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U.S. DEPARTMENT OF COMMERCE**

**FIELD HEARING ON
NOAA'S ACTIVITIES IN THE ARCTIC**

**BEFORE THE
COMMITTEE ON COMMERCE, SCIENCE AND TRANSPORTATION
UNITED STATES SENATE**

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Good morning Senator Begich, Senator Stabenow, and distinguished guests. My name is Laura K. Furgione, and I am the Deputy Assistant Administrator for Weather Services at the National Oceanic and Atmospheric Administration (NOAA). I called the State of Alaska, America's Arctic, home for 15 years. During this time, I worked for NOAA's National Weather Service (NWS), in Kodiak, Fairbanks, Juneau, and most recently, from 2004 to 2008, as the Alaska Regional Director in Anchorage. Thank you for inviting me to testify before you today on NOAA's activities in the Arctic.

This hearing puts a well-deserved spotlight on emerging Arctic issues. On behalf of NOAA, I would like to thank the Committee on Commerce, Science and Transportation for its continued attention to the issues associated with a changing Arctic and the myriad impacts to its people and the ecosystems on which they depend. I would also like recognize Senator Begich and Senator Stabenow for their leadership and support on Arctic issues, including the numerous important pieces of Arctic-related legislation that Senator Begich has worked to advance this Congress. The Administration is looking closely at Arctic policy and management, as evidenced by the work underway to implement the January 2009 National Security Presidential Directive-66/Homeland Security Presidential Directive-25 (NSPD 66/HSPD 25) on an Arctic Region Policy, and the identification of the Arctic as an area of special emphasis in the Final Recommendations of the Interagency Ocean Policy Task Force, adopted by the President by Executive Order on July 19, 2010. The Ocean Policy Task Force's Final Recommendations call for "better ways to conserve, protect, and sustainably manage Arctic coastal and ocean resources ... new collaborations and partnerships to better monitor and assess environmental conditions ... [and] improvement of the scientific understanding of the Arctic system and how it is changing in response to climate-induced and other changes."

As you know, there is now widespread evidence of climate change in the Arctic region, most dramatically observed in loss of sea ice. In four of the last five years, we have witnessed the lowest sea ice extents on record, as well as a 35 percent decrease in thicker multi-year sea ice during the same time period. Recent Arctic temperature increases are more than double those found at more southerly latitudes, suggesting that the Arctic may be disproportionately affected

by changes in the Earth's climate. The Arctic's 2008 annual mean air temperature over land was the fourth warmest on record, which continues a long-term upward trend. And while the annual mean temperature over land for 2009 was cooler than in recent years, the average temperature for the last decade remained the warmest in the record beginning in 1900. In addition, we are detecting shifts in ocean ecosystems from the Aleutian Islands to Barrow, Alaska, due to a combination of Arctic warming, large natural variability, and sensitivity to changing sea ice conditions.

These changes are already being felt in communities around the Arctic and especially here in the State of Alaska where, for example, coastal communities like Newtok are experiencing rapidly eroding shorelines forcing costly and life-changing retreat inland. In the same way, increasing coastal storms in the autumn in recent years are impacting barge operations that supply coastal communities with necessary supplies. In other parts of the State, thawing permafrost and unprecedented outbreaks of insects like the spruce beetle are profoundly changing the landscape and presenting new risks to infrastructure. The availability of species that Alaskans depend on for subsistence and economic livelihoods is also changing, whether in the northward movement of marine fish species, the range of migratory herds, or displacement of walrus and seal populations. These impacts and a myriad of others present Alaskans and, by extension the Nation, with a broad range of overwhelming challenges.

As Dr. Jane Lubchenco, the NOAA Administrator and Under Secretary of Commerce for Oceans and Atmosphere, has said:

“Most of what we have seen in the Arctic Ocean has led us to believe that warming is happening even faster than many of the models are predicting. The melting of the ice in the Arctic Ocean is happening at a faster pace than we had predicted. And that is creating new opportunities in the Arctic Ocean... [opportunities that] need to be pursued in ways that are precautionary and take into the account the need to ensure that those systems remain healthy and resilient through the coming changes.”

