joke with my friends that we here in Congress are on the board of directors of America. We are, kind of. And the Navy right now is in its warfighting box, its warfighting bubble, if you will, with Korea. We are no longer locked in a massive land war in Iraq and Afghanistan, so there is money going to the Navy again for ships.

And they are looking at Asia, and they are looking around the world, and they are in their war bubble. And that is fine. And the Arctic is not where they—they are not playing at war in the Arctic right now so it is not a priority. That is my opinion of why they are not involved.

Mr. Young brought up a czar of the Arctic. We have a czar of the Arctic. Admiral Ray, it could be you, it could be Commandant Schultz, but it should be somebody—I mean, you are already here. You are already doing it. You are the ones that are going to have the Arctic strategy that we help you put together that you bring to us in September. Hopefully that will negate the need for anything—for us to do anything legislatively, because we shouldn't be doing that. But we need to make sure that you are.

So you all agree on one thing: The Arctic is opening up very quickly; and two, we are slow in our ability to—we are slow right now in our planning for how to not just extort the Arctic for natural resources, but how to make sure everybody is going to up there, and being clean, driving clean, fishing well, what they are—

I mean, we have the oversight over that around the world except for there, and that needs to be fixed.

And the Coast Guard is doing it, Mr. Garamendi and I, Mr. Graves. And Don Young has been doing this for over 30 years, working on this one issue. So now that we are getting the boats, I think you need the strategy to go with the boats.

And you are in charge, Admiral Ray. I mean, Admiral Schultz is the Arctic czar, as far as I am concerned, and we are going to get our information from you. And, hopefully, it is enough so that John and I can just sit here and not do anything and say, hey, that is a great strategy, let's implement it, as opposed to having to change it or create it ourselves.

Mr. GARAMENDI. Just one question.

Mr. HUNTER. Sure.

Mr. GARAMENDI. Is there anybody here from the U.S. Navy?

Mr. HUNTER. Admiral Titley.

Admiral TITLEY. Retired Navy, which means I do not have to start everything with "I support the President's budget."

Mr. GARAMENDI. Admiral, as good as you are, you don't count in answering my question.

Admiral TITLEY. Not at all. But——

Mr. GARAMENDI. My question was asked for a very, very specific reason, and there is no one in this room from the U.S. Navy.

Mr. HUNTER. So that is very telling. And my answer to that is, that that is fine, because with Congress' funding and with the Coast Guard's strategy and ability and know-how from being there, I think we have this down.

And we are going to drag the Navy along screaming and kicking, but we are going to drag them and we are going to make sure, too, that they do—tow them along. We are going to make sure that they do the right thing, too, when it comes to the actual icebreaker itself, meaning—and this is a time for a different discussion, but now that we are getting the ships, we don't want to see LCS communication suites on the Coast Guard icebreaker. We want to make sure that the Navy gets involved where they are supposed to and stays away where they need to stay away when it comes to the acquisition.

So with that, thank you all for being here, very informative discussion. And, finally, we are moving on this stuff and we are making a difference, and we are making changes because of all of you, and the few that actually came to the hearing today, which we appreciate.

With that, the hearing is over.

[Whereupon, at 12:29 p.m., the subcommittee was adjourned.]

STATEMENT OF
THE HONORABLE JOHN GARAMENDI
SUBCOMMITTEE ON COAST GUARD AND MARITIME TRANSPORTATION
HEARING ON "MARITIME TRANSPORTATION IN THE ARCTIC: THE U.S. ROLE"
JUNE 7, 2018

Good morning Mr. Chairman, I will be brief in my opening remarks to allow as much time as possible to engage with the outstanding panel of witnesses assembled here this morning.

There is little to no doubt that a warming Arctic climate is creating new opportunities, and significant new challenges for the Federal Government, especially so for the U.S. Coast Guard.

The retreat of sea ice, the opening of previously impassable Arctic waters, and the insatiable demands of a growing global human population, will create tremendous competition and pressure among Arctic and non-Arctic nations to access and develop the untapped natural resources of this nearly pristine region above the Arctic Circle.

As our country's sole military, maritime law enforcement service, inevitably it will fall upon the Coast Guard to protect U.S. sovereign interests in the Arctic. Moreover, when called upon, I am confident the Coast Guard will do the best it can with the assets and resources at its disposal. There is no reason to think otherwise.

What does raise concern, however, is whether the Coast Guard – or for that matter the entire Federal Government -- is adequately preparing for the inevitable.

From what I have read in today's testimony, it would appear that we are not.

If anything, the Federal Government appears to have been far too complacent, if not neglectful, in establishing a solid foothold for a bona fide Federal presence along what will be a vast and mostly inhospitable fourth U.S. Coast.

The challenges cannot, and should not, be underestimated. Moreover, we can no longer accept representatives of the administration brushing aside our inquiries by broadly claiming that "a whole of government approach" will address all needs.

No, the days of empty bromides and recalcitrance have to end.

The Coast Guard prides itself on being *Semper Paratus*, or always ready. At present, however, adherence to that motto appears more an aspiration than an operational reality.

Consequently, this hearing provides an important opportunity to establish a baseline of information that we can return to and reassess in future hearings. We need answers to several important questions, such as:

- Is the Coast Guard's recapitalization of its polar icebreaker fleet on schedule? For that matter, what about the Coast Guard's other capital needs to ensure mission performance in the Arctic?

- Has the Coast Guard begin the process of revising its concept of operations in the Arctic to address all mission needs, especially maritime domain awareness, search and rescue and oil spill response?

- Moreover, are other Federal agencies, particularly NOAA and the U.S. Army Corps of Engineers, aggressively moving ahead with plans to ensure the availability of deep water ports, accurate navigation tools, and telecommunications in the Arctic?

These questions are just a few that immediately come to mind. I expect that other members have questions of their own, and I welcome their engagement on this vital topic.

Let me conclude by saying that we cannot afford to ignore what is unfolding in the Arctic. As a maritime power and an Arctic state, the United States must embrace this challenge. For if not, rest assured, other nation states, friend and foe alike, will fill that vacuum. Thank you.

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TESTIMONY OF
ADMIRAL CHARLES W. RAY
COAST GUARD VICE COMMANDANT

ON

"MARITIME TRANSPORTATION IN THE ARCTIC: THE U.S. ROLE"

BEFORE THE

HOUSE COAST GUARD AND MARITIME TRANSPORTATION SUBCOMMITTEE

JUNE 7, 2018

Introduction

Good morning Mr. Chairman and distinguished Members of the Subcommittee. It is my pleasure to be here to discuss the U.S. Coast Guard's strategy and operations to advance safe, secure, and environmentally responsible maritime activity, as well as the Service's efforts to safeguard national security interests in the Arctic Region.

The Coast Guard has been operating in the Arctic Ocean since 1867, when the United States purchased Alaska from Russia. As in all U.S. waters, our missions include enforcing laws and regulations, conducting search and rescue, advancing navigation safety and environmental stewardship, and assisting scientific exploration. As the Nation's visible maritime presence in the Arctic, the Coast Guard is also addressing the region's broader national security interests, including: economic security, environmental security, food security, geopolitical stability, human security, national defense, and sovereignty.

The state of affairs in the Arctic has significantly changed over the past 150 years. The Arctic is one of the world's most challenging operating environments due to the extreme weather, vast distances, and lack of infrastructure. As nations, industry, scientists, and the public explore and pursue emerging opportunities, the region is also experiencing unprecedented change, including rising geopolitical interest and expanding human activity. Additionally, Americans in the region are adapting to the rapid changes in the environment and activity impacting their ways of life.

Our Nation's need to protect its interests in the Arctic are both pressing and enduring. Doing so requires a whole-of-government approach, in which the Coast Guard plays a significant role in the implementation of national policy. The Coast Guard's vision for the Arctic is a cooperative environment that balances the needs and requirements of the region's diverse group of stakeholders.

With increasing human activity and international interest, our sovereignty, security, and prosperity in this dynamic region hinge on effective governance; effective governance can only be achieved through physical and diplomatic presence.

National Security Interests in the Arctic Region

The United States is an Arctic nation with extensive sovereign rights and responsibilities in this region. Moreover, national security interests in the Arctic are broader than anywhere else in the U.S. As access to the region evolves, many nations across the globe aspire to assert or expand their role in governing the region; the changing weather patterns and receding ice continue to present risks and opportunities across a broad spectrum of stakeholders. The United States must plan for a robust, year-round maritime presence commensurate with the expanding interest in the Arctic's strategic value, in its natural resources, and in its potential as a transportation corridor between Asia, Europe, and North America. If we are not vigilant, other nations will outpace us in developing their competing interests in the Arctic.

Actions and intentions of Arctic and non-Arctic States shape the security environment and geopolitical stability of the region. In particular, our two nearest-peer competitors (Russia and China) have both declared the Arctic a strategic priority. Twenty percent of Russia's landmass is north of the Arctic Circle, and both onshore and offshore resource (minerals, oil, and gas) development is crucial to the Russian economy. Russia is also advancing the growth of the Northern Sea Route (NSR) for trans-Arctic shipping and other commercial opportunities. The NSR reached a new shipping record last year with 9.74 million tons of goods transported along the route, and Russia expects that number to reach 35 million tons by 2025. From a military perspective, Russia's long Arctic coastline, once stripped of sea ice, will be both newly vulnerable to attack, and newly able to support surface fleets readily deployable between the Atlantic and Pacific. The Russian government is currently rebuilding and expanding military bases that had previously fallen into disuse. These renewed capabilities include air bases, ports, weapons systems, troop deployments, domain awareness tools, and search and rescue. Additionally, Russia has the world's largest number of icebreakers. With nearly 50 icebreakers that include four operational, nuclear-powered heavy icebreakers, and three new heavy, nuclear-powered icebreakers currently under construction, Russia maintains the capabilities, capacities, experienced crews, and infrastructure necessary to operate and surge into the Arctic year-round.

China has recently taken an active role in Arctic development, pursuing economic investments with every Arctic nation in key strategic areas, such as oil and gas development, ports, railways, and infrastructure. They have purchased numerous resource deposits throughout the region, including uranium, energy, and rare-earth elements. With the release of their new Arctic Policy paper in January of this year, they have declared themselves a nation intrinsically tied to the Arctic, and signaled their intention to play a security and governance role in the region. China has directed Chinese companies and government agencies to become more involved in Arctic affairs, and is rapidly developing its ability to operate in the region. In 2019, China will launch its first home-built icebreaker, and has begun designing an even more powerful Polar icebreaker expected to have twice the icebreaking capability of its newest vessel now under construction. These efforts will give China greater access than the United States currently has to the Arctic, its ports, and its resources.

Economic, environmental, and human security and stewardship are also linked to the changes and expanding activity in the Arctic. Significant increases in natural resource extraction in the U.S. Arctic has not yet materialized, but industries continue to explore opportunities so that they are positioned to leverage economic prospects as they emerge. Current industry growth in the Arctic includes a significant increase in cruise tourism and transpolar flights, which could potentially increase search and rescue missions and risk to environmental integrity. Additionally, we have observed steady but measured growth of shipping through the Bering Strait over the past ten years, across all sectors of industry. As the Arctic continues to experience longer and larger periods of reduced or ice-free conditions, industry and other nations (China in particular) will likely continue to explore the possibility of seasonal trans-Arctic commercial shipping through the three Polar routes. These routes offer considerable savings between northern ports in Asia, Europe, and North America versus other more traditional routes, though the high variability of spring and fall conditions will pose a danger to even seasoned operators and undoubtedly increase the demand signal for our Coast Guard's services.

Food security is another significant issue for Arctic residents and our Nation as a whole. The Bering Sea provides more than half of the wild-caught fish and shellfish in the United States, and the wildlife for subsistence harvesting. Alaska is ranked seventh in the world in global fish exporters, and their seafood industry accounts for almost $6 billion a year in total economic activity. Additionally, approximately 70% of the U.S. Arctic population relies on subsistence hunting and fishing for survival, the vast majority of which comes from the sea. Thus, changes occurring in the Arctic Ocean are increasing the risk to food security for the globe, from shipping that disrupts migration patterns, to increased risk of pollution incidents, to growth in illegal, unreported, and unregulated fishing as fish stocks migrate.

As human activity continues to increase in the Arctic region, challenges associated with illicit activity and non-state actors are likely to increase. Communications are an important and emerging area of industry activity in the Arctic as well, and an area that is likely to draw significant attention given its strategic importance. The importance of securing communications cables and data centers against penetration by hostile state, state-affiliated, and non-state actors should be fully recognized. As an emerging maritime chokepoint for both commercial and military ships, the Bering Strait is a strategic waterway to which access must be assured. Additionally, our commitment to freedom of the seas must be demonstrated in the Arctic Ocean as it is demonstrated around the globe.

The Coast Guard in Alaska and the Arctic Region

The Coast Guard's Arctic policy and objectives are set forth in our 2013 Arctic Strategy. The objectives are to Modernize Governance, Broaden Partnerships, and Improve Domain Awareness. Achieving these objectives requires continued leadership, extensive presence, and effective collaboration. Our plan for implementing this strategy and improving national security in the Arctic includes integrated strategic and operational planning and initiatives. I would like to highlight some of the initiatives that have particular impacts on our national and international security.

Diplomatic Presence

As many nations and other stakeholders across the world aspire to expand their roles and activities in the Arctic, the Coast Guard is working collaboratively through international bodies to address the emerging challenges and opportunities in the region. One example is our support to the Arctic Council, which is a high-level international forum primarily focused on environmental protection and sustainable development issues in the Arctic region. The Council is composed of the eight Arctic nations (United States, Canada, Denmark (Greenland), Iceland, Norway, Sweden, Finland, Russia), six Arctic indigenous groups, observer nations (including the U.K., China, South Korea, and various other European and Asian nations), and non-governmental organizations' observers. The Coast Guard plays a significant role in supporting our Nation's existing engagement in Arctic Council activities, as well as in the Federal role in governance of the U.S. Arctic. The Coast Guard is committed to working with its international and multilateral partner organizations, and supports U.S. involvement in Arctic Council efforts through its representation in two standing working groups; Emergency Prevention, Preparedness & Response (EPPR), and Protection of the Arctic Marine Environment (PAME). Under the EPPR working group, the Coast Guard leads the U.S. Government delegation and serves as Chair of the Marine Environmental Response Experts Group. Within PAME, the Coast Guard participates in the Shipping Experts Group where we support projects such as mitigation of risks associated with the use and carriage of heavy fuel oil by vessels in the Arctic. The Coast Guard also serves on the Council's Task Force on Arctic Marine Cooperation, and has been active in other task forces that established the 2011 Arctic Search and Rescue Agreement, the 2013 Oil Spill Prevention and Response Agreement, and the 2015 Framework for Oil Pollution Prevention.

The Coast Guard has also guided Arctic security through other international bodies such as the International Maritime Organization (IMO). The Coast Guard was instrumental in the IMO's development and adoption of the International Code for Ships Operating in Polar Waters (Polar Code) to cover the design, construction, equipment, operational, training, and environmental protection matters relevant to ships operating in the Polar regions. In 2017, the Coast Guard completed a rulemaking process to issue Polar Ship Certificates to U.S. vessels. We also developed and promulgated guidance to industry and our Captains-of-the-Port on how to ensure compliance with the Polar Code. Additionally, the Coast Guard is finalizing the Port Access Route Study (PARS) for the Chukchi Sea, Bering Strait, and Bering Sea. The overarching goal of the PARS was to determine if ship routing measures could help reduce the risk of marine casualties and their impact on the environment, to increase the efficiency and predictability of vessel traffic, and to preserve the paramount right of navigation while continuing to allow for other reasonable waterway uses. Based on this PARS, in November 2017 the Coast Guard and the Russian Federation jointly submitted a proposal to the IMO to establish a system of two-way routes in the Bering Strait and Bering Sea. The Coast Guard also submitted an associated proposal to establish Areas to be avoided in three environmentally sensitive areas. The IMO adopted these measures at the 99th session of its Maritime Safety Committee which concluded on May 25, 2018. We anticipate that the new routing measures will enter into force on January 1, 2019. The Polar Code and Bering Strait PARS are extraordinary examples of our Coast Guard being proactive in addressing emerging international and domestic maritime concerns in the Arctic.

Last, the Arctic Coast Guard Forum (ACGF) is a bridge between diplomacy and operations. Formally established in October 2015, the ACGF operationalizes all of the elements of our Arctic strategy as well as the objectives of the Arctic Council. It is a unique, action-oriented maritime governance forum where the Coast Guard and our peer agencies from the other seven Arctic nations strengthen relationships, identify lessons learned, share best practices, carry out exercises, conduct combined operations, and coordinate emergency response missions. In 2017, the ACGF conducted its inaugural live search and rescue exercise, Arctic Guardian 2017. This exercise demonstrated the unique challenges of operating in the Arctic, and reinforced the need for international cooperation in this environmentally sensitive area. With the increase of commercial traffic, discussions between the Heads of Delegation and Ambassadors during Arctic Guardian highlighted the criticality of coordination in maritime environmental response and the responsibility to ensure search and rescue resources are prepared to respond.

Operational Presence

America's Arctic Shield is the Coast Guard's annual operation in the Arctic that employs a seasonal and mobile approach to execute our statutory missions in the region. In 2017, America's Arctic Shield operations advanced national and Coast Guard strategic goals by aligning operations to mitigate real-world threats, leveraged opportunities of strategic interest, and performed statutory missions. This involved the re-establishment of a temporary, forward operating location in Kotzebue, AK, as well as the deployment of major cutter forces, air assets, communication equipment, personnel, and logistics support to conduct Coast Guard missions. During 2017, the Coast Guard employed the icebreaker HEALY to conduct maritime patrols and support scientific operations. The high endurance cutter SHERMAN and medium endurance cutter ALEX HALEY also operated in the Bering, Chukchi, and Beaufort Seas, conducting maritime patrols and serving as forward deployed response assets. In July and August of 2017, the seagoing buoy tender MAPLE completed a historic voyage through the Northwest Passage, marking the first time a Coast Guard cutter not designated as a heavy or medium ice breaker, transited the passage since 1967. Additionally, the Coast Guard worked collaboratively with multiple agencies to enhance prevention and response plans at all levels of government. Our key highlights include: completion of 28 search and rescue cases (collectively saving 20 lives and assisting 27 others); Coast Guard and Navy divers completing the first Arctic ice dive operations from the HEALY since 2006; conducting multiple exercises such as Operation Arctic Guardian; hosting an oil spill seminar, and equipment deployment in Utqiagvik, AK; visits to 41 remote villages (educating more than 4,000 children in boating and water safety programs); exchanges and joint operations with the Royal Canadian Navy and Coast Guard; and ALEX HALEY's successful medical evacuation of a Chinese national from the Chinese ice breaker XUE LONG near Nome, AK.

This year, America's Arctic Shield 2018 shoreside operations commenced on March 1. Those operations include a focus on western Alaska and the Bering Strait. They will also include a three-pronged approach consisting of outreach, operations, and assessment of capabilities in order to support marine safety, search and rescue, law enforcement, and other Coast Guard statutory missions in the Arctic. Consistent with our Arctic Strategy, our goal is to further develop a comprehensive understanding of the capabilities required to operate in this austere environment, as well as to broaden partnerships in support of Arctic operations.

In 2018, operations will continue to be supported by the re-activation of a forward operating location in Kotzebue on July 1 to coincide with increased cutter, aircraft, and shoreside presence. Other activities include facility and vessel inspections, gold dredge fleet inspections, maritime safety compliance enforcement, ice rescue training, marine mammal protection enforcement flights, sovereignty patrols, and scientific research. Planned exercises include an oil spill exercise in Bethel in August, a preparedness and response exercise on the North Slope, and a joint marine pollution contingency exercise with Russia planned for November. Year round outreach efforts will continue to deliver education and awareness services to Arctic communities and outlying native villages.

