Testimony of
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on
U.S. Coast Guard's Leadership on Arctic Safety, Security and Environmental Responsibility
before the
The House Committee on Transportation and Infrastructure
Subcommittee on Coast Guard and Maritime Transportation
December 7, 2022 10 a.m. EDT

Good morning, Chairman Carbajal, Ranking Member Gibbs, and distinguished members of the subcommittee. I appreciate the opportunity to testify today in this hearing addressing Coast Guard leadership on Arctic safety, security and environmental responsibility, and I thank you for your continued support of the United States Coast Guard.

I am a professor of Information Systems at Le Moyne College in Syracuse, New York, and a senior research scientist in the Department of Industrial Engineering at Rensselaer Polytechnic Institute, in Troy, New York. I am a 1979 graduate of the U.S. Merchant Marine Academy at Kings Point, in the 2nd class of women to graduate from a federal service academy. Upon graduation, I was licensed by the Coast Guard as a Third Mate, and ultimately as Second Mate, and I sailed on tankers, liquefied natural gas carriers, and ocean-going integrated tugs and barges carrying super phosphoric acid to Russia.

I have been licensed by the Coast Guard, my research has been funded by the Coast Guard, and my research, exploring technology impacts in safety-critical systems and the marine transportation system, is important to the future of the marine transportation system.

I'm currently investigating the impact of advanced visualization and artificial intelligence technology on maritime safety, decision-making, communications and agility in a series of simulator experiments using Google Glass with the Staten Island Ferry. My earliest research developed and tested an artificial intelligence ship navigation system aboard Trans Alaskan Pipeline Service (TAPS) Trade tankers sailing into and out of Valdez, Alaska. My current research takes me further north in Alaska, with funding from the National Science Foundation, as our research team develops resource allocation models, and addresses the challenges and needs for resilient maritime infrastructure in the Arctic, with benefits for Arctic communities.

Most recently, several weeks ago, I was in Fairbanks, Alaska with my students, having met with Coast Guard Sector Anchorage and with researchers at the University of Alaska Fairbanks, on our research projects that use uncrewed aerial systems in Arctic search and rescue, and for Arctic maritime infrastructure data gathering and analysis. We flew out as Typhoon Merbok blew in, and the impacts of the Typhoon and the onslaught of the increasingly impactful series of major storms and maritime events besieging the Arctic and Western Alaska are both impressive and frightening to consider.

I have had the privilege of being associated with the National Academies of Science, Engineering and Medicine (NASEM) for 30 years, and just completed my 2nd tour as Chair of the National Academies' Transportation Research Board/Marine Board. I have also chaired or co-chaired five NASEM studies and served on four other NASEM committees. In 2014, I chaired the NASEM study sponsored by the Coast Guard, the U.S. Arctic Research Commission, the American Petroleum Institute, the Department of Interior/Bureau of Safety and Environmental Enforcement and the Bureau of Ocean Energy Management, the Marine Mammal Commission, NOAA, and the Prince William Sound Oil Spill Recovery Institute. That study assessed the nation's ability to respond to a catastrophic oil spill in the Arctic. The nation's capability to respond in 2014 was not strong, and in 2022, it has not measurably improved.

I am also a member of the current NASEM committee examining the adequacy of Coast Guard statutory authorities in light of novel uses of the maritime environment, including foreseeable developments such as aquaculture, autonomous systems, decarbonization of maritime vessels and systems, offshore energy, fishing, migration and commercial space operations. Our committee's work is in process at present, and I will not comment on its process, deliberations, conclusions or recommendations, except to note that Coast Guard Arctic activities and missions are some of the 'foreseeable developments' noted in the committee's statement of task.

My focus today will be on three areas important for Coast Guard leadership in the Arctic: maritime domain awareness, support for Coast Guard operations and personnel, and Coast Guard needs for resilient physical, technological and human infrastructure in the Arctic.

Background

The United States is an Arctic nation, and the United States Coast Guard serves as the nation's first maritime responder and the lead federal agency for homeland security, safety, and environmental stewardship in the Arctic. Coast Guard roles have expanded in the Arctic to include representing American interests as a leader in the international bodies governing navigation, search and rescue, vessel safety, fisheries enforcement, and pollution response across the entire Arctic.