As access to the region opens up because of sea ice retreat, we are seeing a corresponding growth in international and domestic attention to the Arctic – manifested in public interest in countries' extended continental shelf claims under customary international law as reflected in the United Nations Convention on the Law of the Sea – as well as maritime domain awareness concerns and opportunities for economic development and access to Arctic resources. Oil companies are investing more in energy exploration and recovery, and commercial shipping interests are anticipating one or more seasonally open trans-Arctic trade routes. The potential for increased cruise ship tourism, commercial fishing and establishment or expansion of other economic activities may exert pressure on the existing marine transportation system infrastructure and our security assets. These pressures are likely to make it more challenging to respond promptly to changing conditions in the region. These economic drivers can also threaten marine and coastal ecosystems as well as Arctic inhabitants already affected by the rapidly changing climate. Furthermore, the Arctic has profound significance for climate and functioning of ecosystems around the globe, so changes in the region affect us all. Climate changes already apparent in the Arctic may portend future global climatic conditions.

As the United States begins to confront these Arctic challenges, it is evident that despite the wealth of traditional scientific knowledge, exploration, and research to date in some areas, basic data is lacking in the Arctic. In order to effectively manage the various Arctic interests, accurate information about environmental conditions in the Arctic is needed.

A strategic approach is essential to best leverage the strengths of NOAA and the many agencies that have missions that relate to or impact Arctic resources. As the uses of the Arctic environment evolve, NOAA believes it is important that decisions and actions related to conservation, management, and use are based on sound science and support healthy, productive, and resilient communities and ecosystems. In addition, because of the global impacts of changes in the Arctic environment, we seek to better understand and predict changes there. NOAA has developed a comprehensive Arctic strategy that integrates and aligns our numerous and diverse capabilities and supports the efforts of our international, federal, state and local partners and stakeholders. NOAA's Arctic Vision and Strategy (available at http://www.arctic.noaa.gov/docs/arctic_strat_2010.pdf) has six priority goals, derived directly from stakeholder requirements, upon which NOAA will focus its efforts:

- 1) Forecast Changes in Sea Ice;
- 2) Strengthen Foundational Science to Understand and Detect Arctic Climate and Ecosystem Changes;
- 3) Improve Weather and Water Forecasts and Warnings;
- 4) Enhance International and National Partnerships;
- 5) Improve Stewardship and Management of Ocean and Coastal Resources in the Arctic; and,
- 6) Advance Resilient and Healthy Arctic Communities and Economies.

These goals were selected because they represent areas where NOAA has the expertise to address emergent Arctic issues that meet two key criteria: providing the information, knowledge, and policies to meet NOAA mandates and stewardship responsibilities; and providing the information, knowledge, and services to enable others to live and operate safely in the Arctic.

Forecasting Changes in Sea Ice

Continued rapid loss of sea ice will be a major driver of large changes across the Arctic, and is the organizing principle for NOAA's Arctic Vision and Strategy. The loss of sea ice affects marine access, regional weather, ecosystem changes, and coastal communities. As ice cover diminishes, marine food webs are expected to dramatically shift from seafloor-dominant systems that favor commercial species such as crabs to water column-dominant systems that favor commercial fish species such as Pollock. The understanding of ice as a habitat also has implications for oil spill response and damage assessment. As the Arctic Ocean becomes seasonally passable and tourism, oil and gas exploration, and shipping increase, floating sea ice will present a major threat to maritime safety and increase the potential for oil spills from vessel traffic in the region.

NOAA is currently conducting operational sea ice analysis and forecasts, evaluating sea ice projections through Intergovernmental Panel on Climate Change climate models, conducting and analyzing satellite and airborne observations of sea ice freeboard or thickness, improving

satellite image analyses, and contributing to the Arctic buoy program. NOAA's NWS has a sea ice desk at the Anchorage Weather Forecast Office which provides operational sea ice forecasting in Alaska. In cooperation with the National Ice Center in Suitland, Maryland, it provides operational analyses and forecasts of sea ice conditions and hazards in the Arctic five days a week. NOAA also supports the National Snow and Ice Data Center, within the Cooperative Institute for Research in Environmental Sciences at the University of Colorado, where a vast array of Arctic data are stewarded and made available to both academic and public users.