In addition to America's Arctic Shield operations, the Coast Guard has a history of leading Arctic exercises to test and develop capabilities, experience, and international and intergovernmental partnerships. The Coast Guard was a major contributor to the October 2015 International Arctic Search and Rescue Exercise, Arctic Zephyr. The purpose of this exercise was to test and practice deployments in accordance with the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic. Its focus was on the coordination of response capabilities of the Arctic nations, local governments, the private sector, and indigenous communities in a mass search and rescue operation. Additionally, the Coast Guard was co-lead with Department of Defense (DoD) for Arctic Chinook, a full-scale exercise held in August 2016. This exercise focused on International Search and Rescue coordination and response in a remote Alaskan Arctic location. The exercise was comprised of more than 1,000 personnel from the Coast Guard, DoD, state and local agencies, tribal organizations, and the Royal Canadian Air Force, boosting Arctic mission coordination between Federal, local, and state responders and promoted interagency and industry support for search and rescue actions. International partners also participated as observers to the exercise.

Icebreaking Capacity and Acquisition Status

The ability for the United States to lead in the Arctic, both diplomatically and operationally, hinges on having the capabilities and capacities (presence) to exert national security and sovereignty. The foundation of this presence is U.S. icebreakers, whose purpose is to provide assured, year-round access to the polar regions. These are platforms that can deliver Coast Guard authorities anywhere, anytime. Under international law, Coast Guard icebreakers are considered U.S. warships. Accordingly, a heavy icebreaker must be fully interoperable with interagency and international stakeholders, including the DoD, to carry out national defense operations. Thus, they will include sufficient space, weight, and power to conduct the full complement of multi-mission activities that support our Nation's current and future needs in the Arctic.

The 2010 High Latitude Mission Analysis Report (HL MAR) identified the need for six new polar icebreakers (three of which must be heavy) under the assumption that, in the future, the Coast Guard would be required to perform nine of its eleven statutory mission year-round in the Arctic, and support all icebreaking needs to sustain our presence in Antarctica. In 2017, the Coast Guard's Center for Arctic Study and Policy completed an addendum to the HL MAR. The objectives were to provide a broad overview of changes in the polar regions over the last seven years and to provide specific information for use in determining potential impacts on mission areas in the polar regions.

This addendum provides confidence in the original findings and encourages the sustained reliance on its initial recommendations.

The current Coast Guard icebreaker capacity is one heavy polar icebreaker, CGC POLAR STAR – commissioned in 1976, and one medium icebreaker, CGC HEALY – commissioned in 2000. The primary differences between heavy and medium icebreakers are endurance and power. The Coast Guard considers a heavy icebreaker to be one that can break at least six feet of ice at a continuous speed of three knots and operate year-round in the Arctic, with the necessary systems and endurance to protect its crew in the event it has to "winter-over" in substantial ice conditions. A heavy icebreaker must also have a fully mission capable cutter endurance of 80 days without replenishment, be able to deploy helicopter detachments, and be able to perform the full suite of Coast Guard missions. Conversely, medium icebreakers are designed to operate seasonally in the Arctic. The Coast Guard has chartered an Integrated Product Team to define the Concept of Operations and requirements for a medium icebreaker. While medium icebreakers like the HEALY provide critical capability identified in the HL MAR, the age and condition of our Nation's only operational heavy icebreaker, POLAR STAR, makes recapitalizing this capability of the highest priority.

Due to the strong support of Congress, the FY 2017 and FY 2018 appropriations included a total of $300 million toward polar icebreaker acquisition. This investment reflects our interests as an Arctic Nation, and reaffirms the Coast Guard's role in assuring access to this region. Additionally, the FY 2019 President's Budget requests $750 million for the construction of an icebreaker, which is a strong message that the Nation is serious about recapitalizing our heavy icebreaker fleet. Key stakeholders participated in the identification of operational requirements, and the Coast Guard approved a cost-informed update to the heavy polar icebreaker Operational Requirements Document (ORD) earlier this year. Most recently on March 2, 2018, the joint Coast Guard and Navy polar icebreaker Integrated Program Office (IPO) released the request for proposals – nearly four weeks ahead of schedule – for the detail design and construction (DD&C) of up to three heavy polar icebreakers. The IPO anticipates receiving bidders' final proposals in September 2018. After proposals are received, the intent is to award the DD&C contract to a single shipbuilder in FY 2019. We are as close as we have been in over 40 years to recapitalizing our icebreaking fleet, and continued investment will ensure we meet our Nation's growing needs in the rapidly evolving and dynamic polar regions.

The Coast Guard also understands that we must maintain our existing heavy and medium icebreaking capability while proceeding with recapitalization. Maintenance of POLAR STAR will be critical to sustaining U.S. heavy icebreaker capability until new heavy icebreakers are delivered. The results of last year's alternative analysis concluded that the most prudent option for maintaining heavy icebreaker capability, until new heavy polar icebreakers are delivered, is to conduct a Service Life Extension Project (SLEP) on POLAR STAR. Robust planning efforts are already underway, and pre-phase, industrial work for this project will begin in 2020, with phased industrial work occurring annually from 2021 through 2023. The end goal of this process will be to extend the vessel's service life until delivery of at least the second new heavy polar icebreaker.

Acknowledging that our only medium icebreaker is approaching 20 years of age, we are also taking initial steps to prepare for a mid-life maintenance availability on HEALY.

Developing new icebreaking capability at best possible speed remains among the Service's highest priorities.

Conclusion

The Coast Guard will continue to lead across the National and international landscape to help shape the Arctic domain as a cooperative environment while preserving our sovereign rights. Presence and collaboration across the national and international spectrum will enable us to reinforce positive opportunities and mitigate negative consequences in the Arctic region. Failing to increase and focus our Nation's leadership in the Arctic will result in other powerful nations taking the lead in a region with critical geostrategic value.

We understand the significant investment required to secure the Arctic, and we appreciate and embrace the trust the Nation has placed in the Service. Thank you for the opportunity to testify before you today and for all you do for the men and women of the Coast Guard. I look forward to answering your questions.

Question#:	1
Topic:	Capital Planning
Hearing:	Maritime Transportation in the Arctic: The U.S. Role
Primary:	The Honorable John Garamendi
Committee:	TRANSPORTATION (HOUSE)

Question: The Coast Guard has limited operational capability north of the Arctic Circle. The closest year-round facility is located in the Aleutian Islands at Dutch Harbor (800 miles south of the North Slope). The Coast Guard also activates seasonal bases in Kotzebue and Nome and conducts annual operations (Arctic Shield) to test capacities and train in this inhospitable region. Yet despite these seasonal activities and the development of an overarching Arctic Strategy, the Coast Guard's fiscal year 2019 Capital Investment Plan (CIP) includes no mention of capital investments (other than polar icebreakers) to support Coast Guard Arctic operations (i.e., deep water ports, shore side infrastructure, IT systems, ATONs, etc.).

How does the Coast Guard explain this omission?

Response: Given limited resources, the Coast Guard's seasonal and mobile approach has enabled concentration of assets in areas where they are most needed at any given time.

Last year's Arctic Shield operations yielded many successes, including the following:

- Coast Guard operations were performed over the course of four months, from July through October.
- We prosecuted 20 search and rescue cases, resulting in 16 lives saved, and another 23 other instances of assistance being rendered.
- Through extensive engagements with other federal, state, local, and tribal agencies, we performed mass rescue, oil spill, and ice rescue exercises; conducted search and rescue training; positioned assets during cruise ship transits; and performed safety and compliance examinations.
- We deployed five cutters, three helicopters, and utilized a HC-130H for logistics and maritime domain awareness flights. As part of that temporary footprint, this year we will again use "Forward Operating Location Kotzebue," an Army National Guard hangar we've leased as a staging base for rotary-wing assets to support our full suite of missions in the Arctic.

Question: When can we expect to see the CIP reflect this need?

Response: The Coast Guard's current seasonal and mobile approach allows the Service to adapt and deploy limited resources in the most effective manner. As human activity in the Arctic evolves, the Coast Guard will continue to evaluate and assess this approach.

Question#:	1
Topic:	Capital Planning
Hearing:	Maritime Transportation in the Arctic: The U.S. Role
Primary:	The Honorable John Garamendi
Committee:	TRANSPORTATION (HOUSE)

Question: Does the Coast Guard believe that it does not need to make any capital improvements to support Coast Guard Arctic operations?

Response: The Coast Guard is regularly assessing the need for capital improvements to support Arctic operations. Continued investment in polar-class icebreakers is critical to ensure ice-capable surface presence in the Arctic. The Coast Guard plans to build at least three polar-class heavy icebreakers.

The Coast Guard recently commissioned two new Fast Response Cutters to operate out of Ketchikan and completed necessary infrastructure improvements to support these ships. The Coast Guard also plans to locate two new Offshore Patrol Cutters and two new Fast Response Cutters in Kodiak. Supporting infrastructure for the future Kodiak-based ships was partially funded in fiscal years 2017 and 2018, and the President's 2019 Budget request to the Congress includes further support for this effort.

The Coast Guard will continue to evaluate and fund infrastructure improvements while balancing other high priority acquisition needs. Additionally, the Coast Guard's Procurement, Construction, and Improvements Fiscal Year 2019 Unfunded Priorities List includes projects for a cutter maintenance building in Kodiak, as well as piers and maintenance buildings for one Fast Response Cutter each in Seward and Sitka.

Question#:	2
Topic:	Arctic CONOPS
Hearing:	Maritime Transportation in the Arctic: The U.S. Role
Primary:	The Honorable John Garamendi
Committee:	TRANSPORTATION (HOUSE)

Question: The Coast Guard released its Arctic Strategy in 2013. It is not clear, however, what the Coast Guard's Concept of Operations is for the Arctic, and when and how the Coast Guard will transition from temporary seasonal operations to a more permanent presence above the Arctic Circle.

Does the Coast Guard have a stable CONOPS for Arctic operations?

Response: Operation Arctic Shield is the Coast Guard's mobile, seasonal, and scalable operation in the Arctic. This operation is aligned with the Coast Guard Arctic Strategy's objectives to improve awareness, modernize governance, and broaden partnerships. Operation Arctic Shield activity includes the deployment of cutters, aircraft, and personnel to the Arctic and is scalable to match threats and risks, opportunities, and mission responsibilities given limited resources.

Question: Considering the rapid change in both the geopolitical and natural environments in the Arctic, does the present CONOPS provide adequate flexibility to allow the Coast Guard to adapt to shifting circumstances and conditions?

Response: The Coast Guard is committed to providing a mobile and seasonal presence in the Arctic, which is scalable, as levels of maritime activity require. Through Operation Arctic Shield, the Coast Guard deploys cutters, aircraft, and personnel to the Arctic, which allows the Coast Guard to adapt to shifting circumstances and conditions. To support these operations, the Coast Guard plans to build six polar icebreakers, at least three of which must be heavy icebreakers. The President's 2019 Budget requests funding to award a contract for detail design and construction of new polar icebreakers, an important next step to ensure Arctic readiness.

Question#:	3
Topic:	Arctic Strategy
Hearing:	Maritime Transportation in the Arctic: The U.S. Role
Primary:	The Honorable John Garamendi
Committee:	TRANSPORTATION (HOUSE)

Question: The absence within the federal government of an over-arching Arctic Strategy to guide future operational planning and investments by federal agencies was exposed and discussed as a genuine liability in protecting and advancing U.S. sovereign and strategic interests in the High North. Members discussed introducing legislation to establish a comprehensive federal Arctic policy and strategy as a possible option to jump start that initiative.

What specific factors must be included in any federal Arctic strategy?

Response: The Coast Guard's Arctic Strategy aims to secure and advance U.S. national interests in the Arctic through three strategic objectives: improving awareness, modernizing governance, and broadening partnerships.

Question: Would legislation be helpful?

Response: Further legislation is not required for the Coast Guard to protect and advance U.S. sovereign and strategic interests in the Arctic. The 2013 National Strategy for the Arctic Region (NSAR) and the associated 2016 Implementation Framework are the overarching federal guidance for the Coast Guard's Arctic strategy. Additionally, the 2017 National Security Strategy (NSS) and the 2018 National Defense Strategy (NDS) emphasize the current and evolving global and national security imperatives. The Coast Guard is applying the priorities in these documents as the Service reviews its current Arctic strategic outlook.

Question: What are your recommendations and associated costs?

Response: The Coast Guard has no additional recommendations related to Arctic strategy and policy.

Question: What would be an appropriate time horizon for implementation?

Response: The Coast Guard has a current Arctic Implementation Plan, which will be reassessed following review of the Service's Arctic strategic outlook.

Question: What critical investments should be made in Coast Guard infrastructure, and in general, how much would these investments cost?

Question#:	3
Topic:	Arctic Strategy
Hearing:	Maritime Transportation in the Arctic: The U.S. Role
Primary:	The Honorable John Garamendi
Committee:	TRANSPORTATION (HOUSE)

Response: The Coast Guard is committed to providing a mobile and seasonal presence in the Arctic that is scalable as required by levels of maritime activity. The Coast Guard plans to build at least three polar-class heavy icebreakers. Continued investment in polar-class icebreakers, which has received strong support from the Administration and the Congress, is critical to ensure ice-capable surface presence in the Arctic.

WRITTEN TESTIMONY OF
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U.S. DEPARTMENT OF COMMERCE

HEARING ON
MARITIME TRANSPORTATION IN THE ARCTIC: THE U.S. ROLE

BEFORE THE
SUBCOMMITTEE ON COAST GUARD AND MARITIME TRANSPORTATION
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE
U.S. HOUSE OF REPRESENTATIVES

June 7, 2018

Introduction

Good morning Chairman Hunter, Ranking Member Garamendi, and Members of the Subcommittee. My name is Dave Kennedy, and I am the Senior Advisor for the Arctic Region at the National Oceanic and Atmospheric Administration (NOAA), within the Department of Commerce. Thank you for inviting NOAA to testify today on our work to support safe and efficient maritime transportation in the Arctic. NOAA appreciates the opportunity to participate today along with representatives from the U.S. Coast Guard, Center for Strategic and International Studies, University of Alaska Fairbanks, Alaska Ocean Observing System, and Pennsylvania State University. We cooperate and coordinate on a regular basis with these agencies and partners in support of the nation's economic and national security interests in the Arctic.

For over two hundred years, NOAA and its predecessor organizations have provided foundational data, products, and services to support safe, efficient maritime commerce. NOAA also has a long history in the Arctic, including conducting research and providing weather and climate services, sea ice forecasting, nautical charting and other navigation services, natural resource management, and oil spill preparedness and response. Today, as sea ice retreats and economic and maritime activity in the Arctic grows, NOAA remains committed to its work in the Arctic.[1] I will touch broadly on NOAA's services, but will focus on our nautical charting mission with an emphasis on the components that are necessary to support maritime transportation and informational infrastructure in the region.

International, Interagency and Local Engagement

NOAA has supported U.S. participation in the international Arctic Council since its

[1] Under the Arctic Research and Policy Act of 1984, the Arctic includes the Aleutian Islands, Bering Sea, Chukchi Sea, Beaufort Sea, and vast terrestrial areas of northern and western Alaska.

establishment in 1996. The U.S. served as the second chair of the council from 1998 to 2000 and chaired the Council again from 2015 to 2017. Through the Council's Protection of the Arctic Marine Environment working group and other efforts, NOAA has supported coordination of efforts to promote safe Arctic navigation. On May 15, the Council launched a public website to assist in implementation of the Polar Code.[2] To better address Arctic hydrographic and nautical charting challenges, NOAA has also participated in the Arctic Regional Hydrographic Commission since 2010.

Since 2016, NOAA has served as the Chair of the U.S. Arctic Observing Network Board and worked towards a sustained and well-defined network of Arctic observations across NOAA, other Federal agencies, the State of Alaska and Alaskan Native Tribes, academia, industry, and international partners, such as the Sustaining Arctic Observing Network. NOAA has been a long-standing sponsor of the Arctic Report Card, an annual, peer-reviewed report developed by 85 scientists across 12 countries. The Arctic Report Card issued its 12th report in 2017. The publication's annual update provides reliable data and observations to support local and regional decision makers in making informed decisions for Arctic communities, national security, industrial growth, environmental health, and food security.

On a local level, the increase in vessel traffic through the Bering Strait into the Chukchi and Beaufort Seas is of concern to Alaska Native coastal communities in the region. These communities rely on subsistence hunting of marine mammals, which are critical to their nutritional, cultural, mental and spiritual well-being. NOAA has been working with the Arctic Waterways Safety Committee (AWSC) to ensure the increase in research vessel traffic does not negatively impact the ability of the communities to hunt marine mammals. Since 2010, NOAA has requested community input for summer survey plans with the AWSC. During these briefings on our planned work, NOAA also details its findings from its prior year survey.

Oil Spill and Hazard Preparedness and Response

Decreasing summer sea ice is contributing to growth in commerce, tourism, and energy exploration in the Arctic. According to a 2015 study coordinated by the U.S. Committee on the Marine Transportation System, shipping transits through the Bering Strait are expected to increase 500 percent by 2025. This increased activity heightens the risk of accidents and discharges of oil and hazardous materials. NOAA's Alaska regional Scientific Support Coordinator provides scientific support to the federal on-scene coordinator for oil spills and other emergencies such as search and rescue. NOAA's contributions include modeling the fate and movement of spills, identifying natural resources at risk, and providing software, mapping tools, and data management capabilities. By law, NOAA is also a trustee for natural resources that

2 The International Maritime Organization's International Code for Ships Operating in Polar Waters. The Web Portal is accessible at http://www.imo.org/en/MediaCentre/HotTopics/polar/Pages/default.aspx.

have been injured by oil and chemicals spills and conducts damage assessment and restoration of these resources.

NOAA participates in joint training and workshops with interagency partners and other Arctic nations on activities such as the use of mechanical recovery, dispersants, and in situ burning following transboundary spill events. NOAA compiles baseline information on natural resources in the Arctic and promulgates standard techniques and guidelines for observing and measuring oil spills and assessing shorelines. Last year, NOAA participated in an interagency oil spill response training for communities in the North Slope of Alaska and held a Science of Oil Spills class in Anchorage.

In 2012, NOAA launched the Arctic Environmental Response Management Application (ERMA®) to integrate and synthesize data into a single interactive map, provide quick geospatial visualizations, and improve communication and coordination among multiple responder agencies. As a common operational picture, ERMA® brings together all of the available information needed for an effective emergency response. In 2017, with funding assistance from the Bureau of Safety and Environmental Enforcement, NOAA improved its display for the Arctic by adding polar projection base maps. This provides a less distorted display of the region while maintaining accurate bearings to the coastline.

Interagency preparedness exercises are essential for critical improvements in spill response procedures. Most recently, in July 2017, NOAA participated in a Mutual Aid Deployment (MAD) exercise on Alaska's North Slope oil field. MAD exercises are held annually on the North Slope with alternating industry hosts. The 2017 exercise was hosted by Hilcorp Alaska (LLC) and included field equipment deployment, an Incident Command Center, and remote operations in Anchorage. NOAA participated in the Incident Management Team at the Command Center along with the U.S. Coast Guard, Hilcorp Alaska (LLC), Alaska Department of Environmental Conservation, and other federal, state, and local responders.

During the United States chairmanship of the Arctic Council for 2015 and 2016, NOAA chaired the Emergency Prevention, Preparedness, and Response (EPPR) Workgroup. Under this leadership, the U.S. delegation to the workgroup delivered several important projects including a Pan-Arctic Oil Spill Response Equipment Database, a Circumpolar Oil Spill Response Equipment Viability Analysis, an updated Guide on Oil Spill Response in Ice and Snow Conditions, and further advancement of exercise procedures for the Agreement on Cooperation on Marine Oil Pollution Preparedness and Response (MOSPA).

Nautical Charts for the Arctic

Since most of the U.S. Arctic is not connected by road or rail, marine transportation is an essential means of transporting goods and people, making NOAA's navigation, observation and

positioning services important for safe and efficient surveying, construction, transportation, and other commerce-related activities. Thus, nautical charts for Alaska and the Arctic are a key component of NOAA's nautical charting mission.

The major requirements for nautical charts are (1) accurate positioning, (2) coastal oceanography such as tides and water levels, (3) shoreline mapping, and (4) hydrographic surveying. NOAA is taking steps to improve the accuracy and reliability of these core capabilities and the nautical charting and navigation services they support.

NOAA released its National Charting Plan in 2017 to improve chart coverage and take full advantage of the capabilities of today's technologies, including the digital Electronic Nautical Chart. This national plan augments NOAA's Arctic Nautical Charting Plan. Both of these plans are designed to ensure that NOAA continues to lead and implement international requirements for hydrographical surveying and charting.