The types of challenges that the Coast Guard is called upon to address in the Arctic are wide-ranging and significant, stretching from traditional missions in vessel navigation; emergency and oil spill prevention, response and mitigation; search and rescue; vessel safety, inspection and compliance; shoreside facilities' safety and inspection; fisheries; migration; offshore energy; and managing a talented but stretched workforce in a tight employment market across an enormous Area of Responsibility (AOR); as well as growing non-traditional missions supporting national geopolitical and humanitarian needs in remote locations.

Arctic maritime activities and transits are increasing due, in part, to changing climatic and environmental conditions, such as rising sea surface temperatures and declines in sea ice extent. As an example, Bering Strait transits totaled 262 in 2009, but doubled in 2021 to 555 (Marine Exchange of Alaska, 2022). Liquefied natural gas (LNG) tanker, cruise ship, and fishing vessel traffic in the Arctic region is increasing. As the region continues to open and strategic competition drives more actors to look to the Arctic for economic and geopolitical advantages, the demand for Coast Guard leadership and presence will continue to grow. Geopolitical developments and

tensions among other nations operating in the region, which are often unpredictable, are constant considerations in U.S. Arctic priorities and operations.

Future geopolitical, fisheries, law enforcement, security and national security interests will bring more and larger vessels of different types to Western Alaska, the Arctic, and through the Bering Strait. With the movement of sea ice through the Bering Strait, occurrences of storms and rough sea waves are also likely to increase, as are maritime navigation risks and the likelihood of vessel accidents. Increases in shipping traffic also bring heightened environmental risks.

Pollution from shipping and human waste is increasing in the Bering Strait. Vessel navigation exposes the Arctic ecosystem to dangers from vessel strikes, noises, and contamination, as well as dangers after accidents, such as oil spills and other hazardous releases. Cleaning up oil spills in the Arctic presents distinct challenges, as conditions such as lack of daylight, remoteness, and ice-cover can complicate response strategies and impact their effectiveness. Furthermore, historic storms exacerbated by climate change are also damaging the Arctic's fragile existing maritime infrastructure, its vulnerable gravel shores, and its power and water facilities, which are often built close to unprotected shorelines.

These effects, coupled with aging fuel tanks located near critical water supplies, melting permafrost, and an increasing number of tsunamigenic landslides near coastal communities and cruise vessel ports, are forcing Arctic communities to relocate, causing shipping and cruise vessel operators to review schedules and port visits, and are occasioning the Coast Guard to consider personnel and workforce assignments.

As oil and gas, shipping, and tourism activities increase, the U.S. Coast Guard will need an enhanced presence and performance capacity in the Arctic, including area-specific training, icebreaking capability, improved availability of vessels for responding to oil spills or other emergency situations, and aircraft and helicopter support facilities for the open water season and eventually year-round. Arctic assignments for trained and experienced personnel and tribal liaisons could benefit by being of longer duration, to take full advantage of their skills.

Operational and personnel support for the Coast Guard's Arctic Area of Responsibility is thus critical, given the size and scope of the Coast Guard's AOR in Alaska, which encompasses over 3.8 million (3,853,500) square miles, and over 47,300 miles of shoreline. Sustained funding and leadership commitment is required to increase the presence of the Coast Guard in the Arctic and to strengthen and expand the Coast Guard's ongoing and future Arctic missions.

1. Maritime Domain Awareness

Coast Guard needs to support effective U.S. missions in the Arctic center depend on effective maritime domain awareness, which for the Coast Guard requires improved visibility and access to transit and destination vessel traffic information. The 2014 NASEM report highlighted Coast Guard needs to obtain broader satellite monitoring of Automatic Identification System (AIS) signals in the Arctic through government means or from private providers. The NAS Committee's recommendation that the Coast Guard expedite its evaluation of traffic through the Bering Strait to determine if vessel traffic monitoring systems, including determining if an

internationally recognized traffic separation scheme was warranted, was followed by 2018 action by the International Maritime Organization (IMO)'s Maritime Safety Committee, which adopted new and amended ships' routing measures in the Bering Sea and Bering Strait, aimed at reducing the risks of incidents—the first measures adopted by the IMO for the Arctic region where the Polar Code applies.

Intrinsic to effective maritime domain awareness is the Coast Guard's increasing need to adopt current and future-facing information technology and systems, as highlighted in several recent GAO reports (U.S. GAO, 2020; 2022). Limited Arctic communications, networks and connectivity, a perennial challenge, impact Coast Guard maritime domain awareness, operational effectiveness and the Coast Guard's ability to interact with its partners in the Arctic.