However, improvements in the sea ice services that NOAA provides, particularly model resolution and forecast frequency, and the integration of different types of observations (including sea ice characteristics and local knowledge) into the forecasts would enhance our understanding of the Arctic environment. For operational planning purposes, it is important that sea ice atlases for Alaskan waters are up-to-date. To support infrastructure planning and development, industry, state and local governments, and federal agencies would benefit from seasonal to multi-decadal sea ice projections to make informed decisions. Research and modeling of Arctic processes and anthropogenic effects are required to achieve these projections, understand the impacts of sea ice loss, and improve weather and climate forecasts for the Arctic and northern mid-latitude regions. NOAA's goal is to provide accurate, quantitative, daily-to-decadal sea ice projections in support of safe operations and ecosystem stewardship during this time of rapid environmental change.

Strengthening Foundational Science to Understand and Detect Arctic Climate and Ecosystem Changes

There is also great uncertainty in tracking the types and magnitudes of social and ecological impacts caused by Arctic climate changes and economic development. For example, the response of marine primary production from additional loss of sea ice and the impacts on higher levels within the food chain are largely unknown. Other examples of changes in the Arctic are the thawing of permafrost, increased coastal erosion, sea level changes, shifts in land and marine transportation patterns, and changes in land-based human subsistence resources. To adequately track these changes, sustained observations are essential. Monitoring and understanding climate change in the Arctic is important for other socioeconomic applications as well, including infrastructure protection related to sea level changes, transportation, and community resilience.

NOAA has a variety of ongoing and/or recent Arctic-focused climate and ecosystem projects. NOAA operates a manned Atmospheric Baseline Observatory six miles east of Barrow, Alaska, to measure changes in atmospheric climate forcing agents. These include carbon dioxide (CO₂) and methane (CH₄), compounds that deplete stratospheric ozone, and related gases. They also include air pollution from Eurasia known as Arctic Haze, black carbon measurements, and surface radiation, to name only a few of the more than 200 measurements conducted at this facility. The observatory was established in 1973 and it has operated continuously to date. It is the world's longest continuously operating atmospheric climate observatory in the Arctic. It is expected to be in operation for the next century, monitoring and documenting the causes of climate change in the Arctic.

Two NOAA polar orbiting satellite downlink antennae that relay images of Arctic sea ice and clouds are supported at this site in Barrow, as well as the northern most NOAA Climate Reference Network station that accurately documents temperature and moisture changes in the region. The NOAA Barrow Observatory also hosts the Department of Energy's North Slope of Alaska Atmospheric Radiation Measurement facility, and supports the adjacent United States Geological Survey Barrow Geomagnetic Observatory. Together, these facilities are the largest collection of environmental scientific instrumentation in the entire Arctic and represent an investment in excess of \$100 million.

To reduce uncertainties in NOAA information and services, NOAA is establishing the basis for an ecosystem-level Arctic Change Detection System within current resources. The goal is to monitor at minimum four key areas: ecosystem responses to sea ice loss, necessary additional climate observations over the Arctic, basic water level information, and accelerated methane release. Such a system includes a marine Distributed Biological Observatory for consistent monitoring of biophysical responses and ecosystem change in the U.S. Arctic as sea ice retreats. The Distributed Biological Observatory was the central recommendation from a NOAA-sponsored stakeholder workshop in May 2009 on the biological impacts of loss of sea ice. Efforts such as the Russian-American Long-term Census of the Arctic can also improve the exchange of information about near and farfield changes in the Arctic. In addition — as evidenced by the science community's surprise at the rate and magnitude of loss of summer Arctic sea ice from 2007 through 2009 — new *in situ*, drifting, airborne, and satellite observing technologies are needed to fill gaps in meteorological and oceanographic fields for temperature, heat, methane feedbacks and other biophysical parameters. Accurate geodetic elevations and water-level information to update obsolete historical datasets will help coastal communities adapt and increase resilience to hazards as ice-diminished coastlines allow a completely new wave and storm surge regime to develop as the seasons change.