Positioning and the National Spatial Reference System

Nautical charts rely on accurate shoreline information and precise positions and elevations of tide and water level stations, which are dependent on an accurate land-based reference framework. NOAA's National Geodetic Survey provides the land-based reference framework, known as the National Spatial Reference System (NSRS), provides the authoritative coordinate system for all positioning activities in the Nation. Due to tectonic activity, land elevation and positioning data in Alaska currently have errors of a meter or more. To rectify this and modernize the NSRS, NOAA is collecting airborne gravity data under its Gravity for the Redefinition of the American Vertical Datum (GRAV-D) initiative. Thus far, the data for the GRAV-D initiative in the Arctic has been collected using a combination of NOAA, other federal government, and contract aircraft. Specifically, we have used the NOAA P-3, the Bureau of Land Management PC-12 (other federal government), and the Dynamic Aviation King Air 200T (contract aircraft).

Under GRAV-D, NOAA collected airborne gravity data over 13.4 percent of Alaska in 2017 (excluding the Aleutian Islands). In FY18, we expect to reach 95 percent coverage of Alaska, (excluding the Aleutians) while collecting data in the Alaskan Arctic over an area the size of Virginia (110K sq. km). The overall GRAV-D effort in Alaska should be completed by the end of 2020. NOAA is also working to provide improved positioning in Alaska through its network of Continuously Operating Reference Stations. These efforts are part of NOAA's 2022 update to the NSRS, which will enable up to centimeter-level accuracy for latitude, longitude, and height, using Global Navigation Satellite System survey techniques at any location.

Tides, Water Levels and Coastal Oceanography

Accurate water level data is another essential component for building accurate nautical charts.

NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) builds and maintains the country's National Water Level Observation Network (NWLON). In addition to providing data essential for surveying and charting, these long-term observations of coastal water levels improve understanding and predictions of coastal change, storm surge, and saltwater intrusion into freshwater systems that are urgently needed to inform decisions by increasingly vulnerable coastal communities in the Arctic. Presently, CO-OPS operates 27 long-term NWLON tide stations in Alaska, 10 of which are located in the Arctic. CO-OPS has identified over 30 gaps in NWLON coverage for Alaska, the majority of which are in the Arctic. Where gaps exist, local tide data must be taken from short-term water level studies or extrapolated from the nearest NWLON station, both of which will introduce potential error. Thus, reducing gaps in NWLON coverage improves the accuracy and redundancy of the reference system.

To address this need, CO-OPS and the Alaska Ocean Observing System (AOOS), which is a part of the NOAA-led Integrated Ocean Observing System (IOOS) program, are developing and testing new technologies to measure water levels in Alaska. AOOS has helped install portable, low-cost systems that help to fill NOAA National Weather Service observation gaps for monitoring storm surges in small coastal communities. Recently, the National Weather Service supported installation of a NWLON station in Unalakleet, Alaska, to provide real-time information for storm surge models, as well as navigation. The maintenance of this station, as well as others in Alaska, has been contracted out to a local Alaska company, JOA Surveys, LLC. JOA is also working with the National Park Service to install a water level sensor to NOAA standards in Cook Inlet that will also help fill a NWLON gap.

NOAA's Office of Coast Survey and CO-OPS are also collaborating to bring online the Cook Inlet Operational Forecast System (OFS), a 3-dimensional hydrodynamic model, in FY19. The OFS will provide nowcast and forecast information for water levels, currents, temperature and salinity to support navigation activities along the ship channel from the mouth of the estuary all the way to Anchorage. CO-OPS is working with AOOS and NOAA's Kasitsna Bay Laboratory to collect marine current information in Kachemak Bay to assist with circulation studies to update the U.S. Tidal Current Tables. These new data will also support the Cook Inlet OFS.

Shoreline Mapping

Shoreline surveys are also critical to keeping nautical charts up to date. In 2017, NOAA doubled its previous years' shoreline coverage, delivering accurate shoreline and topographic features for over 700 miles of coastline. This data enables mariners to pinpoint their locations relative to the coast, navigate to and from ports safely, and find harbors of refuge when in need. In addition to charting, accurate shoreline data is a key requirement for many other uses, including maritime domain awareness, waterways management, and environmental protection from oil spills and other hazardous events.

Hydrographic Surveying

Nautical charts are only as good as the accuracy of the underlying hydrographic data and less than 5 percent of the U.S. maritime Arctic is charted to modern international navigation standards. The scale of the hydrographic survey requirement in Alaska and the Arctic is vast, with 426,000 square nautical miles within the U.S. Exclusive Economic Zone (EEZ) and nearly half of that significant to navigation.

Through the Office of the Coast Survey, NOAA continues to prioritize and undertake hydrographic surveying in the expansive, remote and often harsh Arctic environment. Over the past three years, NOAA and its contract partners have acquired nearly 1,500 square nautical miles of hydrographic survey data in the Arctic. For 2018, our survey plans include seven projects in waters off Alaska, covering 2,066 square nautical miles. Those areas include: the north slope of Kodiak, West Prince of Wales Island, Tracy Arm, Lisianski Strait and Inlet, southwest Alaska Peninsula, Morzhovoi Bay/Cold Bay, and Point Hope and Vicinity. Five of these projects will be carried out by our regional contracting partners. They are an essential component of the balanced hydrographic survey program NOAA employs in Alaska and across the nation.

NOAA also works with private sector partners and academia to develop and deploy Autonomous Surface Vessels (ASV) for chart-quality surveys. For the past two years, our contractor in Alaska has employed unmanned surface vehicles to conduct hydrographic surveys. Through a partnership with the University of New Hampshire's Center for Coastal and Ocean Mapping we plan to use an ASV and a NOAA ship-based crew to conduct a hydrographic survey in the Arctic this year. In 2016, we collaborated with the Pacific Marine Environmental Laboratory to use a Saildrone ASV to acquire data in the Bering and Chukchi Seas. Based on the success of that mission, we are currently updating our Bering Sea charts with the ASV-gathered data. This collaboration expanded in 2017 to five ASVs and we look forward to updating more charts with that data and further investigating the use of Saildrones as an additional, cost-effective survey capability.

The Nautical Chart

A primary purpose for many of these functions is to support NOAA's production of the Nation's nautical charts. As with all mapping and geospatial activities, the nautical chart has been transformed by modern technologies, including the transition to digital charts. NOAA released its National Charting Plan in 2017 to improve chart coverage and take full advantage of the capabilities of today's technologies, including the digital Electronic Nautical Chart. This national plan augments NOAA's Arctic Nautical Charting Plan referenced earlier. These plans are based on extensive outreach to users. They also are designed to ensure NOAA continues to lead and implement international requirements for surveying and charting.

Looking to the Future: Enhancing NOAA's Core Missions in the Arctic

While NOAA's core missions remain the same, advances in technology are providing opportunities to greatly enhance the accuracy, timeliness, and integration of our products and services, including those that inform and support marine navigation and transportation in the Arctic. To ensure that we consider the needs of and challenges facing our Arctic stakeholders, NOAA continues to look for innovative partnerships with the private sector and other stakeholders, including the ability of the private sector to incorporate NOAA data and services to develop new applications to enhance operations and efficiency. NOAA will continue reaching out to our Arctic stakeholders by convening a meeting of our Hydrographic Services Review Panel (a federal advisory committee) in Juneau this August.

Conclusion

NOAA plays a unique and important role in providing critical informational infrastructure to support safe, reliable, and efficient marine navigation in the Arctic and elsewhere. Local, state, federal, and international partnerships are critical to achieving successful Arctic operations in this unique and challenging environment. There is more work to be done to facilitate commerce in the Arctic and NOAA is working to develop and apply technology and data in innovative ways to improve our navigation products and services. Thank you again for the opportunity to testify today. I appreciate the Subcommittee's time and attention and look forward to answering your questions.

"Maritime Transportation in the Arctic: The U.S. Role"
Subcommittee on Coast Guard and Maritime Transportation
Thursday, June 7, 2018, 11:00 a.m.
2167 Rayburn House Office Building
Washington D.C.

Questions for the Record

Submitted on behalf of Ranking Member John Garamendi (CA-03):

Arctic Navigation Products and Service

The National Oceanic and Atmospheric Administration (NOAA) is responsible for producing a whole series of navigation services and products in the United States, including Alaska and the Arctic. In Alaska, roughly four percent of navigable waters have accurate nautical charts. NOAA has identified in its Arctic Nautical Charting Plan more than 38,000 square nautical miles as navigationally significant survey priority areas and has estimated that it could take up to 25 years to conduct hydrographic surveys in these priority areas.

(1) What innovative approaches and collaboration is NOAA using to address this huge survey backlog for navigationally significant areas in the Arctic? What can NOAA do to accelerate this effort?

Answer:

NOAA uses two ice-capable ships, the Rainier and the Fairweather, as well as contractors, to conduct hydrographic survey work in the Arctic. In addition, NOAA uses several innovative approaches to survey priority areas in the Arctic.

First, NOAA routinely polls its federal partners for existing bathymetric data that they may have. NOAA also co-chairs the Alaska Mapping Executive Committee and works closely with the State of Alaska private sector and academia to obtain data, including hydrographic data that Quintillion and Shell acquired in recent years. These data from external sources are valuable to NOAA for nautical charting and decision support. NOAA can also assess satellite data for bathymetry in shallow coastal waters. Satellite-derived bathymetry is another innovative tool that can support survey efforts by reducing the amount of time and area to survey, increasing NOAA's ability to efficiently provide updated nautical charts to the local mariner.

Finally, NOAA is also utilizing private sector autonomous and uncrewed surface vehicles[1] (ASV and USV) to support nautical charting and hydrographic surveying. In 2016, NOAA used a Saildrone ASV to acquire data in the Bering and Chukchi Seas. Based on the success of that mission, NOAA is updating our Bering Sea charts with the ASV-gathered data. NOAA is

[1] While similar in some respects, an ASV is typically deployed and left to conduct its work without direct and constant oversight, while an USV is deployed and constantly monitored and operated from a central location/vessel.

committed to using its partnerships as well as new tools such as satellite derived bathymetry and ASV/USVs to improve coverage of priority survey areas in the Arctic.

(2) Does the Department of Defense or other intelligence agencies have hydrographic survey data that could be de-classified and subsequently utilized for the development of commercial nautical charts and navigation products?

Answer:

NOAA does engage with the Navy and National Geospatial Intelligence Agency (NGA) on available hydrographic data in the Arctic and other U.S. waters. In February 2018, NOAA, NGA and Navy worked together on an assessment of existing data holdings in relation to Seabed 2030, the global initiative to map the world's oceans by 2030. Navy and NGA examined their data holdings with a goal to identify any existing data not already archived at the NOAA National Centers for Environmental Information (NCEI) that could be shared or declassified. The agencies plan to continue periodically assessing available data for release.

It should be noted that there is not that much new, releasable NGA or Navy data in U.S. waters, including the Arctic. As a general rule, NOAA is responsible for surveying inside the U.S. Exclusive Economic Zone, Navy survey assets primarily operate in international waters, and NGA charts areas outside of the U.S. EEZ. The Navy's submarine force continues to collect bathymetric data during operations, exercises, and transits through the Arctic. The Navy shares its releasable Arctic data through the Science Accommodation Mission (SAM) program. Arctic environmental data, including bathymetry, is processed and released through the National Snow & Ice Data Center (NSIDC) soon after Navy vessels return to port. This data has been helpful to efforts such as the International Bathymetric Chart of the Arctic Ocean for bathymetric information in international waters.

NOAA and NGA work together on the Arctic Regional Hydrographic Commission, where NGA leads the Arctic Maritime Spatial Data Infrastructure with a goal for all coastal member states to release as much existing data as possible in the Arctic marine domain. NGA provides unclassified data and context to the situation via its .mil website on past and projected ice extents, energy resource potential, search and rescue agreements, maritime boundaries and submission, navigational warnings areas, bathymetry data, airfields, ports and more.

One activity intended to bear fruit in the coming year is the effort characterized in the Navy/U.S. Coast Guard National Fleet Plan (Appendix F) to "advocate for an international agreement on hydrography and nautical charting in the Arctic. Elements would include opportunities for: leveraging vessels of opportunity for environmental sensing; data collection and sharing; satellite and aerial derived information (e.g. bathymetry); standards for interpreting data; improved Arctic marine spatial data infrastructure; and regional analysis and chart production." This can include Navy vessels supplying trackline data to NOAA as they transit to and through the U.S. Arctic, at differing levels of quality depending on the instrumentation aboard the vessel. Even minimum quality data is useful and will be incorporated into the International Hydrographic Organization

Data Centre for Digital Bathymetry at NCEI.

Oil Spill Preparedness and Response

The Committee on the Marine Transportation System released a report in 2015 that estimated the seasonal decrease in sea ice could result in a 500 percent increase in shipping transits through the Bering Straits. An obvious side effect of this increase is a heightened risk of vessel accidents and the release of oil and other hazardous materials into Arctic waters.

(3) Are the current levels of oil spill response capabilities in the Arctic sufficient to meet the projected increase in maritime traffic?

Answer: As seasonal decreases in sea ice open up the Arctic to more vessel and other economic activity, there will be a commensurate increase in potential for accidents, spills, and other environmental hazards. The Arctic will remain a remote and challenging place to work. Challenges for response and damage assessment capabilities in the Arctic include remote locations, challenging logistics, severe weather, short windows of open-water and daylight in which to respond, and lack of ports and infrastructure.

(4) Since the Exxon Valdez oil spill 30 years ago, how many new innovative systems and technologies have been developed to respond to oil spills in frigid Arctic waters?

Answer: Many new innovative systems and technologies have been developed since Exxon Valdez. For instance, NOAA launched Arctic ERMA® (Environmental Response Management Application) in 2009. Arctic ERMA® is an online mapping tool that brings together the available geographic information needed for an effective emergency response in the Arctic. ERMA® integrates data—some occurring in real time such as weather and ice radar—into a single interactive map, providing a quick visualization of on-the-ground conditions. Another example of an innovative system to address oil spill response in the Arctic is NOAA's work with the U.S. Department of State through the Arctic Council and its Emergency Prevention, Preparedness and Response (EPPR) Working Group. One of the EPPR projects included a joint effort with the International Maritime Organization to produce updated response guides for spill response in ice and snow and remote Arctic conditions.

(5) Should the federal government direct more research and development funding in this area?

Answer: To date, funding for oil pollution research as a whole has been provided through various state and federal agencies and industry and research results are shared through avenues such as the Interagency Coordinating Committee on Oil Pollution Research. NOAA in particular relies heavily on partnerships with agencies and organizations for oil pollution research to develop a deeper understanding of Arctic systems.

Reliance on GPS Signals

The use of electronic navigation systems and nautical charts by maritime commercial operators is becoming increasingly commonplace. These new tools are highly accurate, cost-effective to revise, and interoperable. Yet, all of these systems rely to one extent or another on Global Positioning System signals, which consequently, makes these systems vulnerable to failure should the GPS signal go dark, be disrupted, or be degraded.

(6) To what extent are the navigation products produced by NOAA, such as electronic charts, dependent on GPS signals to operate accurately and reliably? What would happen to these products if GPS signals were disrupted, intentionally or accidentally? Should there be a backup position, navigation and timing signal for GPS?

Answer: The Office of Coast Survey produces electronic nautical charts (ENCs) and raster nautical charts (RNCs). These products are designed to be used with Electronic Navigation Systems that are dependent on GPS signals for positioning. Thus, accurate and reliable GPS signal is critical for safe navigation using electronic nautical charts. Most electronic navigations systems can handle short periods with weak or no GPS signal, updating the ship position based on the last known position and the ship's speed and course over time, known as dead reckoning. However, loss of electronic positioning from GPS would make it very challenging to navigate on an ENC because it is difficult to make a visual position fix on an ENC, as compared to using a paper chart.

Safety of Life at Sea class ships (internationally-bound passenger vessels or 500 tons gross tonnage vessels) must operate with Electronic Chart Display and Information System (ECDIS) in addition to a backup system for navigation, either a separate and independent ECDIS system or paper charts. Redundancy in navigation equipment is extremely important for safe navigation. Redundancy for establishing position and time should be equally important.

Arctic Strategy

The absence within the federal government of an over-arching Arctic Strategy to guide future operational planning and investments by federal agencies was exposed and discussed as a genuine liability in protecting and advancing U.S. sovereign and strategic interests in the High North. Members discussed introducing legislation to establish a comprehensive federal Arctic policy and strategy as a possible option to jump start that initiative.

(7) What specific factors must be included in any federal Arctic strategy? Would legislation be helpful? What are your recommendations and associated costs? What would be an appropriate time horizon for implementation? What critical investments should be made in maritime and coastal infrastructure, and in general, how much would these investments cost?

Answer: As part of the ongoing implementation of the existing interagency National Strategy for the Arctic Region (NSAR), NOAA's activities in the Arctic are focused on weather, sea ice and climate forecasts; predictions for operational economic and safety of life decisions; fisheries

management; navigation services; emergency response and putting environmental data into the hands of U.S. Arctic residents.

Further, almost of all of NOAA's existing authorities are national in scope, which means that most of NOAA's authorizations already apply in the U.S. Arctic. NOAA has the capabilities to address the Arctic's environmental information needs within existing authorities and continues to take steps to provide foundational geospatial science and observations to remote areas.

NOAA is not able to speak to the broader Federal investments in maritime and coastal infrastructure, which would encompass a wide range of Federal agencies, and be supplemented by activities supported by the State of Alaska, local governments, and stakeholders.

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

Statement Before the

House Transportation and Infrastructure Committee
Subcommittee on Coast Guard and Maritime Transportation

"Maritime Transportation in the Arctic: The U.S. Role"

A Testimony by:

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June 7, 2018

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Mr. Chairman, Ranking Member Garamendi, and distinguished members of the subcommittee, thank you for the opportunity to speak again to you on an issue which impacts U.S. national security and its sovereignty. More Congressional committee hearings should be dedicated to understanding emerging economic and military developments in and around the Arctic region to ensure the United States has a capable and credible maritime presence in the Arctic. My testimony today is drawn from an extensive research project that CSIS completed last fall entitled, "Maritime Futures: The Arctic and the Bering Strait Region."

Former Commandant of the U.S. Coast Guard, Admiral Paul Zukunft, recently called the Arctic America's "Fourth Coast;" a coast that must remain safe, secure, and well-stewarded today and in the future.[1] Unfortunately, only 4.1 percent of America's Fourth Coast (the U.S. maritime portion of it) is charted to modern international navigation standards. And what is charted, including waters off western Alaska and the Aleutian Islands, is based on information that dates back to before World War II while other regions remain entirely unsurveyed.[2] Our knowledge of Arctic waters are limited, outdated, or are insufficient due to a lack of data.[3] The Arctic's high latitude presents unique communication challenges which is limited by geomagnetic interference and minimal satellite coverage and bandwidth. The United States lacks sufficient air and sea infrastructure along Alaska's western and northern shores, and along the narrow Bering Strait.[4] Without knowledge and presence in the Arctic, we lack sovereign control.

This is not how one would imagine the United States – the world's greatest maritime power – would strategically approach the emergence of a new ocean, the Arctic Ocean, or protect its Fourth Coast.

For far too long, the United States has done the bare minimum to appropriate sufficient resources to enhance maritime infrastructure and improve emergency response capabilities along our Fourth Coast. We have perfected the art of "making do" by "making it work" which equates to a Coast Guard seasonal presence (July – October) along the U.S. Arctic Coast and a prayer that should "something happen" in the American Arctic, it will occur during this season, and preferably near a pre-positioned U.S. maritime asset.

While trans-Arctic shipping and destinational shipping may be muted today, we anticipate an increase in maritime traffic through the narrow Bering Strait, particularly as LNG carriers from

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[1] Admiral Paul F. Zukunft, Keynote Address at CSIS event "The Arctic of the Future: Strategic Pursuit or Great Power Miscalculation?" May 10, 2018, https://www.csis.org/analysis/arctic-future-strategic-pursuit-or-great-power-miscalculation-keynote-address.

[2] Hydrographic Services Review Panel, "Charting the U.S. Maritime Arctic," National Oceanic and Atmospheric Administration, February 2018, https://www.nauticalcharts.noaa.gov/hsrp/recommendations/2018/HSRP-Charting-Maritime-Arctic-28feb2018.pdf; Hannah Hoag, "NOAA is Updating its Arctic Charts to Prevent a Nautical Disaster," *Arctic Deeply*, August 29, 2016, https://www.newsdeeply.com/arctic/community/2016/08/29/noaa-is-updating-its-arctic-charts-to-prevent-a-nautical-disaster.