Key to effective maritime domain awareness is the development of and requirement for data standards for nautical charting, water level, vessel transit and safety data, among others. Recent efforts, such as the multi-agency work led by the Department of Homeland Security and NOAA, the U.S. Committee on the Maritime Transportation System (CMTS) and the U.S. Department of Transportation/Maritime Administration in their Data Harmonization project--in which the Coast Guard was a participant—are an important step forward in this area.

Current nautical charts for the increasing number of vessels transiting the Arctic, and to support Coast Guard missions in the Arctic, are a persistent challenge and NOAA prioritization and resources to accomplish accelerated bathymetric surveys and nautical charting are critical in this regard.

Several studies have addressed Coast Guard risks and challenges in the Arctic. Few efforts, however, have adopted systematic processes and advanced analytics with multiparty Arctic stakeholders to determine the impact and risks of the accelerating technological, industry, climate, geopolitical and economic changes currently facing the Coast Guard or envisioned in the future Arctic. The Coast Guard could benefit from a comprehensive assessment of the risks it confronts in the Arctic, similar to the multi-party, shared decision processes and analyses followed in the Coast-Guard led and supported maritime risk assessments in Prince William Sound, Cook Inlet, and the Aleutian Islands, and similar to the processes that were followed in the State of Washington's two Vessel Traffic Risk Assessments, and the vessel traffic risk assessments currently underway, led by the Washington State Department of Ecology.

A national risk framework that informs Arctic priorities is important as the Coast Guard and Department of Defense increasingly operate in the Arctic and update their Arctic strategies in light of evolving geopolitical forces. A structured approach consistently followed would guide strategic investments, promote transparency and accountability, and include assessment of existing and future Arctic policies and programs.

2. Support for Coast Guard Operations and Personnel

Changing Arctic traffic and environmental conditions will increase needs for Coast Guard emergency response, vessel safety and environmental protection capabilities. Maritime resources and other rescue equipment and supplies for response are limited in the Bering Strait

region, with the U.S. Coast Guard far from possible incident locations. As Liquid Natural Gas (LNG) tankers, ore and gravel carriers, and government, research and cruise vessels make more transits, the Coast Guard will likely need to expand its capacity to monitor compliance with transit and environmental regulations in the Arctic region. Ensuring environmental response infrastructure is sufficient and foreign vessels transiting international straits are complying with regulations will be increasingly important over the next decade, as will promulgation of pollution control or mitigation measures, and measures imposed internationally by the Polar Code.

Coast Guard Arctic missions require new technology, skills, certifications and experience. As the Coast Guard increasingly adopts and regulates the use of uncrewed and autonomous maritime systems—in the air, on the water's surface and under the sea – Coast Guard needs for operational policies, procedures, certification, training and performance measurement with these new technologies will be required. Autonomous systems and uncrewed aerial systems are being tested, used and evaluated by the Coast Guard, by industry and by academia to assist with Coast Guard missions in vessel inspection; search and rescue; oil spill response; maritime infrastructure protection; and fisheries management. Training, certification and re-certification policies and procedures are thus important needs for the Coast Guard in the Arctic, and increasing use of autonomous and uncrewed systems will require the Coast Guard to adapt their operations, training and certification policies and procedures.

Key to effective operational support are robust, secure and available communications and connectivity, a perennial Arctic challenge. As important are the data, storage, retrieval, management, security and analytical issues associated with new types of structured (text, numbers, statistics) and unstructured (video, audio, simulation, pdfs, augmented and virtual reality) data being collected in the Arctic with autonomous and uncrewed systems.

Accelerating changes in the Arctic region increase the Coast Guard's needs for data and data infrastructure. **Real-time and longitudinal data on sea ice, charting and navigation data, and shoreline effects data are needed.** New missions and operations, such as the use of autonomous and uncrewed systems for vessel and facility inspections; oil spill prevention and response; support for U.S. geopolitical activities; border protection; humanitarian response; and fisheries management, among others, will require **secure data, server, cloud storage and networks, as well as efficient enterprise-wide data and information storage, retrieval and management, and advanced analytic techniques, all of which will be a challenge for the Coast Guard.** Memoranda of Understanding (MOUs) and resources to support this need, and/or arrangements with sister maritime and data agencies are lacking, resulting in gaps and lost opportunities to leverage new technology, data and visualization of Arctic baseline and trend data.