Improve Weather and Water Forecasts and Warnings

Major stakeholders and partners, including the U.S. Coast Guard and the State of Alaska Division of Homeland Security and Emergency Management, require more useful weather and water information for planning and decision making to protect lives, property, and manage the region's many resources. Arctic populations rely heavily on aviation and marine weather for safe transportation and access to goods and services.

A 2006 study by the National Institute of Occupational Safety and Health reported that the accident rate for commercial pilots in Alaska was five times higher than the national average. Additionally, Alaska's \$4 billion fishing industry is one of the most dangerous occupations in the Nation, primarily due to the harsh weather conditions in the region.

Improvements in weather and water information will lead to increased safety and efficiency in these important sectors. Environmental observations and studies supporting weather and ice forecasts are highly limited in both geographic scope and frequency. For example, there is inadequate real-time meteorological data in U.S. Arctic waters to support accurate forecasting of ocean storms which have serious potential to threaten marine transportation, offshore oil and gas operations, and the Arctic coastal communities. The 2009 failure of NASA's QuikSCAT satellite scatterometer and the 2008 expiration of an agreement between NOAA, NASA and the Canadian Space Agency for valuable, cost-free synthetic aperture radar (SAR) data from the

RADARSAT1 mission continue to hinder Arctic weather and sea ice services capability. NOAA is attempting to mitigate these impacts by procuring data from foreign satellite operators through a partnership with the University of Alaska's Alaska Satellite Center. This information is critical in real-time forecasting and warning of events such as rapid sea ice formation, river ice jams, and storms carrying hurricane force winds that are major hazards for life, property and economic activities in the Arctic.

NOAA has also operated the Fairbanks Command and Data Acquisition station in Fairbanks, Alaska since 1965 which manages the aforementioned Barrow satellite downlink antennae. From that station, NOAA accesses data from its Polar-orbiting Operational Environmental Satellites (POES), various NASA research satellites, and a number foreign environmental satellites which provide space-based data that are used by NOAA to develop its forecasts, warnings, and information for surface, marine, and aviation weather interests, with emphasis, when possible, on high-impact events such as extratropical storms and polar lows, storm surge and other coastal hazards such as tsunamis, heavy precipitation, floods, droughts, volcanic ash, and space weather. Services are delivered through a number of media outlets from internet to high frequency radio broadcasts. NOAA is working to improve Arctic marine weather, sea ice, and storm surge forecast services by addressing greater needs for observations, modeling, and forecasts while incorporating new techniques for ensuring this information leads to the best possible decisions and associated response. Improved forecast services will better ensure the safety and security of marine transportation, oil and gas exploration, and tourism activities, and protect northern and western Alaska coastal communities from storm surge, inundation, and erosion hazards. Arctic weather also plays an important role in global weather; understanding this role is essential to improving global forecasts. NOAA understands that regular forecasts and support for the Arctic region will contribute to the protection of life and property and the enhancement of the economy, and will help to fulfill NOAA's obligations in cooperative agreements with international partners, and treaties such as the International Convention for the Safety of Life at Sea. For example, from the Fairbanks station, NOAA receives alerts from locator beacons that have been activated by persons in distress in the Alaska wilderness, or from mariners or aviators in distress. The signals from these beacons are transmitted via NOAA satellites which provide support under the auspices of the international Search and Rescue Satellite-Aided Tracking (SARSAT) program.

Enhance International and National Partnerships

No single region better exemplifies the complex interdependence of communities and changing ecosystem conditions than the Arctic. The breadth and complexity of the cultural, societal, economic, and environmental impacts requires a concerted, systematic and rapid effort with partners from international to local levels.