[3] "Caution Required When Using Nautical Charts of Arctic Waters," *Arctic Regional Hydrographic Commission (AHRC)*, June 28, 2017, https://www.iho.int/mtg_docs/rhc/ArHC/ArHC_Misc/Notice%20on%20caution%20required%20when%20using%20nautical%20charts%20in%20Arctic%20waters3.pdf.

[4] Heather A. Conley, Matthew Melino, and Andreas Østhagen, *Maritime Futures: The Arctic and the Bering Strait Region* (Washington, DC: CSIS, November 2017) https://csis-prod.s3.amazonaws.com/s3fs-public/publication/171027_Conley_MaritimeFutures_Web.pdf?mHPGy0uKqRMcek0zw6av5jI332MeELk5

the Russian Arctic make their way to Asian energy markets. Transits through the Bering Strait have more than doubled over the past decade.[5] Over time, these increased transits will stretch and expose our thinly resourced and outdated capabilities until we are no longer able to respond to a major environmental accident or mass casualty incident.

The United States requires a pro-active, long-term plan to protect the U.S. coastline in Alaska, patrol U.S. territorial waters in the North Pacific and the Bering, Chukchi, and Beaufort Seas, and enforce our 200-mile Exclusive Economic Zone (EEZ) as well as our maritime demarcation border with Russia. These tasks are critical to the future prosperity and national security of Alaska and the United States as interest in Arctic energy exploration, natural resource extraction, fisheries, tourism, and maritime transportation grows.

Presence = Sovereignty in the Arctic

The U.S. Coast Guard's District 17 maintains a physical presence in several Alaskan cities ranging from the southeast tip of Ketchikan to Cordova and Kodiak in the south and as far inland as Fairbanks.[6] However, the Coast Guard's most critical posts for operating in the Bering Strait include Kodiak, Unalaska in the Aleutian Islands, a seasonal presence in Kotzebue, and Sitka which include hangars for aircraft such as HC-130Hs, MH-60-Ts, and MH-65-Ds used for critical response missions.[7] These aircraft compliment the Coast Guard's most significant presence in the Arctic region – U.S. Coast Guard Cutter (USCGC) *Munro*, USCGC *Spar*, and USCG *Alex Haley* to enforce fishery laws, ensure commercial fishing vessel safety, and responding to search-and-rescue missions.

Enhanced U.S. Arctic presence and sovereignty must be built on reliable command, control, communications, computers, and information technology (C4IT) capabilities and knowledge of Arctic waters. Some communities in the Arctic have cellular phone networks, but with limited – albeit improving – broadband coverage, capacity, and reliability.[8] A lack of geospatial and oceanographic infrastructure to support nautical charting and accurate positioning services along the coasts of the Chukchi and Beaufort Seas exacerbate the challenge as do gaps in geodetic coverage, tides and currents, hydrographic surveys, and shoreline mapping.[9]

An additional shortcoming in Arctic assets is the lack of deep-water ports. The closest U.S. deep-water port is Dutch Harbor in the southern Bering Sea, which is over 800 miles from the Bering Strait. Surrounding the strait, there are three primary Alaskan-based ports that service vessel traffic: Nome, Kotzebue, and the DeLong Mountain Transportation System (DMTS) port servicing the Red Dog Mine. However, the water depth at these ports does not exceed 10 meters, severely restricting the number and type of vessels able to dock.[10]

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[5] Sierra Fletcher, "Bering Sea Vessel Traffic: Risk Analysis," Nuka Research and Planning Group LLC and Ocean Conservancy, December 2016, 16, https://oceanconservancy.org/wp-content/uploads/2017/01/bering-sea-vessel-traffic-1.pdf.
[6] Ibid, 14.
[7] Ibid, 14.
[8] "United States Coast Guard Arctic Strategy," 14.
[9] Ibid.
[10] PAME Working Group, "Arctic Marine Shipping Assessment 2009 Report," Arctic Council, April 29, 2009, 108, https://www.pmel.noaa.gov/arctic-zone/detect/documents/AMSA_2009_Report_2nd_print.pdf.

Members of this subcommittee are all too familiar with the lack of icebreaking capabilities. Icebreakers provide assured year-round access to ice covered waters so that the U.S. Coast Guard can meet its statutory missions as well as national and international obligations. Icebreakers also serve as mobile infrastructure for the region. Mobility and flexibility in projecting presence in the Arctic is essential. We are encouraged that efforts to procure one new heavy icebreaker are underway, with it scheduled to enter service in 2023 (we hope). But to be clear this new heavy icebreaker will be predominantly used in Antarctica, not the Arctic. And to add another important point of clarity, the United States also does not currently have an interim icebreaker solution for the *next five years*. Should there be a catastrophic mechanical failure of the one U.S. heavy icebreaker, the *Polar Star*, before 2023, the U.S. would have to lease icebreaking capabilities from other nations on an emergency basis. There are currently no leasable heavy icebreakers in the global inventory to our knowledge, save for Russian icebreakers, that would meet U.S. Coast Guard mission needs. This is not hyperbole or a hypothetical – the Polar Star is plagued by significant mechanical difficulties.[11] Again, this is not how a great maritime power would typically respond to such an immediate and significant capability deficiency, but this is the current and future reality the United States faces for the next five years.

Simply put, the U.S. Coast Guard is inadequately resourced to execute its mission in the Arctic which means we are not in a position to sufficiently safeguard U.S. territorial waters and EEZ when foreign-flagged vessels traverse the narrow Bering Strait.

With the exception of the procurement of a new heavy icebreaker, the United States has not altered its Arctic presence in any meaningful way over the past decade. More importantly, the United States no longer has the luxury of remaining an indifferent Arctic actor.

Our Competitors are More Interested in the Arctic than the United States

In stark contrast, Russia and China have declared the Arctic to be an economically and militarily strategic region with both nations having stated Arctic policies which seek to project influence *beyond* their coastlines to secure future national interests. Both countries are making substantial economic investments in the Arctic while Russia is reasserting itself militarily.

Russia is increasing its conventional military strength across the region, with plans to construct new military bases at Rogachevo, Cape Schmidt, Wrangel Island, and Sredniy Island.[12] The strategically located Kola Peninsula maintains a number of naval bases and shipyards under the command of Russia's Northern Fleet, which was recently outfitted with new air defense systems such as the S-400 and Pantsir-3 systems.[13] Last year Russia also activated a new complex radar system on Wrangel Island in an effort to solidify its presence and improve its aerial situational

[11] Christopher Woody, "The Coast Guard's only heavy icebreaker has been fighting engine failure and flooding in the frigid Antarctic," *Business Insider*, February 8, 2018, http://www.businessinsider.com/coast-guard-icebreaker-polar-star-engine-failure-flooding-in-antarctic-2018-2?r=UK&IR=T.

[12] Damien Sharkov, "Take A Tour Of Russia's Giant New Arctic Military Base," *Newsweek*, April, 18, 2017, http://www.newsweek.com/tour-russias-giant-new-arctic-military-base-585759.

[13] "Modernization Time: Russian Northern Fleet to Receive More S-400 Systems," *Sputnik International*, January 8, 2016. https://sputniknews.com/military/201601081032850620-russia-military-modernization/.

awareness.[14] There has also been a resurgence in Russian submarine activity across the region. Russia is actively seeking to modernize it submarine fleet, with plans to build new ballistic-missile subs and a new class of nuclear-powered subs.[15] This would allow them to project power not only in the Arctic but also across the broader North Atlantic region and the strategic Greenland-Iceland-United Kingdom (GIUK) Gap.

Much of Russia's economic activity in the Arctic centers on developing the Northern Sea Route (NSR) as a viable alternative shipping route that will more directly connect Russian energy producers with Northern Europe and Asian markets. The focus of Russia's economic investment in the Arctic is the Yamal LNG project based in the Sabetta Port on the Yamal Peninsula. The $27 billion project, partially funded by Chinese investment (Chinese companies own 29.9 percent), exported its first shipment in December 2017, and less than three months later, ships carried the first one million ton of LNG through Arctic waters. Infrastructure investment around the Yamal LNG project includes an international airport, port harbor and approach channels, vessel traffic management systems, navigational support aids, and marine service buildings.[16] To accommodate an increase in LNG carriers and maritime traffic, Russia invested and planned for the construction of 10 search-and-rescue stations along the NSR to complement existing Marine Rescue Coordination Centers, Marine Rescue Sub-Centers, hydrographic bases, and navigational equipment.[17] They have also invested heavily in its icebreaking capabilities. In 2016 alone, Russia floated three new icebreakers, the diesel-electric *Polaris* (January 2016), the diesel-electric *Ilya Muromets* (June 2016), and the nuclear-powered *Arktika* (June 2016), which is expected to be the world's largest icebreaker when completed in 2019.[18]

A self-described "near-Arctic State," China's ambitions for the Arctic are grounded in its pursuit of greater global economic growth, shipping route diversity, and an increased scientific presence. Its reliance on the Strait of Malacca for its export-led economy has led Beijing to identify alternative shipping routes, such as the NSR. With numerous transpolar and NSR sea voyages by Chinese shipping company COSCO, China remains focused on developing a "blue economic passage" that will promote trade "to Europe via the Arctic Ocean" as part of its Belt and Road Initiative,[19] which explicitly "encourag[es] Chinese enterprises to take part in the commercial use of the Arctic route."[20] With the inclusion of the Polar Silk Road in its global economic governance strategy, China is growing its presence through infrastructure investments including research stations, airports, ports, LNG terminals, icebreakers, and undersea cables in the circumpolar Arctic, and most interestingly, in Alaska. In some instances, China's Arctic projects may also have

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[14] Damien Sharkov, "Russia Deploys Air Radar on Arctic Wrangel Island," *Newsweek*, January 4, 2017, http://www.newsweek.com/russia-deploys-air-radar-arctic-wrangel-island-538527.
[15] Christopher Woody, "Russia has 'stepped on the gas' with its submarine fleet – and NATO is on alert," *Business Insider*, April 28, 2018. http://www.businessinsider.com/russia-submarine-warfare-increasing-focus-2018-4.
[16] "Yamal LNG Infrastructure," Novatek, accessed May 31, 2018, http://www.novatek.ru/en/business/yamal-lng/yamal_infrastructure/.
[17] Heather A. Conley, Matthew Melino, and Andreas Østhagen, *Maritime Futures: The Arctic and the Bering Strait Region* (Washington, DC: CSIS, November 2017), VII, https://csis-prod.s3.amazonaws.com/s3fs-public/publication/171027_Conley_MaritimeFutures_Web.pdf?mHPGy0uKqRMcek0zw6av5jI332MeELk5
[18] "Russia Floats Out *Arktika* Icebreaker, Set to Be World's Largest," RT, June 16, 2016, https://www.rt.com/business/346997-russia-arktika-icebreaker-float/.
[19] "Full text: Vision for Maritime Cooperation under the Belt and Road Initiative," *Xinhua*, June 20, 2017, http://www.china.org.cn/world/2017-06/20/content_41063286_2.htm.
[20] Ibid.

military applications such as scientific research stations becoming staging grounds for military satellites or commercial airports serving as future air bases.[21] In November 2017 Chinese President Xi Jinping and President Trump signed a five-party Joint Development Agreement (JDA), worth an estimated $43 billion and includes three of the largest Chinese energy and finance companies – Sinopec, Bank of China, and China Investment Corporation to develop Alaskan LNG for export to China.[22] The *Xue Long 2,* China's second icebreaker (and first domestically built) is scheduled to be completed in 2019. China is also designing an additional more powerful icebreaker. This coincides with Chinese development of a modern navy, enabling greater power projection capabilities in the Arctic region.

Russia and China have not altered their economic strategies in the Arctic despite modest maritime traffic through the Bering Strait and the NSR due to fluctuating commodity prices, high insurance costs, and environmental regulations. China and Russia do not base their Arctic investment decisions on market economic dynamics. But Western countries, which are guided by market forces, question the near-term economic viability of the Arctic. Western oil companies have not yet uncovered an Arctic energy boon. British company Cairn Energy abandoned efforts off the coast of Greenland after its $1.4 billion venture did not yield the predicted reserves[23]; Norway's hopes of uncovering a large oilfield in the Korpfjell Well in the Barents Sea yielded small, non-commercial quantities of natural gas and no oil[24]; and Royal Dutch Shell's six-year, $7 billion odyssey in the American Arctic collapsed with an estimated loss of around $4.1 billion in future earnings.[25] There are also legitimate questions surrounding the future growth in trans-arctic shipping as the shallow waters along the NSR are not compatible with large draft container ships, thus negating a flurry of new investment and resources.

Place Your Bet Carefully on the Future of the Arctic

Today, the United States is "betting" that the region will remain of limited strategic value and that its current, minimalist capability posture will be sufficient. Because Russia and China take such a dramatically different and long-term view (the next half-century, not the next budget cycle) of the Arctic's geopolitical significance and economic potential, the United States must assess the U.S. national security and strategic implications of such a disparate Arctic perspective between the U.S. and its competitors, as stated in the National Security and National Defense Strategies.

Could the United States lose access to portions of its maritime Arctic in the future?

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[21] Ashley Feng and Sagatom Saha, "China's Arctic Ambitions in Alaska," *The Diplomat*, April 20, 2018, https://thediplomat.com/2018/04/chinas-arctic-ambitions-in-alaska/.

[22] Presidents Trump and Xi Witness Historic Signing of Joint Development Agreement for Alaska LNG" (press release), Office of the Governor of Alaska, November 8, 2017, https://gov.alaska.gov/newsroom/2017/11/presidents-trump-and-xi-witness-historic-signing-of-joint-development-agreement-for-alaska-lng/.

[23] Terry Macalister, "Greenland halts new oil drilling licenses," *The Guardian*, March 27, 2013, https://www.theguardian.com/world/2013/mar/27/greenland-halts-oil-drilling-licences.

[24] Nerijus Adomaitis, "Norway's Arctic oil ambitions suffer setback as most promising well yields none," *Reuters*, Augusts 29, 2017, https://www.reuters.com/article/us-statoil-norway/norways-arctic-oil-ambitions-suffer-setback-as-most-promising-well-yields-none-idUSKCN1B90NH.

[25] Karolin Schaps, "Royal Dutch Shell pulls plug on Arctic exploration," *Reuters*, September 28, 2015, https://www.reuters.com/article/us-shell-alaska/royal-dutch-shell-pulls-plug-on-arctic-exploration-idUSKCN0RS0EX20150928.

What are the implications if America's Arctic resources are exploited and infrastructure is constructed by Chinese rather than U.S. firms?

Perhaps Russia and China are over-extending themselves economically and militarily and America has established the appropriate policy and course of action.

Which nation is correct about the future of the Arctic? That is the strategic question we must address. If the United States is incorrect about the Arctic, we will be placed at a great strategic disadvantage with deleterious military implications for the North Atlantic and North Pacific.

Prudence would suggest the United States must ensure an enduring and credible maritime presence in the Arctic to secure its Fourth Coast. America's current posture does not yet meet this requirement.

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"Maritime Transportation in the Arctic: The U.S. Role"
Subcommittee on Coast Guard and Maritime Transportation
Thursday, June 7, 2018, 11:00 a.m.
2167 Rayburn House Office Building
Washington D.C.

Questions for the Record

Submitted on behalf of Ranking Member John Garamendi (CA-03):

1. Priorities for Infrastructure

Ms. Conley, you reference several different needs to improve the operational footprint of the federal government and its capability to project and enhance U.S. sovereignty in the Arctic.

- Recognizing that there will never be enough funding to address all priorities simultaneously, what would you recommend as the highest priorities for the Congress to address this need?

Answer:

The United States must articulate a clear Arctic policy with defined priorities and implementation timelines, dedicated budgetary resources for those stated priorities, and sustained high-level U.S. government leadership to ensure policy accountability.

The U.S. government's first priority must be to ensure adequate national defense and protection of America's Arctic coastline, territorial waters, and Exclusive Economic Zone (EEZ). To do so, the United States must have:

(1) Greater icebreaking capability specifically for the Arctic;

(2) Develop additional infrastructure and communication capabilities; and,

(3) Re-position U.S. military forces and re-think U.S. command structure to deter potential conflict in the Arctic.

Icebreaking Capability. There has been a great deal of discussion regarding the "icebreaker gap" between the U.S. and Russia but it is not the gap that must drive U.S. decision-making but rather the need. The United States' extremely limited and aging icebreaker fleet that must serve both the Arctic and Antarctica underscores the complete lack of past investment. Icebreakers are national security assets which perform a multitude of tasks such as search-and-rescue operations, collecting and integrating data and information during a crisis, being a platform for scientific research, and offering resupply services to remote communities – all activities that increase

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national capabilities in the Arctic. Importantly, heavy icebreakers must have the space, weight, and power to carry weapons. Mobility and flexibility in projecting U.S. power and sovereignty in the Arctic is essential. Repeated U.S. government studies have underscored the need for the United States to have three heavy and three medium icebreakers. The new heavy icebreaker, if budgeted, will be available by 2023 and will be designated for use in Antarctica, not for the Arctic. This is why the U.S. must procure three heavy icebreakers. However, the United States does not have an interim icebreaker solution to 2023. The U.S. must have icebreaking capabilities in the Arctic beyond the medium icebreaker, the Healy. This is the most urgent task alongside expedited procurement of new icebreakers.

Additional Arctic Infrastructure and Communications. The Arctic is increasingly used for destinational and trans-Arctic shipping between Asia and Europe and North America and Europe. Increased vessel traffic through the Northern Sea Route, the Northwest Passage, and the Trans-Polar Route will mean additional vessel traffic through the narrow Bering Strait. Additional infrastructure must be constructed to ensure the sovereignty and safety of the U.S. Arctic coast and waterways, as well as to improve maritime domain awareness near U.S. shores. The U.S. lacks deep-water ports – the nearest is Dutch Harbor in the Aleutians, over 800 miles from the Bering Strait. Alaska is also without sufficient airfields and search and rescue stations as well as sufficient communication and satellite capabilities. The U.S. government must take a more proactive role in improving and integrating intelligence, surveillance and reconnaissance (ISR) for military assets, such as submarines, aircraft, other platforms, and U.S. and allied forces operating in the high northern latitudes.

A New U.S. Military Posture for the Arctic? The Department of Defense must recognize that the Arctic may become a region of potential military threat. Congress has largely driven senior U.S. defense officials to focus on potential dangers and threats that could emanate from the Arctic (during Congressional hearings) but successive U.S. administrations have not wanted to focus on the region or allocate budgetary resources to the Arctic. This is short-sighted and could endanger the United States. U.S. military assets to defend the U.S. homeland against increasing security threats in the Arctic and North Atlantic exist – America's missile defense architecture is in the Arctic (Alaska and Greenland); 700 U.S. Marines are positioned, on a rotational basis, in Norway to deter Russian aggression; the U.S. is contributing to the 40,000 forces participating in NATO's largest biennial military exercise, Trident Juncture, in October-November of this year– but we do not have a military strategy or plan.

2. Geopolitical Arctic Adversaries

Your statement offers compelling evidence that both Russia and China are aggressively expanding their capabilities to advance their interests in the Arctic, both now and far into the future.

- Of these two countries, which presents the greatest threat to U.S. sovereign interests in the Arctic, and why?

Answer:

Russia's and China's military and economic advancements in the Arctic must compel the U.S. to focus on a broader security and defense strategy for the region. Both countries have declared the Arctic to be an economically and militarily strategic region and have dedicated budgets to support their policy vision. This is a stark contrast to the U.S. which studies and observes the actions and behaviors of others in the Arctic but refuses to take decisive policy action. For many years, Washington has placed its "bet" that the Arctic will be of future limited strategic value. China and Russia have placed a very different bet. In fifty years, which country will be right? The answer to this question has significant strategic implications for the country.