Coast Guard needs to support their environmental protection mission and oil spill response activities, including drills, simulations, and use of new technology, **are significant.** The 2014 NASEM report *Responding to Oil Spills in the Arctic Marine Environment,* (https://nap.nationalacademies.org/catalog/18625/responding-to-oil-spills-in-the-us-arctic-marine-environment) addressed challenges in the U.S. capability to respond to a catastrophic Arctic oil spill, including needs for oil spill response capabilities, research, logistics, infrastructure, training and international coordination.

Some of the NASEM 2014 report recommendations have been addressed—such as a call for evaluation of traffic in the Bering Strait and oil spill and emergency response training programs for local entities so as to develop trained response teams in local villages--but others, such as (1) the call for increased Coast Guard presence and performance capability in the Arctic, (2) establishment of a comprehensive, collaborative, long-term Arctic oil spill research and development program, or (3) increased oil spill response infrastructure and marine facilities in the Arctic, have not.

In addition, the technology, data and scientific infrastructure required for effective Arctic oil spill response noted in the NASEM 2014 report still needs significant bolstering. This includes (1) an improved real-time oceanographic-ice-meteorological forecasting system and (2) high resolution satellite and airborne imagery coupled with up-to-date high resolution digital elevation models that are updated regularly to capture the dynamic, rapidly-changing U.S. Arctic coastline.

3. Coast Guard Needs for Resilient Physical, Technological and Human Infrastructure

Coast Guard leadership in the Arctic depends on resilient physical, technological and human infrastructure. The rapid and often unpredictable changes occurring in the Arctic are likely to increase pressure on Arctic infrastructure and Coast Guard resources over the next decade. Historically, investments in Arctic infrastructure have not grown with expanded Coast Guard responsibilities. Coast Guard Evergreen strategic planning exercises have identified challenges in and lack of investment in communications, situation and domain awareness capabilities, resource availability and allocation hurdles, and lack of political and institutional will (Tingstad, et al., 2018). The resources available through the Nome Deep Draft Port project will bring new attention to and opportunities to invest in resilient maritime physical infrastructure. As important will be the required associated investments in Coast Guard technology and human infrastructure that are essential elements in a robust and resilient Coast Guard in its Arctic operations.

Developing and strengthening partnerships in the Arctic is a critical Coast Guard leadership role. Effective Coast Guard Arctic missions rely on communications, information sharing and partnerships with neighboring countries and provinces, as well as on international policy developments at the IMO, among Arctic nations, and at consultative and deliberative groups such as the Arctic Council.

Coast Guard Arctic operations occur in a unique social and cultural setting that is reliant on local and traditional knowledge and on strong bonds within and with communities and across Arctic stakeholders. Co-production of knowledge, policies, regulations, programs, and activities from the inception of those activities, in the planning stages through completion and project monitoring, with local stakeholders, indigenous partners and community leaders, as well as knowledge sharing, are crucial for the Coast Guard's effectiveness. In addition, the Coast Guard's partnerships with industry, classification societies, international partners, and R&D institutions are also extremely important for Coast Guard Arctic operations, and in developing improved Arctic maritime domain awareness.

Ultimately, a robust and resilient maritime infrastructure requires significant, long-term and interdisciplinary Arctic research. Research partnerships could clearly benefit the Coast Guard and its Arctic missions. Agencies such as the Arctic Research Commission, the polar and Arctic programs at the National Science Foundation (NSF), the National Institutes for Health (NIH), the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the Bureau of Safety and Environmental Enforcement (BSEE) and the Bureau of Ocean Energy Management (BOEM), FEMA, NOAA and the U.S. Army Corps of Engineers, along with the State of Alaska, industry partners and coalitions, incorporated and unincorporated Arctic boroughs, Alaska Native Corporations, non-governmental organizations, academia, environmental groups, and community leaders are natural partners.

Mr. Chairman, Ranking Member Gibbs, and members of the Subcommittee, thank you again for the opportunity to testify before you on the U.S. Coast Guard's leadership in the Arctic. The U.S. Coast Guard is a critical leader and partner in the Arctic, with increasing demands and missions stretching their capacity and capability. Your support of the Coast Guard's critical mission needs, including maritime domain awareness, operations and personnel, and for a resilient physical, technological and human maritime infrastructure in the Arctic, is essential for an effective U.S. Coast Guard today and in the future.

Thank you for the opportunity to share these thoughts with you today and for all that you do for the men and women of the United States Coast Guard. I look forward to your questions.

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