NOAA currently cooperates with other Arctic nations directly, as well as through international institutions and organizations, to support work in areas such as weather, climate, aviation, and marine observations, forecasts, and services; ecosystem management; marine transportation (e.g., hydrography and nautical charting); fisheries; and ice monitoring. These relationships allow us to cooperate on sea ice forecasts, as well as efforts to understand and predict changes in the Earth's environment by observing the Arctic atmosphere and cryosphere from manned

observatories in places such as Summit, Greenland and Tiksi, Russia. NOAA is also an active participant in numerous international organizations such as the World Meteorological Organization, the International Maritime Organization, the International Hydrographic Organization, and the Arctic Council. NOAA serves in leadership roles in two Arctic Council working groups (Protection of the Arctic Marine Environment and Arctic Monitoring and Assessment Program), while providing expertise to others. Current Arctic Council work includes assessing the effects of pollutants in the Arctic, reviewing the comprehensiveness and efficacy of existing governance mechanisms for the Arctic marine environment, and understanding the status of biodiversity in Arctic ecosystems.

Modeling climate change at the regional and global levels is an enormous task, best accomplished by sharing data at multiple levels – with universities and researchers, with Federal and State agencies, with other Arctic countries, and with non-Arctic countries possessing satellite and observation capabilities in the Arctic. NOAA is working to continue and expand these relationships through partnerships and formal bilateral arrangements, recently highlighted by the signing of the comprehensive climate change agreement between the Department of Commerce and Department of the Interior (DOI). Understanding and predicting how ice cover and consistency will change in the Arctic will necessitate cooperation. NOAA seeks to increase both its interagency and international partnerships to improve the accuracy, timeliness, and coverage of its sea ice forecasts – ensuring seamless transitions across jurisdictional boundaries and enhancing safe navigation.

These changes in climate and sea ice are also driving changes in marine ecosystems (including species abundance and composition) in ways not yet fully understood. Due to the interconnected nature of Arctic ecosystems, the U.S. will need to continue to improve collaboration and engagement with other Arctic nations through international mechanisms, such as the Arctic Council and our bilateral relationships, to better understand, observe, research, and manage Arctic resources. NOAA will provide leadership and resources to support Arctic governance and science organizations. Specifically, NOAA will continue to support the Arctic Council and its working groups, which monitor and assess biodiversity, climate, and the health of humans and ecosystems, and contribute to international approaches to ecosystem and protected area management, as well as management of shipping.

Continued coordination across federal entities, such as that provided by the Interagency Arctic Research Policy Committee, will be essential to implement overarching U.S. Arctic Policy goals, particularly those identified by the U.S. Arctic Policy (NSPD 66/HSPD 25) and the Interagency Ocean Policy Task Force's Final Recommendations. NOAA continues to develop and advance partnerships with our colleagues from the National Science Foundation (NSF), DOI, and the U.S. Arctic Research Commission, along with a multitude of other federal agencies that are focused on Arctic issues. A good example is NOAA's regular collaboration with the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE, formerly the Minerals Management Service) on a variety of biological assessments. BOEMRE is currently funding roughly \$29M in NOAA fisheries and marine mammal studies, along with other cooperative environmental impact, meteorological and oceanographic Arctic study projects in the Chukchi and Beaufort Seas.