Russia. For the past decade, Russia has re-prioritized the Arctic as a national imperative – in keeping with Vladimir Putin's desire to restore Russia to its great power status. The Arctic is essential to Russian economic and military survival. As a result, Russia prioritizes the development of Arctic natural resources; the promotion of the Northern Sea Route through infrastructure projects like icebreakers, ports, and search and rescue stations; and the reconstruction of military installations in remote regions such as Franz Josef Land and Wrangel Island where it has placed Russian special forces and surface-to-air missiles. Russia is reviving its military presence in the Arctic and North Atlantic through its strategic submarine deterrent and increased conventional capabilities on the Kola Peninsula. It consistently probes weaknesses in Arctic nations' regional defenses. Air and sub-maritime incursions in the Greenland—Iceland—UK (GIUK) Gap continue with the U.S. Chief of Naval Operations, Admiral Richardson, suggesting that Russian submarine activity in the North Atlantic is at pace with activities during the height of the Cold War.[1] Russia's Northern Fleet conducted 4,700 exercises in 2017, and a similar number is planned for 2018 with many of these exercised designed to enhance power projection capabilities. Recognizing Russia's new military posture and doctrine in the Arctic, its testing of new weapons systems or violation of arms control treaties, NATO has reconstituted its Atlantic Command and the U.S. has placed rotational forces in Norway but beyond this, the U.S. has not taken any other steps to deter potential Russian aggression.

Economically, Russia sees Arctic energy as a future source of economic growth centered around the Yamal LNG project and Sabetta Port. Russia also is seeking to substantially extend its outer continental shelf to the North Pole. More than 20 percent of Russia's GDP is produced in the Arctic and sub-Arctic regions, with approximately 75 percent of oil and 95 percent of natural gas reserves located in the north.[2] As a result, Russia prioritizes the development of Arctic.

[1] Lucas Tomlinson, "Russian submarine activity largest since Cold War: top US Navy admiral," *Fox News*, August 8, 2018, http://www.foxnews.com/world/2018/08/08/russian-submarine-threat-largest-since-cold-war-top-us-navy-admiral.html.
[2] Michael Lambert, "Russia's Arctic Ambitions Held Back by Economic Troubles," *Center for International Maritime Security*, February 28, 2018, http://cimsec.org/russias-arctic-ambitions-held-back-economic-troubles/35590.

China. An uptick in China's activities in the Arctic began about fifteen years ago but substantially increased over the past five years in part due to its need to seek alternative shipping routes to the Straits of Malacca; its need to increase its energy, mineral and protein sources; and its economic diplomacy (Belt and Road Initiative) with Arctic Council states. Russia's financial shortcomings due to Western sanctions and the precipitous drop in global energy and commodity prices accelerated China's Arctic economic plans alongside its broader engagement with the Arctic Council and other Arctic multilateral fora. In 2015, China described the Arctic as a new strategic frontier (alongside space and the sea bed) where there was "undetermined sovereignty." But by January 2018, China constructed an argument in its released Arctic White Paper that Arctic states must acknowledge China's rights under international law and therefore its equality to the Arctic states regarding its continued access to the high seas of the Central Arctic. China is interested in the development of a "blue economic passage" that will promote trade "to Europe via the Arctic Ocean" as part of its Belt and Road Initiative, (which now includes the Arctic) alongside greater scientific research which includes the construction of research stations and icebreakers. China has quietly and effectively used its economic interests in the Arctic to counter any future attempts to minimize its ability to secure access to the Arctic under its "win-win" mantra. U.S. policymakers must be more attentive to and understand the implications of China's growing economic presence in Greenland (in and around Thule Air Force Base) which entails satellite receiver stations, airports, and attempts to purchase former Danish naval bases in southern Greenland in addition to China's interests in constructing ports, pipeline, and LNG related infrastructure in Alaska. Chinese economic activities may ultimately diminish U.S. strategic assets in both Alaska and Greenland.

- Would U.S. influence be enhanced within the Arctic Council if the United States were to ratify to the United Nations Convention on the Law of the Sea? Would this help the United States contain geopolitical rivals?

Answer:

The United States would substantially strengthen its position in the Arctic as well as its global maritime leadership position if it would immediately ratify the United Nations Convention on the Law of the Sea. U.S. ratification of UNCLOS would also enhance U.S. economic growth and increase job creation. Today, the U.S. is unable to submit scientific claims to extend its outer continental shelf which could increase U.S. protection and economic exploration of significant portions of the Chukchi and Beaufort Seas. It is estimated that Alaska's extended continental shelf may extend to a minimum of 600 miles from the Alaskan baseline.[3] Much of this area is rich in oil and gas, with an estimated 73 billion barrels of oil and oil-equivalent natural gas located in the Arctic Alaska province, the second highest estimated production capability of all Arctic provinces.[4] The U.S. is currently unable to secure mineral rights as part of the Seabed

[3] James W. Houck, "The Opportunity Costs of Ignoring the Law of Sea Convention in the Arctic," *Hoover Institution: Arctic Security Initiative*, 2013.
[4] U.S. Geological Survey, Circum-Arctic Resource Appraisal: Estimated of Undiscovered Oil and Gas North of the Arctic Circle 4 (2008) http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf.

Mining Authority. Russia is close to receiving an assessment from the UN of its scientific claims which could substantially increase its reach over vast swathes of the sea bed and waters above following bilateral negotiations with Denmark and possibly Canada.

Having said this, UNCLOS ratification would not materially change U.S. policy or position in the Arctic Council, an intergovernmental forum formed in 1996 to enhance measures to collectively protect the Arctic's environment and to explore sustainable economic development opportunities. Over the past twenty years, the Arctic Council has successfully identified emerging issues, conducted groundbreaking climate and marine assessments, and established a strong internationally cooperative and consensus-based framework. It also serves as an effective forum for dialogue with participation from the Permanent Participants of indigenous peoples' organizations as well as a growing number of observers.

Should the United States ratify UNCLOS, it would be able to initiate a diplomatic campaign that would highlight the clear differences in China's international maritime legal position in the South China Sea (the so-called nine dash line), which runs against UNCLOS and the interpretation of the rights of EEZs and internationally adjudicated overlapping maritime claims, versus Beijing's view that it has international legal rights under UNCLOS to the high seas of the Central Arctic Ocean. U.S. ratification would also diminish more extreme nationalistic voices in Russia that conspiratorially believe that the U.S. has not ratified UNCLOS because it wishes to take unilateral action in the future. Although this is a false claim and U.S. policy is that UNCLOS is customary international law regardless of whether the U.S. Senate ratifies UNCLOS or not, it provides a rallying cry to Russia nationalists to suggest that "It is our territory, it is our shelf, and we'll provide its security. And we will make money there…They [the West] will put us on a sanctions list—but tanks do not need visas."[5]

- What actions could the administration undertake to counter the activities in the Arctic of Russia and China?

Answer:

The U.S. must first determine whether or not the Arctic region is a strategic imperative and develop long-term policies and budget resources accordingly. If it decides it is not, the U.S. will be ceding portions of the Arctic to its two peer military and economic competitors, according to the 2018 National Security Strategy and National Defense Strategy which describe an unfolding great-power competition where, "China and Russia challenge American power, influence, and interests, attempting to erode American security and prosperity." Both documents are silent about the Arctic.

[5] Lucy Clarke-Billings, "Russia begins huge surprise air force drill on same day as NATO starts Arctic training," *Independent*, May 27, 2015, http://www.independent.co.uk/news/world/russia-begins-huge-surprise-air-force-drill-on-same-day-as-nato-start-arctic-training-10275692.html.

In addition to developing greater icebreaking capability specifically for the Arctic; additional Arctic infrastructure and communication capabilities; and, re-positioning U.S. military forces and re-think U.S. command structure to deter potential conflict in the Arctic, the U.S. should also:

- Ratify UNCLOS
- Ensure that China's economic and energy-infrastructure related activities in and around Alaska are thoroughly reviewed by CFIUS
- Maintain an active U.S. leadership stance within the Arctic Council, IMO, and Arctic Coast Guard Forum.
- Continue to demonstrate American leadership in scientific research and increase U.S. scientific presence (e.g., research stations) and engagement across the circumpolar Arctic
- Strongly encourage NATO to develop an Arctic strategy
- Create a forum where military dynamics in the Arctic can be discussed transparently to make clear Russian intentions behind the modernization of Soviet era bases, the placing of missile defense systems on remote islands, and the purposes behind increased underwater incursions and violations of neighbors' airspace.

The U.S. should engage in diplomatic efforts to develop a *Declaration of Military Conduct in the Arctic* in line with the current OSCE's confidence-building measures. This declaration would outline provisions to include mandatory notification by every county 21 days in advance of major military exercises (25,000 forces and above) and the requirement that the eight Arctic states be invited as observers to these exercises. Additionally, each year the eight Arctic states would submit an annual military exercise plan and update their emergency contact and communication information. Each nation would agree that all aircraft would have operational transponders sending appropriate electronic signaling when in flight. Such a declaration would remove a sense of uncertainly and prevent miscalculations, which currently represent the greatest threats to peace and stability in the Arctic.

3. Arctic Strategy

The absence within the federal government of an over-arching Arctic Strategy to guide future operational planning and investments by federal agencies was exposed and discussed as a genuine liability in protecting and advancing U.S. sovereign and strategic interests in the High

North. Members discussed introducing legislation to establish a comprehensive federal Arctic policy and strategy as a possible option to jump start that initiative.

- What specific factors must be included in any federal Arctic strategy? Would legislation be helpful? What are your recommendations and associated costs?

Answer:

Congress should develop legislation entitled *The American Arctic Sovereignty Act*. This Act must focus on the *"National Security and Homeland security interests in the Arctic region*" (as stated in NSPD 66/HSPD25). Focusing on the priorities noted above, Congress would appropriate funds to achieve these priorities with a clear timeline for completion. The U.S. Coast Guard should be designated as the lead federal agency and coordinator of policy and operations in the Arctic with support from the Department of Defense. *The American Arctic Sovereignty Act* would create a National Arctic Security Center (NASC) within the Department of Homeland Security which would be modeled on, although at much smaller scale, the National Counter-Terrorism Center (NCTC), which would bring together in the intelligence, law enforcement, and other relevant federal agencies such as NOAA, NASA, the National Ice Center, etc. The NASC would collect and disseminate timely information among federal, state, local, and tribal stakeholders to improve overall readiness and operational capacity. Separately, *The American Arctic Sovereignty Act* would work with the House and Senate Armed Services Committee to amend the 2011 Unified Command Plan for the Arctic. The Arctic region currently falls under the jurisdiction of USNORTHCOM and USEUCOM. USEUCOM is the main Area of Operation (AOR) but USNORTHCOM defends the American Arctic (Alaska) and monitors increased activity in the Bering Strait Region. As vessel traffic in the Bering Strait Region increases to and from the Indo-Pacific region, USPACOM remains responsible for the Russian Pacific littoral and the extreme western approaches to the Bering Strait, two critical areas for monitoring Chinese and Russian maritime activity in which their navies are exercising and interacting more frequently. However, USPACOM lost most of its responsibilities in the Arctic following the 2011 reorganization, although it maintains an air defense presence in Alaska through the 11th Air Force which works jointly with other commands including NORAD. USPACOM's Alaskan commands also participate in emergency rescue-and-recovery missions within the Pacific AOR and could be called upon to support search-and-rescue operations above the Arctic Circle. All three COCOMs must better integrate their operational command responsibilities.

- What would be an appropriate time horizon for implementation?

Answer:

The U.S. is already late to defend its sovereignty in the Arctic and has fallen behind its peer competitors. The Arctic must receive renewed policy focus and budget attention from the Trump

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administration as well as Congress to mitigate emerging limitations to U.S. freedom of navigation and operations in the Arctic.

- What critical investments should be made in infrastructure, and in general, how much would these investments cost?

Answer:

Please see above.

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TESTIMONY OF

DR. LAWSON W. BRIGHAM

INTERNATIONAL ARCTIC RESEARCH CENTER

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UNITED STATES COAST GUARD ACADEMY

BEFORE THE CONGRESS OF THE UNITED STATES

HOUSE OF REPRESENTATIVES

Committee on Transportation and Infrastructure

Subcommittee on Coast Guard and Maritime Transportation

Hearing: *Maritime Transportation in the Arctic: U.S. Role*

2167 Rayburn House Office Building

Washington, DC ~ June 7, 2018

Introduction

Good morning Mr. Chairman and distinguished members of the Subcommittee. I am honored to testify today regarding the roles of the United States in Arctic maritime transportation and the marine infrastructure requirements for the U.S. maritime Arctic. My name is Lawson Brigham and I am a researcher at the International Arctic Research Center of the University of Alaska Fairbanks and a Fellow at the Coast Guard Academy's Center for Arctic Study & Policy. I received my PhD in Polar Oceanography from the University of Cambridge in the United Kingdom. During my U.S. Coast Guard career I served as commanding officer of icebreakers on the Great Lakes and in Antarctic & Arctic waters. I have also served as Chair of the Arctic Council's Arctic Marine Shipping Assessment from 2004-09 and have recently been a member of the Council on Foreign Relations Independent Task Force which released its report titled *Arctic Imperatives: Reinforcing U.S. Strategy on America's Fourth Coast* in March 2017. My comments today are personal perspectives based on my polar operational experiences and participation in U.S. and international Arctic affairs.

No discussion of Arctic marine transportation can be made without a review of the Arctic Council's *Arctic Marine Shipping Assessment (AMSA) 2009 Report*. The United States was a lead country in this effort with Canada and Finland; more than 200 experts from the eight Arctic states, the Arctic indigenous people, and other key stakeholders (such as the global shipping

industry) contributed to AMSA. The Report contained 96 findings under key themes including: marine geography; Arctic sea ice changes; the history of Arctic marine transportation; law of the sea and governance of the maritime Arctic; the AMSA traffic database; scenarios of future marine uses; indigenous peoples issues and the human dimension; environmental considerations and impacts; and Arctic marine infrastructure requirements and gaps. The AMSA effort can be understood from three perspectives

- As a *baseline assessment* of Arctic marine activity using the AMSA (2004-05) database as an historic snapshot of Arctic marine use.
- As a *strategic guide* for use by a host of Arctic and non-Arctic actors and stakeholders.
- As a policy document of the Arctic Council since the recommendations of the AMSA 2009 Report were negotiated and consensus for their approval was reached by the Ministers of the eight Arctic states.

The 17 recommendations of AMSA, approved by the Arctic state ministers in April 2009, included three, inter-related themes: ***Enhancing Arctic Marine Safety***; ***Protecting Arctic People and the Environment***; and, ***Building the Arctic Marine Infrastructure***. The recommendations in these themes are fundamental to responding to increased marine use and to future investments required for enhanced marine safety, environmental protection and effective facilitation of marine operations. All continue to require close international cooperation. The huge deficit in Arctic marine infrastructure significantly requires careful long-term planning and large investments from a host of public and private sources. New public-private partnerships will require development and political support.

The Drivers of Arctic Marine Transportation

One of the major tasks of the AMSA team was to determine the many uncertainties and key driving forces that might shape the future of Arctic navigation out to years 2020 & 2050. AMSA used a scenarios (plausible futures) approach that identified 120 factors or driving forces that could be influential. The most highly influential factors included: global oil prices; the importance of a stable legal regime for the Arctic Ocean; new Arctic resource discoveries; world trade patterns and radical changes in global trade dynamics; a major Arctic shipping disaster; limited windows of Arctic marine operations (seasonal impacts on shipping economics); Arctic maritime enforcement; escalation of Arctic maritime disputes; the marine insurance industry; rapid climate change and changes that are more disruptive sooner than anticipated; disputes between indigenous marine uses and commercial navigation; more active, non-Arctic maritime nations such as China, Japan and Korea becoming involved in Arctic Ocean navigation; and, global (International Maritime Organization) agreements on Arctic ship construction, marine safety and maritime pollution rules & regulations.

The diversity of these factors and uncertainties highlight the ***complexity*** and ***global connections*** that can influence the future of Arctic Ocean marine operations and shipping. For example, global price stability was determined to be a major factor and during the conduct of AMSA (2004-09) oil prices fluctuated from a high of US$147 per barrel to a low of US$55 per barrel (today's price is approximately US$65-66). This was deemed to be a huge factor for future onshore and offshore hydrocarbon development, and directly impacting the levels of offshore marine support and Arctic marine transportation systems. In the AMSA scenarios process, three criteria were used to select the two most influential factors for the scenarios matrix and the future of Arctic marine navigation: the degree of plausibility; relevance to Arctic and maritime affairs; and, being at the right threshold of the many factors considered. Two most influential factors stood out under this evaluation: ***resources and trade*** (the level of demand for Arctic natural resources and trade); and, ***governance*** (the degree of relative stability of rules and standards for marine use both within the Arctic and internationally). These two primary factors were used to develop a set of four plausible futures for Arctic navigation. It is important to note that a changing climate and Arctic sea ice retreat provide for greater marine access and potentially longer seasons of navigation throughout the Arctic Ocean. ***However, the economic factors of Arctic natural resource development, connections to global markets, and global commodities prices are considered the primary drivers of future Arctic marine operations and shipping.***

This is the situation we view today in the development of Arctic natural resources in the Russian North and the investments in their national Arctic waterway, the Northern Sea Route, to facilitate the marine transportation of these valuable resources to global markets. A similar situation exists in Norway with its strategic focus on offshore development in Arctic Norway and the requirements for marine systems to support these complex, Arctic operations. For the United States the potential for offshore exploration and development of the Alaskan maritime Arctic (in the Beaufort and Chukchi seas), and the requirements for safe, effective marine transportation systems, are driven primarily by the economics of Arctic natural resource development. Maritime governance must also be considered highly important for all these regional Arctic developments in the form of a stable, operating system of legal and regulatory measures that are reinforced by broad international cooperation.

Lack of Arctic Marine Infrastructure

One of the greatest concerns and significant risks identified by the Arctic states in the AMSA report is the ***general lack of marine infrastructure in the Arctic,*** except for the coasts of Iceland, northern Norway and northwest Russia. Missing or lacking infrastructure in most Arctic areas include: hydrographic data and marine charts; complete and adequate coverage of marine communications; environmental monitoring (for weather, sea ice, and icebergs); search and rescue capability; environmental response; aids to navigation, and more. For much of the Arctic, the lack of deepwater ports, places of refuge, salvage and towing services, and port reception facilities – all normally available to the global maritime industry – is of very serious concern to the Arctic states and the global community. This huge deficit in marine infrastructure makes it

very difficult to evaluate the full risks associated with Arctic marine operations and shipping, and exposes new Arctic marine projects to an incomplete or non-existent safety net.

The AMSA report concludes that the vastness and harshness of the Arctic environment make the conduct of marine emergency response more difficult throughout the region. The Arctic Ocean's hydrographic database for charting is not adequate in most areas to support future levels of Arctic marine operations (for commercial shipping, offshore development, tourism, fishing and research). In addition, the monitoring network of meteorological and oceanographic observations critical to safe and efficient navigation is extremely sparse and not adequate to support increases in Arctic marine transportation. Importantly, the marine infrastructure that is missing in the Arctic Ocean for the commercial world is likewise generally absent for naval and military operations. The lack of ice information, marine charts, communications, and emergency response is no less critical to the safe and effective operation of security forces as it is to commercial Arctic marine operators. This situation places importance on having civil and military organizations in the Arctic working together on infrastructure issues and developing mechanisms for emergency response well in advance of a maritime incident or crisis situation.

A Council on Foreign Relations (CFR) Independent Task Force (2016-17) assessed the challenges and opportunities for the United States in the Arctic region in the face of changing conditions. Two of the six major goals in the final report noted two critical infrastructure needs: "funding up to six icebreakers operated by the U.S. Coast Guard and having at least three operational in the polar regions at any one time," and, "improving telecommunications, energy, and other infrastructure in Alaska to support a sustained security presence and economic diversification." The report discussed several key needs: mapping and weather prediction requirements; a U.S. Arctic deepwater port; developing a trans-Arctic search and rescue communications network; and, creating a series of safe harbors and search and rescue stations along the coast. Notable information to the Task Force from NOAA's Hydrographic Services Review Panel is that only 4.7% of the U.S. maritime Arctic is charted to modern international standards (although there are U.S. nautical charts available for the entire region).

Within the CFR report section reserved for additional member views, I was joined by three task force members in stating that "the lack of infrastructure in the U.S. maritime Arctic is a ***serious national gap*** with human, security, economic and environmental implications for the 21st century. Many elements of infrastructure mentioned in the CFR report require sustained, long-term investment: hydrography and charting; a viable Arctic port; polar icebreaking capability; advanced communications; a robust environmental observing system; strengthened monitoring and surveillance; search and rescue capacity; environmental response capacity; aids to navigation; marine salvage; and more. All are necessary to respond to increasing Arctic marine use, facilitate marine navigation, and provide for a robust marine safety and environmental protection framework not only in the U.S. Arctic, but throughout the circumpolar world." It is clear a major marine infrastructure gap remains throughout the U.S. maritime Arctic.

Recent Progress and United States Arctic Leadership Roles

During the past decade the United States has played leadership roles at the International Maritime Organization (IMO), the Arctic Council and among the Arctic states in negotiating a number of key instruments related to Arctic marine use and transportation The U.S. under the leadership of the Coast Guard at the IMO in London worked with the Arctic states and other major maritime nations to develop a new IMO code for ships operating in the polar regions. The result is an international, mandatory set of marine safety and environmental protection rules and regulations for ships sailing in Arctic and Antarctic waters (known as the Polar Code). Four key and binding Arctic agreements have also been developed with strong leadership from the State Department:

- Arctic Search and Rescue Agreement (2011) (among the Arctic states)
- Arctic Oil Spill Preparedness and Response Agreement (2013) (among the Arctic states)
- Agreement on Enhancing International Arctic Science Cooperation (2017) (among the Arctic states)
- Agreement on Unregulated Fishing in the Central Arctic Ocean (December 2017) (Canada, Iceland, Norway, Russia, USA, China Japan, South Korea and the European Union).

Each of these agreements will require robust implementation and, in some cases as with the IMO Polar Code, effective enforcement. Importantly, continued international cooperation will be required not only among the eight Arctic states, but also among all maritime states and the global maritime industry.

Near-term U.S. Arctic Marine Infrastructure Needs and Summary

The role of the United States in future Arctic marine transportation can only be improved by sustained investments in a range of marine infrastructure in Alaska. Priority investments and near-term actions from my perspective include:

- ***Hydrography and Charting*** ~ increased funding to NOAA's National Ocean Service to increase hydrography and charting in America's Arctic frontier (highest priority).
- ***Implementation and Enforcement of the IMO Polar Code*** ~ support and additional funding to the Coast Guard for all requirements related to the application of the IMO Polar Cade in U.S. Arctic waters.

- ***U.S. Arctic Port at Nome*** ~ funding for dredging and outer breakwater construction to allow for the mooring and support of large ships in all seasons. This development will provide for a port presence (and support) of major U.S vessels within the U.S. maritime Arctic (for example, Coast Guard icebreakers, naval combatants, government survey & research ships, and commercial vessels). Such an investment will make Nome a more effective, regional hub port to other smaller harbors and to future offshore development in U.S. Arctic waters.

- ***Icebreaking Capacity*** ~ funding to DHS and the Coast Guard has been appropriated to begin addressing the critical needs to replace and enhance the U.S. polar icebreaker fleet. Sustained funding in near-term budgets must be a priority to meet a recognized national requirement for U.S. polar icebreaker capacity.

- ***Arctic Waters Monitoring and Surveillance of Marine Traffic*** ~ funding support for continued development of effective military and civilian (such as the Marine Exchange of Alaska) systems for enhanced monitoring & surveillance, or 'domain awareness,' of marine operations and shipping in U.S. Arctic waters.

- ***Search & Rescue and Environmental Response*** ~ support to the Coast Guard and other federal agencies to fully implement and meet U.S. responsibilities under the Arctic SAR Agreement and the Arctic Oil Spill Preparedness & Response Agreement.

- ***Seward Marine Center and Polar Research Ship Sikuliaq*** ~ continued federal support to the University of Alaska Fairbanks for the Seward Marine Center (under the College of Fisheries and Ocean Sciences) and the research ship *Sikuliaq* which operates extensively in U.S. Arctic waters and beyond into the Arctic Ocean.

- ***Communications and Aids to Navigation*** ~ increased funding for enhanced military and civilian communications systems and advanced aids to navigation (physical and virtual) in the U.S. maritime Arctic.

Thank you Mr Chairman for the opportunity to testify before you today. I am happy to answer any questions you may have. I would also be very pleased to provide additional information to the Subcommittee members and staff at any time.

"Maritime Transportation in the Arctic: The U.S. Role"
Subcommittee on Coast Guard and Maritime Transportation
Thursday, June 7, 2018, 11:00 a.m.
2167 Rayburn House Office Building
Washington, D.C.

Dr. Lawson W. Brigham, Faculty and Distinguished Fellow,
International Arctic Research Center, University of Alaska Fairbanks
Responses to Questions for the Record

Submitted on behalf of Ranking Member John Garamendi (CA-03):

1. International Cooperation

In your discussion of the 2009 Arctic Marine Shipping Assessment, you stressed that to achieve the 17 recommendations in the report to enhance marine safety, environmental protection, and facilitation of marine operation, close international cooperation will be required.

- Does the preference of the current administration to withdraw from international agreements and antagonize longstanding allies pose a legitimate threat to cooperation among other member states of the Arctic Council?

Cooperation among the Arctic states continues to be close and effective. Four examples are illustrative of the ongoing cooperative situation in the Arctic. On 11 May 2017 in Fairbanks, Alaska the U.S. and the seven other Arctic states signed the *Agreement on Enhancing International Arctic Scientific Cooperation.* This agreement is a key instrument for maintaining peace, stability and constructive cooperation in the Arctic. At the end of 2017 successful negotiations concluded among nine states (USA, Canada, Denmark, Iceland, Norway, Russia, China, Japan, and South Korea) and the European Union on a draft *Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean*; this agreement is to be signed in September 2018 and enter into force. Involving Arctic and non-Arctic states this agreement provides a new model for international governance at the top of the world. A third example is a bi-lateral effort between the U.S. and Russian Federation. In November 2017 the two Arctic states proposed to the International Maritime Organization (IMO) a system of two-way routes for vessels to follow in the Bering Strait and Bering Sea. The 99th IMO session in London during May 2018 approved the U.S.-Russia voluntary ship routing measures (and six precautionary areas) which will take effect 1 December 2018. These are the first international ship routing measures in polar waters approved by the IMO. Fourth, the Arctic Coast Guard Forum also continues to evolve into an effective maritime cooperative venture among the coast guards of the eight Arctic states; a successful joint exercise was held in Iceland in September 2017. Thus the United States has actually participated recently in international agreements with regard to the Arctic and has help strengthen cooperation among the Arctic states & non-Arctic states within the Arctic Council. There certainly is concern that the U.S. withdrawal (on 1 June 2017) from the 2015 Paris Agreement on climate change mitigation could possibility impact work at the Arctic Council and other organizations. However, thus far the member states of the Arctic Council are addressing a broad range of Arctic issues

including climate adaptation and resilience with close cooperation. The Arctic Council is also developing an *Arctic Council Strategic Plan* which will likely incorporate all drivers of change in the Arctic and provide a long range vision for closer international cooperation in the Arctic.

Does this undermine our ability to establish a stable governance regime in the Arctic?

Not recently. The primary and stable governance regime in the Arctic is the United Nations Convention on the Law of the Sea (UNCLOS). Three binding agreements of the Arctic states also provide stable governance: the *Arctic Search & Rescue Agreement* (2011); the *Arctic Oil Pollution Preparedness & Response Agreement* (2013); and, the new *Agreement on Enhancing International Arctic Scientific Cooperation* (2017). The *IMO Code for Ships Operating in Polar Waters* (2017-18) provides another strong measure of stability and international maritime cooperation with regard to Arctic marine safety and environmental protection. The Charter of the Arctic Council itself (established by the Ottawa Declaration of 1996) provides a highly effective forum for cooperation and enhancing stability in the region. The one issue of concern in the region, shared by the Arctic states and many non-Arctic states, is that the U.S. has not ratified UNCLOS (the only Arctic state to not yet ratify). A Council on Foreign Affairs *Arctic Imperatives* report identified a key goal of "securing U.S. rights to perhaps more than 386,000 square miles of subsea resources on the extended continental shelf by ratifying UNCLOS." U.S. ratification of UNCLOS would likely enhance stable governance, security, and international cooperation in the Arctic Ocean.

2. <u>Lack of Infrastructure</u>

You cited in your written statement the 2017 Council on Foreign Relations assessment of Arctic imperatives, and in your additional views you stated, "the lack of infrastructure in the U.S. maritime Arctic is a serious national gap with human, security, economic and environmental implications for the 21st Century."

- Are you seeing any signs that the federal government is starting to move in the right direction to address these gaps?

Several federal agencies and departments have begun to move in the right direction with a clear focus on U.S. Arctic infrastructure needs. NOAA's National Ocean Service has moved to increase hydrographic surveys and charting of the U.S. maritime Arctic. Its Hydrographic Services Review Panel has established an *Emerging Arctic Priorities Working Group*. NOAA and the U.S. Coast Guard have worked closely together using the Coast Guard polar icebreaker *Healy* to complement NOAA ship hydrographic surveys of marine routes through Bering Strait. During the past decade the Coast Guard has worked relentlessly to address the acquisition of polar icebreakers for the U.S. Presidents Obama and Trump have both spoken of these needs and supported budgetary efforts for the acquisition of polar icebreakers for the Nation & the Coast Guard. During the past decade the Coast Guard in Alaska has deployed its people, aircraft and cutters to America's Arctic under Operation Arctic Shield: a mobile and seasonal (summer) maritime presence in the

region. The U.S. Army Corps of Engineers (Alaska District) has recently partnered with the City of Nome on a port planning process and port of Nome modification feasibility study. The Denali Commission continues to support village infrastructure protection efforts for Alaska's coastal Arctic communities. All of these proactive efforts in the U.S. maritime Arctic are appropriate and laudable responses, but all are constrained by the lack of increased federal funding.

- What level of investment should the Congress consider, and over what timeframe?

The U.S. maritime Arctic (the waters in the 200 nautical mile Exclusive Economic Zone and the coastal zone) is essentially the 'Arctic Frontier.' Levels of investment by the Congress to be considered during the next decade should initially address national security maritime needs (icebreakers, a strategic Arctic port, and hydrography/charting), human needs (moving coastal communities) and environmental protection. New offshore leasing in the Chukchi and Beaufort seas for hydrocarbon exploration requires near-term federal funding to enhance marine safety, response, and environmental protection (federal) responsibilities in the region. Federal infrastructure investments are required for a host of maritime requirements including: effective communications; hydrography and charting; aids to navigation; a deep water port; polar icebreakers; observing systems (for ice and weather forecasting); satellite & shore-based monitoring and surveillance systems (for ships, pollution and marine emergencies); search and rescue Arctic capacity; Arctic environmental response capacity; and, implementation & enforcement by the Coast Guard of the *IMO Code for Ships Operating in Polar Waters* (Polar Code). Longer term federal investments (a ten to twenty-year horizon) are required to facilitate economic development focusing on the linkage of Alaska's natural resources to global markets. Requirements include U.S. Arctic *export* ports (dredging and construction to be facilitated by the U.S. Army Corps of Engineers) that have intermodal connections to rail and road systems. Longer term investments in Alaska's future development of its Arctic natural resources require public (Federal and State)-private-partnerships.

- What is the level of planning and investment by the state of Alaska and the private sector in Alaska to build, operate and maintain maritime and other infrastructure above the Arctic Circle?

The level of planning and investment by the State of Alaska in small harbors around the entire coast of Alaska, including the Arctic, to support local/regional fishing and recreational boating has been long-term and considerable. However, the State looks to the federal government for funding larger ports and marine infrastructure (including: federal hydrogaphic surveying & charting; weather & ice observing systems; the conduct of Coast Guard missions; marine domain awareness; and, more) in its Arctic region. As a private sector example, Shell was a major leaser of Chukchi Sea offshore areas in 2008 through September 2015, when it abandoned exploratory drilling for Arctic offshore oil. Shell reported that it had invested seven billion dollars in this search for oil in the offshore of Arctic Alaska. Some of these funds supported near-term infrastructure needs, environmental observing, jobs, ship serving, and training for Arctic communities.

However, these episodic investments by the private sector have not addressed the fundamental, long-term gaps in infrastructure in the U.S. marine Arctic. Initial federal investments will be required in this frontier Arctic marine region to provide a *framework* for addressing future human, security, safety and longer-term economic development challenges. My strong belief is that the gaps in infrastructure within the U.S. maritime Arctic are so *vast* that they cannot be filled by actions of the State of Alaska and the private sector.

3. Arctic Strategy

The absence within the federal government of an over-arching Arctic Strategy to guide future operational planning and investments by federal agencies was exposed and discussed as a genuine liability in protecting and advancing U.S. sovereign and strategic interests in the High North. Members discussed introducing legislation to establish a comprehensive federal Arctic policy and strategy as a possible option to jump start that initiative.

- What specific factors must be included in any federal Arctic strategy? Would legislation be helpful? What are your recommendations and associated costs?

The U.S. has as recently as May 2013 had a *National Strategy for the Arctic Region (NSAR)* signed by President Obama. The Obama Administration released in January 2014 a *National Implementation Plan for the NSAR* providing guidance to a host of federal departments and agencies. This effort can be viewed as a process to provide 'integrated management' of the federal government's response to U.S. Arctic requirements, a potential model for what is required today. *The Implementation Plan* included a ten-year horizon for maritime infrastructure that would be used to prioritize investments; public (federal)-private-partnerships were considered important, perhaps an early indication any new initiatives could be constrained by the federal budget process. Any new Federal Arctic Strategy must include an integrated management plan with time horizons and federal agency detailed plans for implementation (and 5-year budget projections).

Legislation on several critical Arctic issues could be influential:

- **Revised legislation for offshore leasing in the U.S. maritime Arctic to include a provision that all leasing revenues generated by the federal leasing process be invested in federal and state marine infrastructure in the region; specify that high priority funds be devoted to enhanced hydrographic surveys and charting by NOAA's National Ocean Service.**
- **Specific legislation to create and appropriate funds for a strategic, deep water Arctic port in Nome, Alaska.**
- **Legislation to appropriate adequate funds for a long-term (multi-year) acquisition program for six U.S. Coast Guard polar icebreakers; the six-ship fleet is advocated by Coast Guard and recommended in the Council on Foreign Affairs *Arctic Imperatives* study released in March 2017.**
- **Legislation requiring a Federal Arctic Strategy that an Administration would coordinate & execute across all relevant departments and agencies from the White House.**

- What would be an appropriate time horizon for implementation?

Implementation of a U.S. Federal Arctic Strategy should have two time horizons:

(A) A near-term, 10-year plan for immediate and critical investments (such as icebreakers, an Arctic port, and hydrography/charting); these federal investments will be in response to key national security requirements and federal offshore leases for hydrocarbon exploration & development.

(B) A long-term, 10 to 25-year plan focusing on the economic development of the U.S. maritime Arctic and Arctic Alaska; such a strategic plan would include significant funding mandates by public-private-partnerships.

- What critical investments should be made in maritime and coastal infrastructure in Alaska, and in general, how much would this cost?

Large federal investments in U.S. Arctic maritime infrastructure are required due to the virtual lack of any such viable & modern infrastructure throughout the region. Critical federal, near-term investments include:

(A) *Hydrographic Surveying and Charting*: NOAA National Ocean Service annual budget increases of an estimated $50M per fiscal year during a 20-year program that is focused on the Frontier Maritime Arctic.

(B) *U.S. Deepwater Arctic Port at Nome*: A near-term investment for five years (estimated cost: $800M-$1.5B) to dredge and construct an outer breakwaters and dock to moor such ships as a naval combatant, Coast Guard icebreaker, NOAA survey vessels, and large commercial carrier. The U.S. Army Corps of Engineers would be the project leader and funded agency. Long-term, additional federal investments will also be required to expand the port to support offshore and onshore natural resource developments in the future.

(C) *U.S. Polar Icebreakers*: Funding the Coast Guard for a multi-ship, acquisition of six polar icebreakers (three large and three medium as advanced by the Coast Guard); estimated cost: $4.5-$5B; additional costs will also be programmed for increases in personnel, maintenance, and operational costs for this new fleet.

(D) *Arctic Waters Monitoring and Surveillance*: For enhancing military and civilian domain awareness in the U.S. maritime Arctic....the monitoring of marine traffic, pollution and emergencies by land-based and satellite systems (estimated cost: $800M over five years).

(E) *Seward Marine Center & Polar Research Ship Sikuliaq*: Federal support to the National Science Foundation to fund improvements at the Seward Marine Center in support of the polar research ship *Sikuliaq* , which operates as a national asset in U.S. Arctic waters and beyond into the Arctic Ocean (estimated cost: $250M).

(F) *SAR, Environmental Response, Aids to Navigation, and IMO Polar Code*: Increases in the federal budget for the Coast Guard are needed for enhanced search & rescue and environmental response in Alaska's Arctic (these missions will require additional rescue and surveillance/logistics aircraft); advanced aids to navigation (physical and virtual) are required throughout this remote maritime region; increased funding is needed for implementation and enforcement of the IMO Polar Code under the Coast Guard's marine safety program; all of these requirements are

necessary for the annual increase in the Coast Guard's expanded (summer) presence in the U.S. maritime Arctic; the cumulative sum of these programmatic and operational costs is unknown, but could be estimated by the Coast Guard in its annual and future budget submissions.

(G) *Communications*: Federal increases in the budget are required to develop secure and effective military and civilian communications systems in this remote U.S. Arctic region; requirements include satellite and land-based systems; an agency task force or National Academy of Sciences study should be funded to study U.S. Arctic marine communication requirements (among a host of key departments and agencies including DOD, DHS/Coast Guard, NOAA, and others).

21 August 2018

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TESTIMONY BY

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BEFORE THE

Subcommittee on Coast Guard and Maritime Transportation
U.S. House Committee on Transportation and Infrastructure

On

Maritime Transportation in the Arctic: The Role of the United States

June 7, 2018
Washington, DC

AOOS
Alaska Ocean Observing System

IOOS
Integrated Ocean
Observing System

Chairman Hunter, Ranking Member Garamendi, Congressman Young, and Members of the Subcommittee:

My name is Molly McCammon, and I have been executive director of the Alaska Ocean Observing System for the past 15 years, based in Anchorage, Alaska. Thank you for inviting me to participate in this hearing on the role of the United States in Maritime Transportation in the Arctic. The Alaska Ocean Observing System (AOOS) is the Integrated Ocean Observing System (IOOS) Regional Association (RA) mandated by Congress to work with the federal agencies, local and state governments, tribes and private industry to coordinate statewide monitoring for Alaska's nearly 44,000 miles of coastline and offshore environments, which is larger than the combined seaboard of the United States.

The Alaska Arctic has been experiencing dramatic changes in the past decade. Already we are seeing extremely low sea ice extent in the winter, particularly in the Bering Strait and Chukchi Sea, as well as later freeze-up dates in the fall, thus paving the way for longer – and potentially riskier - Arctic navigation seasons, with an increased likelihood of a nearly ice-free Arctic in this century. The U.S. and nations such as Russia, China, Korea, and Japan are eyeing increased access and use of this new Arctic Marine Highway for shipping, offshore oil and gas and mining activities, and commercial fishing, and thus, potentially competing with subsistence activities and indigenous food security. For that reason, the marine waters and coastlines of the Beaufort, Chukchi and Bering Seas, which comprise the entirety of the U.S. Arctic, make this region of great importance to national and international security.

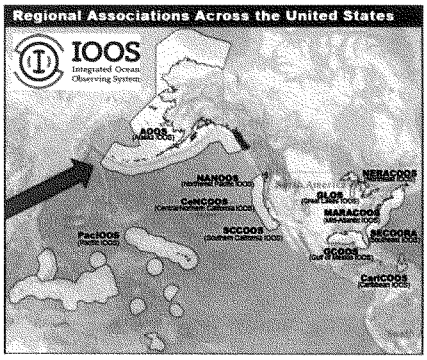

Fig. 1. Map showing the 11 Regional Associations in the IOOS Program, with the Alaska Ocean Observing System (AOOS) denoted by the red arrow. AOOS is responsible for observing in two oceanic boundaries including the Arctic and North Pacific and is the only RA with an Arctic border and adjacency to two nations: Canada and Russia.