In the State of Alaska, NOAA partners with public and private sectors at the federal, state, and local scales. The agency is a member of the Alaska Climate Change Sub-Cabinet's Advisory and Technical Working Groups, and also plays an active role in the Alaska Climate Change Executive Roundtable to facilitate cooperation among agencies seeking solutions to Alaska's climate change challenges. Through the roundtable, NOAA has acquired sites for observing stations; benefitted from sister agency capabilities to implement Administration events such as the public meetings in Anchorage associated with the Ocean Policy Task Force; and worked on defining clear synergistic roles for new tools and services such as the proposed NOAA Climate Service and DOI's Climate Science Center and their Landscape Conservation Cooperatives. NOAA and BOEMRE also partner closely to engage Alaska Natives regarding oil and gas impacts to subsistence activities through the annual "Open Waters" meeting. NOAA has had long standing co-management agreements with several Alaska Native Organizations regarding research and management of marine mammals in Alaska (excluding walrus, polar bears and sea otters which are managed by DOI). NOAA believes co-management should serve as the foundation for the management of subsistence takes of marine mammals in Alaska. In addition, NOAA participates in a Cooperative Agreement with the Alaska Eskimo Whaling Commission (AEWC) for the management of its subsistence hunt and fully cooperates with the AEWC on related domestic issues and through U.S. engagement at the International Whaling Commission. NOAA is also on the oversight committee of the North Slope Science Initiative and is contributing to the development (and eventual implementation) of the Arctic and the DOI Western Alaska Landscape Conservation Cooperatives. Finally, NOAA has a close working relationship with faculty and staff at the University of Alaska, through partnerships such as the Alaska Regional Integrated Science and Assessments group and Alaska Sea Grant which conduct research on the impacts of climate change and ocean acidification on commercial and subsistence fisheries in the Bering and Chukchi Seas. Continuing to build and sustain strong partnerships with the State of Alaska and other local, regional and international stakeholders will be critical to achieving success in the Arctic.

Improve Stewardship and Management of Ocean and Coastal Resources in the Arctic

As the Arctic Ocean becomes more accessible with the retreat of sea ice in summer months, cascading consequences must be anticipated. Biophysical and chemical changes in the ocean, combined with increasing human uses will impact the Bering, Chukchi, and Beaufort Seas. Currently, commercial harvest of groundfish, shellfish, salmon and other resources, primarily in the Bering Sea, constitute almost 50 percent of marine fish landings in the United States. Further, these same resources, plus various species of marine mammals, seabirds, and other marine life are critical to the maintenance of the subsistence lifestyle of over 40,000 indigenous people who inhabit small towns and villages on Alaska's Arctic coastline.

NOAA currently conducts population assessments and ecological process studies to meet its living marine resource management mandates. An important research gap is that existing ecosystem models are unable to provide reliable information on how loss of sea ice, increased ocean acidity, and increasing ocean temperatures will specifically impact key fish and mammal species. NOAA is leveraging existing resources to expand limited aspects of its current Arctic ecosystem research program and the regional Alaska Ocean Observing System, as well as

implement better data collection, analyses, and models to provide reliable predictions of the changes coming to marine ecosystems in the U.S. Arctic. It is critical to both the U.S. economy and the coastal inhabitants of the U.S. Arctic that NOAA, in cooperation with federal, state, and local partners and stakeholders, improve its capabilities to understand and predict the full spectrum of changes associated with climate change in the Arctic, with the intended outcome of improving the stewardship and management of Arctic marine resources.

Additional surveys are needed to assess the impact of climate change, loss of sea ice, and ocean acidification on living marine resources in the northern Bering, Chukchi, and Beaufort Seas. One key management question is how productivity and species composition will change with the loss of sea ice, increased acidity, and sea surface temperature warming. Very few surveys have been conducted to date to assess the status of living marine resources in the northern Bering, Chukchi, and Beaufort Seas because of limited access to survey vessels and aircraft during the ice free summer months. NOAA is exploring ways to increase its Arctic survey capability. For example, it is considering supplementing the NOAA fleet that performs survey work with contracting vessels.

NOAA is working to expand two existing programs, while continuing on-going assessment programs on marine mammals, fish, and shellfish: (1) the Bering Aleutian Salmon International Survey and the Russian-American Long-term Census of the Arctic, which are cooperative international research programs in the northern Bering and Chukchi Seas, and (2) NOAA's ocean acidification program. The former will provide critical information on the biodiversity of this region and a baseline for assessing how biodiversity will respond to climate change and loss of sea ice. The latter activity will result in greater attention given to the impact of more corrosive waters on the ecology and life history of key Arctic species such as king crab. It is NOAA's intent to continue annual trawl surveys for groundfish and crab in the Bering Sea and biennial acoustic surveys. These surveys form the base for sound management of groundfish and crab resources in the Bering Sea.