The Need

The U.S. Arctic in Alaska needs a robust marine and coastal observing infrastructure providing real-time surface current, sea ice, water level and weather data to support national interests in this region, as documented in multiple planning and strategic documents by NOAA, the Navy, and the Coast Guard, as well as numerous reports by the National Academy of Sciences. Yet, to date, the U.S. Arctic has been significantly under-observed, especially compared to other U.S. coasts. Similar to many regions of the world that lack power, easy road access and robust communication systems, the Alaska Arctic is a challenging environment for obtaining sustained observations, especially in real-time. However, this information is essential for forecasting and reporting on ocean conditions to improve navigation safety, assessing and planning for risks and incident response including oil spills and search and rescue operations, and responding to coastal hazards such as longer periods of mobile ice and increased impacts of waves and storms on coastlines and communities.

The Role of AOOS and Our Partners
To meet this need, AOOS is partnering with the National Weather Service, the Marine Exchange of Alaska, the Office of Naval Research, the Department of Homeland Security's Arctic Domain Awareness Center, the Bureau of Ocean Energy Management, the University of Alaska, and other federal and state agencies, private industry, and NGOs to identify and fill observing gaps, demonstrate new observing technologies and infrastructure, and develop data and information products and applications. AOOS adds several unique capabilities to the mix of entities helping to meet ocean and coastal observing needs in Alaska's Arctic. These include: our Congressional mandate to work with the private sector; our broad-based governing board made up of state and federal agencies, the University of Alaska and other Alaska research institutions, and representatives of the private sector including marine navigation, fisheries, oil and gas industries, and tribes; strong stakeholder engagement and outreach programs; the ability to quickly deploy assets and easily pool funding from multiple sources, including the private sector; and use of the AOOS Data Assembly Center with the largest collection of Arctic data, models, and visualization tools, powered by a state of the art high performance computer center.

OBSERVING TECHNOLOGIES AND TOOLS

High Frequency (HF) radars & remote power modules: These systems measure real-time hourly speed and direction of surface currents over a large region of the coastal ocean, from a few kilometers offshore up to 200 km, and can operate under any weather conditions. The products can be used operationally for sea state conditions, search and rescue operations, navigation and oil spill response and are crucial inputs into circulation models and forecasts. Although most of the west and east coasts of the U.S. have full HF radar coverage, Alaska has only three sites in the Chukchi and Beaufort Seas currently in operation with support from AOOS in support of offshore oil and gas operations. With new funding in NOAA's FY 17 budget, AOOS will be installing two additional radars in the Bering Strait region in the summer of 2019, although four would be ideal. There is no radar coverage in the Aleutian Island passes, also part of the official U.S. Arctic, which, as part of the Great Circle route between North America and Asia, experience extensive vessel traffic and threats from navigation incidents. The Alaska radars are sustained by remote power modules developed by the University of Alaska Fairbanks, and run on renewable energy (wind and solar) for "off-the-grid" use.

X-band sea ice radars: Images of near-shore sea ice conditions (up to approximately 20 km or 11 nautical miles) are recorded every four minutes and sent via internet to the University of Alaska, where they are processed to derive maps of ice velocity, divergence and convergence. The imagery and animations are regularly used by local subsistence hunters, analysts at the National Weather Service's Anchorage Ice Desk, and commercial and civilian mariners for navigational purposes when mobile sea ice poses a potential threat to their vessels. Only one sea ice radar is in regular use in the Utqiaġvik (Barrow) area, but the equipment is old and needs replacement. Additional radars would be extremely valuable.
Wave buoys: These buoys measure and transmit data on surface currents, waves and sea surface temperatures – all critical data for safe navigation and validating models and forecasts. Managing these buoys has been logistically challenging, as seasonal sea ice has restricted use to occasional seasonal deployments in the Bering Strait and Chukchi Sea. However, with longer periods of

ice-free seasons, usage of these buoys becomes more realistic. One new wave and current buoy will be deployed by AOOS outside the Port of Nome in summer 2018. At least five more are needed in key transportation areas: Unimak Pass, Bristol Bay, Bering Strait, Kotzebue Sound, and Barrow.

Real-Time Ice Freeze-up Detection Buoys: Real-time ice observations are typically restricted to seasonal mooring operations that can only be conducted with a ship during ice-free conditions. However, it is exactly during the breakup and freeze-up transitions when observations are most needed for accurate ice forecasting and modeling efforts. Recently, the IOOS Ocean Technology Transition (OTT) program supported AOOS, the University of Alaska and industry partner Pacific Gyre to pilot an ice detection buoy system for two seasons in the Chukchi Sea to provide real-time temperature and salinity data throughout the water column running up to the day of freeze-up. The mooring remains in the water without recovery while the surface buoy detaches on command at freeze-up, allowing this system to remain in place throughout the freeze-up process. With increased ship traffic, deployment of these buoys becomes increasingly realistic, and could significantly lengthen the period of real-time ocean observations during the late fall and early winter in the Arctic. Only one is in use at this time; more are needed.

Water Level Observations Where Conventional Methods Don't Work: Accurate water level observations are fundamental for safe navigation, mapping and charting, storm-surge forecasting, informed emergency response, and ecosystem management, and Alaska's extensive and remote shorelines are especially under-instrumented, leaving coastal populations and infrastructure exposed. This is in part because of obstacles including seasonal ice, lack of coastal infrastructure and rapid coastal erosion, all which render conventional water level sensing technologies inapplicable. The entire west and north coasts of Alaska have only four NWLON (National Water Level Observing Network) tide gauges, providing the most precise and robust measurements. At least one more is needed in Kotzebue Sound, as well as replacement of one that was destroyed during a fire in Port Moller.

The NWLON in-water systems are expensive and don't work in most regions with shore-fast ice. Numerous activities are underway to trial alternative technologies in remote Alaska to help fill gaps in coastal water level observations. These include: bottom-mounted pressure sensors on subsurface moorings that will provide year-round (although not real-time) simultaneous and co-located waves and water level data; bridge-mounted, Iridium satellite telemetered, ultrasonic gages over tidal rivers in nine remote Alaska communities providing real-time data; and rapid deployment of portable water level sensors in coastal communities impacted by fall/winter storm surges providing post-storm data to improve forecasts.

Of particular interest is the use of GPS reflectometry techniques, a land-based method that provides water level information at accuracy levels necessary for computing principal tidal constituents, estimating tidal datums, and providing observations needed to improve storm surge and inundation forecasts. The approach uses reflected satellite GPS or GNSS signals to determine the height of a reflecting surface, such as the ocean, relative to a stable GPS antenna of fixed local height, recording variations in water levels as changes in the position of the antenna relative to the reflecting water surface. These systems are lower-maintenance, require less power, and are easier and less expensive to install and maintain compared to traditional

water level gages, while still providing highly accurate water level information to meet the immediate needs. AOOS and the National Weather Service are supporting two separate pilot projects, with additional locations now being considered for potential deployments along low-infrastructure regions across the state.

Use of Automatic Identification System (AIS) stations: The Marine Exchange of Alaska maintains a network of real-time vessel tracking stations across Alaska. AOOS is now equipping many of these stations with weather sensors that report localized wind conditions alongside vessel tracking information. These stations could be further enhanced to report local subsistence activity or other community observations to vessels transiting nearby. There now are eight real-time AIS systems equipped with weather sensors in the Arctic (four in the Aleutians, two in the Bering Sea and two along the North Slope). Two more Arctic installations are planned for 2018[C1].

Another use of the AIS system, in particular throughout the rapidly changing Arctic region, is AOOS development of an historic database of vessel traffic data, providing data synthesis, archive, and display for use in a variety of associated decision-support tools. The goal is to enhance usability of this increasingly valuable dataset for analyzing potential oil spill impacts from vessel groundings and collisions, developing risk management measures for maritime domain awareness, ensuring subsistence use avoidance, and planning and prioritization for hydrographic (bathymetric) surveys necessary for establishing modern navigational chart information as the region becomes more accessible due reduced seasonal sea ice.

Ecosystem Monitoring: A key element of national security and marine domain awareness is an understanding of the changing marine ecosystem and providing for long-term ecosystem and climate trend data. AOOS is working with partners to establish a network of fully instrumented and state of the art ecosystem moorings to serve as year-round anchors for associated ship surveys in the three major basins representing the Arctic: the Bering, Chukchi and Beaufort Seas. The Chukchi Sea Ecosystem Moored Observatory is completely built out and now provides continuous multi-disciplinary, year-round observations within Shell Oil's past oil and gas lease area, a known Arctic biological hotspot. Due to the presence of sea ice in this region for much of the year, the moorings do not have a surface expression and cannot report data in real-time, but are uploaded during the annual mooring turn-around cruises that occur during the open water season. These instruments are producing high temporal resolution time series throughout the entire year, including the under-sampled and poorly understood seasons when sea ice inhibits more traditional ship-based sampling.

Another AOOS pilot effort uses autonomous buoyancy-controlled gliders to observe sub-surface water column conditions and track marine mammals in near real-time. A passive acoustic device mounted inside the glider together with hull-mounted hydrophones maps the presence of marine mammals along the glider trajectory. Data are sent to the project computer via Iridium satellite whenever the glider surfaces for communication and mission instruction. With improved lithium battery capacity, the glider can now operate more than 90 days, enabling it to cover the majority of the eastern Bering and Chukchi Seas in a single deployment. The information is illuminating how marine mammals, especially those that may be threatened or endangered, interact with and

adapt to changing environmental conditions. Use of such gliders on an operational basis could greatly enhance Arctic marine domain awareness in the future.

AOOS Data Assembly Center and Arctic Data Portal: AOOS now operates a centralized regional data assembly center (DAC) with web-based analytical and visualization tools and products. AOOS – and the AOOS DAC - was recently certified by NOAA, ensuring that it meets federal standards for data management and quality control. The AOOS DAC, and a specific Arctic data portal, serves real-time, contemporary and historical data assets from international, federal, state, and regional governmental programs, as well as research and observing activities conducted by private industry (oil and gas, shipping and fishing), non-governmental organizations and international research cooperatives. The portal is built on AOOS's enterprise-level infrastructure that offers hardened cyber security, system backup and redundancy, and High Performance Computing (HPC) and storage resources for high-availability data access. The AOOS Arctic portal (http://portal.aoos.org/arctic) is designed to help users find, access, and analyze data for planning, research, decision making and emergency response in the Arctic. Users can take advantage of the portal's sophisticated charting abilities, including comparisons between data sources, binning by time, and plotting of climatologies and anomalies to discover and explore data. Custom compilations and data comparison chart can be created, saved, and shared to spotlight environmental events or geographic locations.

Recommendations

1. As the Arctic continues to become more accessible and receive greater attention and use, the United States needs to invest in additional observing assets in the region. A modest investment in dollars would be invaluable in ensuring that the U.S. has the marine domain awareness to manage that usage, respond to potential emergencies such as an oil spill or search and rescue incident, and provide for the nation's security in the face of increased international presence in the Arctic.
2. All of the activities described above depend on substantial partnerships and leveraging of resources. These should be fostered and enhanced with additional mechanisms for transferring and sharing of funds among federal agencies and with the private sector.
3. Many of these activities depend on our integration within the national Integrated Ocean Observing System (IOOS) Program, an innovative partnership between 17 federal agencies and 11 regional systems dedicated to addressing the need for timely and accurate data and information about the nation's oceans and coasts, with NOAA as the lead Federal agency. The Integrated Coastal Ocean Observing System Act of 2009 provides the foundation for this system, and H.R. 237, the Integrated Coastal and Ocean Observation System Act Amendments of 2017, sponsored by Alaska Congressman Don Young, is now before the House Natural Resources Committee. A companion bill has already passed the Senate. Adequate funding for this program is essential.

Conclusion

I appreciate the opportunity to speak to you today about the United States' role of ocean and coastal observing in the emerging Arctic. We refer to this region as the new Arctic Marine Highway, and similar to any traditional highway, the U.S., with its state, local and private sector partners must provide the services, protections and enforcement essential to making this strategic

region scientifically understood, economically productive, and environmentally safe. Thank you for your time.

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August 21, 2018

The Honorable Duncan Hunter, Chairman
Subcommittee on Coast Guard and Maritime Transportation
U.S. House of Representatives
Washington, DC 20515

RE: AOOS response to Questions for the Record Submitted on behalf of Ranking Member John Garamendi following June 7, 2018 hearing on "Maritime Transportation in the Arctic: The U.S. Role"

1. Arctic Ocean Observation Needs

Your statement lays out a compelling need for more robust marine and coastal observing infrastructure to support national interests in the Arctic.

- *In terms of High Frequency (HF) radars, what is needed for full HF coverage in the U.S. Arctic, and does your regional association have the capability to manage such a system? What would this cost?*

A long-term commitment to a backbone High Frequency (HF) radar array is essential in the in the U.S. Arctic to meet national, environmental and economic security needs. Radar data would inform vessel tracking, safety and efficiency, as well as ocean circulation and oil spill trajectory models and forecasts. Ideally, we would have 100% coverage at key Aleutian Island passes, across the entire Bering Sea, through the Bering Strait, and along the entire North Slope of Alaska (Chukchi and Beaufort Seas), where oil and gas activities are expected to increase over the next 10 years. However, given the region's remoteness, lack of existing communications, power and access, and high costs, our goal is now to provide HF radar capability regionally at critical locations for safe navigation and emergency response efforts that require surface current information. These also happen to be areas most likely to see a maritime incident due to increasing ship traffic, increasing offshore oil and gas development activities, diminishing ice, and new open waterways that do now have adequate bathymetric (bottom depth) information, thus increasing risks for loss of life and incidents. These priorities would also build upon and enhance existing capacity:

- Utqiaġvik region, formerly known as Barrow, originally in response to Chukchi sea offshore oil and gas exploration, and now in support of Beaufort Sea development and juncture of Chukchi and Beaufort Seas.

Status: Currently 3 Operational HFRs. $750k replacement costs in next 2-5 years, $160 O&M annually.

- Bering Strait region, major chokepoint for increased vessel traffic from the Northern Sea Route and Northwest Passage on both U.S. and Russia sides.
  Status: 2 Operational HFRs planned for installation in 2019 with funding in 2018 IOOS budget. $900K initial capital costs & 1year O&M, $160K O&M annually.

- Unimak Pass, key Aleutian Islands passsage to the Arctic and for Great Circle Route.
  Status: Planned but not funded. Estimated $1 Million initially for radars, remote power modules, installation & 1-year O&M. $160K O&M annually after.

- Eastern Beaufort between Prudhoe Bay and Kaktovik, bordering Arctic National Wildlife Refuge potential oil development site and tying together the Canadian and U.S. Beaufort.
  Status: Planned but not funded. Estimated cost $1M initially, $160K O&M annually.

The national Integrated Ocean Observing System manages the nation's HF radar system through its 11 regional associations, of which AOOS is one. AOOS currently manages the HF radars in Alaska through a contract to the College of Fisheries and Ocean Science at the University of Alaska, Fairbanks, which houses the state's technical expertise for deploying, operating, and maintaining HF radars, as well as providing all the engineering aspects (remote power modules, platforms, remote installation requirements, etc.).The data is processed at UAF, and then served up in near real-time on the AOOS data portal and through the HFR Data Assembly Center at Scripps Institute of Oceanography.

Total cost: $4M in capitalization, about $650K O&M annually. Life cycle of radars is xx years.

HFRs can only measure surface currents in the ice-free or broken ice seasons. These can be augmented during the seasonal ice seasons with X-band sea ice radars in key locations. These are less expensive since they can be placed in communities with existing power such as Utqiaġvik, Prudhoe Bay, Wainwright, etc.

Status: 1 X-band radar in Utqiaġvik that needs replacement. $100K replacement cost, $20K/year O&M. 3 additional X-band radar sites: Prudhoe Bay, Kaktovik, Wainwright.

- *Regarding wave buoys, what are the total life cycle costs for these buoys? Are they affordable to maintain?*

Life cycle estimates for wave/current buoys are based on 5-year lifecycles, although if well maintained, buoys will last much longer before they need replacement. Cost in Year 1 is roughly $160K. Years 2-5 costs are $60K per year, assuming they need annual turnaround, which is required in the Arctic where buoys can only be deployed in ice-free seasons of the year. Total 5-year costs: $400K per buoy. The main costs are the initial purchase, shipping and repairs, which usually entails battery replacements.

National Data Buoy Center (NDBC) buoys are larger and more expensive (approximately $250-300K each) but do deliver additional weather parameters. As part of a national system, NOAA relies on the US Coast Guard and national contractors for maintenance, often resulting in long periods without data if a buoy "goes down". The wave buoys used by AOOS are part of the US Army Corps of Engineers' Coastal Data Information Program and can be serviced by local vessels and operators, which usually results in less "down time".

2. Autonomous Gliders

The pilot effort by your organization to use autonomous buoyancy-controlled gliders to observe sub-surface water column conditions and track marine mammals in near real-time over substantial distances was a compelling example of how "blue technologies" are changing how we monitor, observe, and operate in the marine environment.

- *How adaptable are these unmanned systems to different uses, such as conducting vessel surveillance to enhance maritime domain awareness?*

Gliders have been in use for years, especially by the Navy to monitor sub-surface vessels and improve our understanding of the world's oceans, as well as the oil and gas industry for monitoring subsurface water column conditions and noise. With new developments in battery technologies and sensors measuring everything from marine mammal calls to ship noise to ocean acidification, gliders are very adaptable, and their usage will only increase.

Wave gliders and Saildrones are also emerging autonomous technologies that have the capability to measure surface and near-surface ocean variables. Wave gliders use waves for propulsion, whereas Saildrones use wind. Both can operate for months at a time.

- *To your knowledge, has the Coast Guard ever expressed an interest in testing these systems in the Arctic as a means to increase capability without significantly operational costs?*

Yes, the Coast Guard is interested in using gliders on a more operational basis, but claim they are not funded to run operational observing programs. The US Department of Homeland Security is currently funding a center of excellence – the Arctic Domain Awareness Center, whose core customer is the US Coast Guard. ADAC is funding the testing of use of gliders for under ice mapping of oil spills and Maritime Traffic Domain Awareness.

- *Are specific "ice hardened" technologies being developed to operate in the harsh and unpredictable Arctic maritime environment?*

Gliders have been used in the harsh environments of Antarctica and the Arctic for more than a decade. The challenge has been battery life for sensors and communications, which has been addressed to ensure batteries last longer and now enables gliders to fly months at a time, and the addition of altimeters to prevent collisions. The most recent challenge now being addressed is how to operate gliders under ice for long periods of time with limited communications.

3. Arctic Strategy

The absence within the federal government of an over-arching Arctic Strategy to guide future operational planning and investments by federal agencies was exposed and discussed as a genuine liability in protecting and advancing U.S. sovereign and strategic interests in the High North. Members discussed introducing legislation to establish a comprehensive federal Arctic policy and strategy as a possible option to jump start that initiative.

- *What specific factors must be included in any federal Arctic strategy? Would legislation be helpful? What are your recommendations and associated costs?*

Any federal Arctic strategy must include provisions for the capitalization and long-term operation and maintenance of observing assets to support Marine Traffic Domain Awareness, including improving forecasts (models) and understanding weather and ocean current systems in the region and support efficient operations, search and rescue, emergency response, and oil spill response.

To support these assets, key ports and communities must have the necessary support infrastructure, including ports and vessels capable of deploying assets and responding to emergencies. These include at a minimum the hub communities of Nome, Kotzebue, Barrow (Utgiaqvik), Prudhoe Bay and Kaktovik.

Legislation is always helpful as it provides congressional approval of activities and supports funding priorities within federal agencies. The US Arctic Research and Policy Act of 1984 was last amended in 1990 and could be a vehicle for updating US policy.

Bringing the U.S. Arctic's observing capacity to a level even one tenth that of the rest of the U.S. coastline, will not happen overnight. Modest investments on the order of tens of millions of dollars over a period of time would make a tremendous difference to national, economic and environmental security in the region.

- *What would be an appropriate time horizon for implementation?*

If funding was available in a single appropriation, most of these assets could be deployed over a 1-2-year timeline. However, full implementation could occur over a decade with incremental investments.

– *What critical investments should be made in ocean observation and other maritime infrastructure, and in general, how much would this cost?*

Other key investments in ocean observations and other maritime infrastructure include:

- Water Level Observations: The U.S. Arctic has only 4 federal NWLON tide stations. AOOS is testing the use of GPS reflectometry stations as a less expensive option to fill in the gaps between those stations. Cost: $100K/ installation (on average) for remote AK. $30K/year O&M per site (mostly iridium and data processing/handling costs, with some site visits). Total cost for 10 sites: $1M capital, $300K O&M.

- Wave buoys: Waves are most important to areas that have ship traffic or tankers/oil barges coming into shore. AOOS just deployed a wave/current buoy outside the Port of Nome in July 2018. Additional buoys are needed for Dutch Harbor, Kotzebue, Barrow (Utgiaqvik), Prudhoe Bay, and possibly Kaktovik. The availability of support vessels for deployment and retrieval are essential to their success. Total cost for 5 additional buoys: $800K in year 1, $300K per year thereafter. As an option for providing hindcast data to improve storm surge and wave forecasting, less expensive bottom-mounted acoustic wave and current sensors could be deployed to operate year-round without real-time data reporting (although they could report real-time if used with cabled observatories). These cost about $40K each and could be retrieved on an annual basis.

- Additional weather observations in the Arctic are critical. Currently year-round weather stations mostly exist at local airports, but do not provide conditions on the water. AOOS has partnered with the Marine Exchange of Alaska to add weather sensors to existing AIS vessel tracking stations. 2 of the 9 AIS stations north of the Bering Strait have weather, with 2 more to be added in summer 2018. Adding weather to the other 5 existing Arctic. stations costs about $5K per station, and about $3-4K O&M per station. Total cost: $25K for capitalization and $15K per year O&M. Additional AIS/weather stations are needed at East Cape St. Lawrence Island, Little Diomede Island, a site between Prudhoe Bay and Barrow, and a site east of Prudhoe to the Canadian Border. Cost for 4 additional AIS/weather stations: $80K, Annual O&M: about $16K.

- Ice Detection buoys provide real-time data through the GTS (Global Transmission System) for real-time data for fall ice forecasting to enable maximum use of open water by vessels. Cost for 4 systems: $100k each for capital, $50K/year for O&M (calibration, mooring set up, shipping, tech time).

- Four routine annual Arctic glider transects during open water seasons to provide broad spatial coverage of ocean conditions throughout the water column and augment coverage by the Distributed Biological Observatory (DBO). Potential locations include Barrow, Wainwright, Dutch Harbor, Kaktovik or Prudhoe Bay. Total cost: about $200K per glider in Year 1 for glider, sensors, batteries, calibration, etc. $60K O&M annually thereafter.

- Distributed Biological Observatory (DBO) ship survey transects in 6-8 designated biological hot spots in the Bering, Chukchi and Beaufort Seas. These operate as "change detection arrays" and are sampled opportunistically during the ice-free season by a consortium of national and international vessels. The U.S. contribution is funded by the National Science Foundation and NOAA for about $800K-1M per year. The data is aggregated and made publicly available and to the broader scientific community.

- Ecosystem moorings to provide year-round biological, chemical and physical observations. One mooring currently exists in the Chukchi Sea. 3 others are planned for Beaufort and southern and northern Bering Sea. Capital cost: about $250K each. Annual O&M: $60K.

- Ocean acidification and Harmful Algal Bloom monitoring. These can be combined with other monitoring by gliders, moorings, Saildrones, ship surveys, and community-based monitoring etc., but need to be built up as sustainable programs.

Conclusion

This response focuses on the development of operational marine assets for the U.S. Arctic and does not address the U.S. need for ice breakers or port and harbor development. It should not be viewed as totally comprehensive. The conceptual Arctic buildout plan developed by AOOS in 2013 (https://www.aoos.org/conceptual-buildout-plan-arctic-ocean-observing-system/) is in the process of being updated in winter 2019 and will provide additional detail. But the assets described above total in the range of $10 million for capital costs, and less than that for annual operation and maintenance, a modest investment given the economic and ecological value of the U.S. Arctic and its key role in national security.

The United States' Role in

Maritime Transportation in the Arctic

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Briefing to the United State House of Representatives Subcommittee on Coast Guard and Maritime Transportation.

Thank you, Chairman Hunter, Ranking Member Garamendi and distinguished members of the Subcommittee, for the opportunity to present today. This is a privilege to come before you today at this hearing and discuss this very important topic.

I am David Titley and currently serve as the Founding Director of the Center for Solutions to Weather and Climate Risk at the Pennsylvania State University. I also hold appointments as a Professor of Practice in Meteorology and a Professor of International Affairs. I had the privilege of serving in the United States Navy for 32 years and retired in 2012 as a Rear Admiral and Assistant Deputy Chief of Naval Operations for Information Dominance. When I retired, I was also the Oceanographer and Navigator of the Navy, and Director of U.S. Navy Task Force Climate Change. Subsequent to my time in the Navy, I served as the Chief Operating Officer position of the National Oceanic and Atmospheric Administration (NOAA). I serve on the Board of Directors for the Council on Strategic Risks, the Advisory Board of the Center for Climate & Security. I am a member of the CNA Military Advisory Board and Hoover Institution's Arctic Initiative. My Center at Penn State currently receives no government or private sector funding; my views today are my own. I am here today because I believe it's important to discuss the challenges to our nation's security posed by a changing climate, particularly in the Arctic. Thank you for holding this hearing.

In the Navy we have a saying, to just give me the 'Bottom Line Up Front' or BLUF. So here's my BLUF for today's hearing:

- **The Arctic's physical environment is changing faster than any other place on Earth today:** Today's Arctic climate continues to warm at a rate twice that of the rest of the world. Temperatures at the North Pole the past three years have reached the freezing point – in the middle of winter. Prior to 2016, this was virtually unheard of. While these days make headlines – especially when it's colder in Washington than at the North Pole – the real news is how much less cold there is in the Arctic relative to even 30 years ago. Over the past three winters, most of the central Arctic has been 5 to 7 degrees Fahrenheit warmer than normal. To put this into comparison: that much warming in Washington DC would make the winters here more like those in North Carolina.

One of the many effects of this tremendous warming has been to thin the ice. 30 years ago, there was nearly as much old hard think ice (scientists call it 'multiyear ice') as there was first year ice. Now nearly 80% of the ice you see in any picture of the Arctic is softer, thinner first year ice, and only 20% of the ice has lasted for more than one year. So the Arctic sea-ice is changing in two ways: it's not only decreasing in extent, losing over 13% each decade each September, but it is also rapidly thinning. Combined, these changes lead to a much more variable, dynamic ice pack that will make maritime transportation more tempting, more feasible – and paradoxically more hazardous due to rapidly changing and less predictable conditions.

- **Our rivals are paying close attention to the changing Arctic, even if we are not:** While the United States has shown, at best, sporadic and episodic interest in the Artic, our great power rivals, as defined in our National Security Strategy, have made deliberate investments in planning and resources. The Russians are actively monetizing their Northern Sea Route and rebuilding their Arctic military capabilities, albeit from a very low post-cold war level. After western sanctions were imposed following Russian actions in Crimea and the Ukraine, Russia has courted Chinese investment for their fossil fuel industry. China meanwhile released its Arctic Strategy in January of this year. China declares itself to be a "near Arctic State" and hopes to jointly build a "Polar Silk Road" – likely the Northern Sea Route -- as the northern flank in its "Belt and Road" initiative. China continues to court the Nordic states and Greenland, likely looking for a combination of natural resources and an Atlantic terminus to any future trans-polar shipping route.

- **There is still time to execute a deliberate strategy that will assert our economic and security interests, assure our allies, and ensure we are ready for the future that will be very different than the past:** In May 2009, at the direction of then Chief of Naval Operations Admiral Gary Roughead, I initiated and led the U.S. Navy Task Force on Climate Change. The U.S. Navy started this task force, not in response to any perceived political pressure, but as a reaction to the collapse of sea-ice in the Arctic in the summer of 2007. Admiral Roughead asked me to assess the conditions in the Arctic, and provide him with recommendations for the Navy's response. My conclusions were that the sea-ice collapse in the Arctic, well ahead of most of the computer models of the time, was the leading edge of climate changes to come that would change the operating environment for the Navy. The goal of Task Force Climate Change was to prepare, in a deliberate manner, the U.S. Navy for this future environment, with an emphasis on getting ready for the Arctic, as it was the change that would likely impact the Navy first.

  In 2009 I characterized the Arctic as "a challenge but not a crisis". However I said if we ignored changes in the Arctic or were slow to respond, we heighten the risk of the region becoming a crisis. We need to address the Arctic taking a "system of systems" approach. We need to address our security, economic, scientific and certainly social issues in the Arctic, while simultaneously understanding the motives and intentions of Russia and China and assuring our allies and friends.

Security Issues in the Arctic

Over the past decade in the Arctic, we have seen an exponential rise in human activity in and around the Arctic; more shipping, more resource extraction and more posturing, particularly by our great power rivals, for control and influence over today's resources today and tomorrow's sea lines of communication. The world is not yet prepared to respond to an major accident that could occur with increasing shipping and energy exploration in this fragile region with limited infrastructure and extreme operating conditions. Although there are a number of Arctic strategies and roadmaps at the national, cabinet and agency level, most are seriously under-resourced, or have little apparent impact on either policy or budget priorities. Preparations for energy exploration are well underway and when oil prices rise, as they always do, the Arctic will be a tempting and economically viable area for exploitation. We assess that today we do not have the communications equipment, navigation aids, and sufficient ice hardened ships to respond to natural or manmade disasters in that fragile area or to protect our vital interests. In other words, we are not prepared in the short term for the rate of increase and we must invest today in increasing our capability and capacity.

This increase in Arctic human activity is playing out on a backdrop of increasingly assertive Russian activity in the Arctic. While the Russians maintain their military buildup in the High North is peaceful and for defensive purposes only, it is impossible for us, our NATO allies, and our partners to ignore the aggressive operations of Russian forces in that part of the world and their high-readiness, no-notice snap exercises[1]. Regardless of intent, Russian forces have, over the past few years, significantly upgraded the ability to operate and command and control forces in the Arctic. Their actions are disconcerting to our allies; we would be remiss to completely ignore this change in security dynamics.

Shipping Issues in the Arctic

At the risk of duplicating what my fellow witnesses and colleagues might say, it's important to outline the many challenges that arise for any arctic maritime transportation operations today or for the next couple of decades, at least. The old Facebook status said it best: "it's complicated".

- It's cold and austere. Yes, the temperatures are warming in the arctic and the ice is melting at unprecedented rates. However, it can still be very cold (-30 degrees) in the winter and very foggy in the summer. It's dark for many months in the wintertime. As the ice thins and breaks up it becomes even more difficult to predict. Thick ice can be like hurricanes: it only takes one to ruin your whole day. Shell found this out to their chagrin in 2012. While the Arctic as a whole experienced record-low sea ice that year, relatively small pieces of multi-year ice floated into the Chukchi Sea and disrupted their offshore operations.
- There is much work still to do charting safe passages and routes for arctic shipping. I'm pleased to note some of this work is underway, with NOAA ship surveys and the Bering

[1] K. Zysk, and D.W. Titley. "Signals, Noise and Swans in Today's Arctic." *The SAIS Review of International Affairs*, 25 (1) 169-181, 2015.

Sea Traffic Separation Scheme that will come into effect this December. However, much of the Arctic Ocean has yet to be surveyed to modern standards.

- If you get in trouble, you may be on your own. Although the Arctic Council has led the implementation of both a Search & Rescue and a Marine Oil Spill Agreements, it's one thing to have a signed agreement, and another to have the resources and training (we would call this 'readiness' in the military) to be able to respond effectively when the call comes.
- The combined impacts of the above-listed bullets give shippers, and more importantly, insurers, pause when running shipping through the Arctic.
- The current routes available for navigating across the Arctic, that is the Northern Sea Route across Russia's coast and the Northwest Passage through the Canadian archipelago, have significant draft limitations for modern commercial shipping. The Northwest Passage is also a technically demanding navigation detail, particularly in waters subjected to high winds, poor visibility, and rapidly varying and unpredictable ice conditions.
- Both Canada and Russia claim parts of their respective sea routes through the Arctic as 'internal waters'. While the U.S. does not recognize these claims, the lack of agreement in governance of specific waters adds uncertainty to any risk equation.
- The current business model of the container fleets stresses both reliability of delivery date and shipping very large numbers of containers to reduce fixed costs. As of today, and likely for the next 10-20 years, those constraints will continue. Once a seasonally ice-free trans-arctic route opens up, most probably sometime in the 2030's, these conditions might change.
- We should always be aware of the potential for disruptive change. The liquefied natural gas (LNG) carrier *Christophe de Margerie* class of ships set a transit speed record for a commercial ship across the Northern Sea Route last August. Another ship in the class transited the Northern Sea Route this past February with no icebreaker assistance. While there are good technical reasons to believe these are 'one of' events – many revolutions are not recognized until they are well underway.

Recommendations

So what should we do? I recommend we take a risk-management approach, similar to how the CNA Military Advisory Board (MAB) has done in their most recent report on the risks of climate change to security.[2] Although most of the CNA MAB members are not scientists, their positions as former senior three- and four-star leaders in the United States Military trained them to seek and assess technical advice from many different fields of expertise.

It's important we step back and consider the obvious: we have never been in a position in the modern world where access to an entire ocean opened up within a matter of decades. While we tend to think that the days of geographic exploration ended in the 18th and 19th Centuries, in many aspects, the changes in the Arctic will likely create a wave of human exploration and

[2] "National Security and the Accelerating Risks of Climate Change.", CNA Corporation, May 2014. https://www.cna.org/cna_files/pdf/MAB_5-8-14.pdf

activity. Now is the time to think carefully about how to manage that very different world and what we want that world to look like. We must think of this in terms of our security, our economy, the likely actions of our friends and rivals, and critically, engage in a meaningful and sustained way with the indigenous people who have lived in the arctic for thousands of years. While many of these recommendations are similar to what I published with Elizabeth Rosenberg 2 ½ years ago[3], they are still relevant today:

- **Update our Nation's Arctic Strategy in response to the changes in our National Security Strategy and National Defense Strategy**
    - Use all our sovereign assets (DOD, DHS, Navy, Coast Guard, NOAA) to develop a coherent and sustainable presence in the Arctic that will demonstrate long-term commitment to our sovereign interests in the Arctic, reassure our Allies, and send an unmistakable message to our great power rivals that as an Arctic Nation, we will neither ignore nor neglect this strategic region.
    - Direct and resource the National Science Foundation to set up a permanent research presence on Svalbard. Both the Russians and Chinese have a presence on the island, but the U.S. does not. I am very confident our Norwegian friends would welcome a permanent U.S. research presence on Svalbard, under the auspices of the 1920 Treaty of Svalbard.
    - Adequately resource the U.S. Coast Guard to construct and operate a new class of heavy icebreakers that will be the foundation of U.S. maritime presence in the Arctic.
    - Reengage with our allies on Arctic exercises. The U.S. Navy sent a guided missile destroyer to the Canadian Exercise NANOOK in 2010, but has not done so since, primarily for budget reasons and the lack of available surface assets. There are valuable lessons learned and experience gained by operating with our partners in the Arctic and High North. We should not let the urgent crowd out the strategically important when allocating assets.
    - Commit to 'Arctic Domain Awareness' to ensure we understand who and what is operating in the Arctic, what the trends are, and to keep our borders safe and protected.
- **Develop – and resource – a plan that in conjunction with state, Native Alaskan corporations, allied, and private sector interests, builds out the foundations of an infrastructure that can support U.S. objectives for a seasonally ice-free Arctic**.
    - Ice predictions need to be improved on all time scales from daily to seasonal to multi-year outlooks. The Department of the Navy is funding today the 'Earth System Prediction Capability' or ESPC – an interagency program designed to provide our country the next-generation of integrated air-ocean-ice-land prediction system[4]. Navy is working with other components of the DoD, as well

[3] E. Rosenberg, D. W. Titley and A. Wicker. Arctic 2015 and Beyond: A Strategy for U.S. Leadership in the High North. *Center for New American Security*, December 2014 https://s3.amazonaws.com/files.cnas.org/documents/CNAS_ArcticHighNorth_policybrief_RosenbergTitleyWiker.pdf?mtime=20160906080459

[4] http://espc.oar.noaa.gov/

as NOAA, NASA and the Department of Energy to ensure our nation has the world's best operational weather and climate prediction tools at our disposal. This national imperative must be a national priority. I want to thank the Congress for including language in the 'Weather Research and Forecasting Innovation Act of 2017' that directs NOAA to cooperate with the DoD on further developing ESPC.

  - Weather forecasts in the Arctic are still significantly less accurate than those we produce for the lower 48. For both safety and economic reasons, this needs to change.
  - We need to continue to map the U.S. Arctic Exclusive Economic Zone (EEZ) waters to support safe maritime navigation and operations as well as gathering data and knowledge for optimal and sustainable ecosystem management.
  - We must address the lack of ports north of the Bering Strait and lack of permanent infrastructure for safety assets, such as Search and Rescue or Oil Spill response ships and aircraft. This should be done in conjunction with partnerships of state and indigenous stakeholders, as well as in close coordination with our Canadian allies.

- **Commit to ratification of the UN Convention of the Law of the Sea (UNCLOS).** UNCLOS was written primarily by the U.S. to encode maritime advantages inherent to our economic and security well-being. UNCLOS is the governance structure for the world's oceans, including the Arctic Ocean. Accession to UNCLOS, among many other advantages, would allow the U.S. to file a claim for seabed resources north of Alaska in an area that is nearly the size of California.
- **Continually adjust policies today based on what we learn** – and for what we might reasonably expect in the coming decades. Ensure we do not simply plan for the best case or even the most likely, but also consider seriously less likely scenarios that pose either great challenges – or great opportunities – to the U.S. We learned in the military a long time ago that hope by itself is rarely a good strategy.

In closing, our country is dealing with a significant change in the world's climate, and nowhere is the climate changing faster than in the Arctic. Our country has met challenges of this magnitude before and succeeded – and we will do so again. While we don't know everything – and we never will – we do know more than enough to act now. By focusing our efforts in a risk-based framework on meeting the challenges of a rapidly changing Arctic, we can prepare for the short-term while shaping our longer-term future. We can provide the policies that give our country security, access and stability to this region of ever-increasing strategic importance. I am convinced that, with focus and sustained leadership, we will be proud and amazed at what we can accomplish in the Arctic.

Thank you very much for your time and attention; I look forward to taking your questions.

"Maritime Transportation in the Arctic: The U.S. Role"
Subcommittee on Coast Guard and Maritime Transportation
Thursday, June 7, 2018, 11:00 a.m.
2167 Rayburn House Office Building
Washington D.C.

Questions for the Record for RADM David W. Titley, U.S. Navy (Ret.), Professor of Practice in Meteorology, Department of Meteorology and Atmospheric Science, Pennsylvania State University

Submitted on behalf of Ranking Member John Garamendi (CA-03):

1. Chinese Arctic Interests

You acknowledge that Russia, not surprisingly, is actively monetizing its Northern Sea Route and rebuilding their Arctic military capabilities. More surprising was your account of China's expansion into the Arctic.

- How concerned are you with Chinese expansion into the Arctic and their interest in supporting investments in infrastructure in other Arctic states as a means of advancing their own foreign and economic policies?
- How might this affect the relationship of the United States with other Arctic states? What are the risks?

Responses not received at the time of publication.

2. Svalbard Island

You recommend that the National Science Foundation set up a permanent research presence on Svalbard Island as a means of demonstrating to our allies and others a long-term U.S. commitment to our sovereign interests in the Arctic.

- Can you expand on this recommendation?
- What is the strategic benefit of establishing a research presence on Svalbard Island?
- Are there other specific locations outside of Alaska that the United States should look to establish a cooperative operating presence?

Responses not received at the time of publication.

3. Arctic Strategy

The absence within the federal government of an over-arching Arctic Strategy to guide future operational planning and investments by federal agencies was exposed and discussed as a genuine liability in protecting and advancing U.S. sovereign and strategic

interests in the High North. Members discussed introducing legislation to establish a comprehensive federal Arctic policy and strategy as a possible option to jump start that initiative.

- What specific factors must be included in any federal Arctic strategy? Would legislation be helpful? What are your recommendations and associated costs?
- What would be an appropriate time horizon for implementation?
- What critical investments should be made in infrastructure, and in general, how much would this cost?

Responses not received at the time of publication.

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