Advancing Resilient and Healthy Arctic Communities and Economies

The Arctic's condition can be gauged by the health of the people living and working in this unique environment, and by the impact of increased economic activity on the region. Indigenous people have long depended upon the unique characteristics of the Arctic for food, livelihoods, cultural heritage, and protection. However, climate change in the Arctic is altering the foundations of their communities and challenging indigenous ways of life. As the ice barriers that protect Arctic coastal communities diminish, the State of Alaska and its people must make critical decisions based on threats from stronger storms, increasing erosion, thawing permafrost, changing animal migration patterns, and sea level changes. At the same time, the loss of sea ice creates opportunities for commercial enterprises, creating tension between traditional uses and new opportunities. Oil companies are investing in exploration, private interests are anticipating an open Arctic trade route, and pressure is increasing on our defense and security assets to maintain a presence in the region in a "response-ready state" because of the increased risks.

In light of these growing commercial, security and coastal community pressures, sustainable management of the region, which until now has been relatively inaccessible, will require federal, state, and local governments to work together to advance improvements in:

- geospatial infrastructure for accurate positioning and elevations;
- tide, current and water level observations and prediction coverage;
- shoreline and hydrographic data;
- nautical charts;
- research on how oil behaves in ice;
- spill response capability and understanding of current environmental conditions for damage assessment and restoration;
- weather and ice forecast coverage; and,
- science-based recommendations for coastal community climate change adaptation strategies.

NOAA has a variety of mandates relating to resilient communities and economies, from hydrographic surveys and nautical charting to coastal zone management and oil spill response. It recognizes that it can make the highest positive impact to Arctic communities and sustainable economic growth by providing an accurate geospatial framework and products and services for safe navigation and security, oil spill response readiness, and climate change. Putting good information into the hands of mariners is essential for safe navigation and environmental protection, and coastal communities and scientists must have the same foundational support for good operational and research decisions.

NOAA is working with partners like the U.S. Coast Guard and local vessel pilots to prioritize surveys of likely shipping lanes in the North Bering and Chukchi Seas to help address the Bering Strait chokepoint, in particular, and more broadly to reduce the risk of accident and environmental impact in Arctic waters. In FY 2010, NOAA is conducting hydrographic surveys in the Bering Strait, a key area of interest to the U.S. Navy, with some additional surveys planned for FY 2011. Through its Gravity for the Redefinition of the American Vertical Datum (GRAV-D) initiative, NOAA is leveraging resources in FY 2010 and FY 2011 to dramatically improve elevation data in the U.S. With current elevation measurements off by as much as two meters, Alaska is the foremost priority for GRAV-D, and gravity data collection flights over Alaska in the summers of 2010 and 2011 will improve that accuracy to two centimeters. This effort will help coastal communities with infrastructure-hardening challenges and decisions on erosion controls and flood protections. In addition, NOAA has recently completed a tide gauge demonstration project in Barrow in order to develop the technology and approaches necessary for long-term water level measurements under harsh Arctic conditions. NOAA's hydrographic services provide valuable information to ensure conservation, management, and use are based on sound science to support U.S. economic growth, and resilient and viable ecosystems and communities.

To improve environmental preparedness, response, and recovery efforts, NOAA is working to expand the NOAA Environmental Response Management Application (ERMA) program to benefit Arctic stakeholders, including coastal communities, Alaska Native villages, the State of Alaska, industry, as well as NOAA and other Federal agencies. NOAA will develop an ERMA

website for two to three areas of high priority to prepare for Arctic oil spill risks, and will likely include an area of concern in the Chukchi and Beaufort Seas. ERMA is a web-based Geographic Information System tool designed to assist both emergency responders and environmental resource managers who deal with incidents that may adversely impact the environment. The application can assist in response planning and is accessible to both the command post and to assets in the field during an actual response incident, such as an oil spill or hurricane. The data within ERMA also assist in resource management decisions regarding hazardous waste site evaluations and restoration planning. ERMA also includes human use and human dimension data components and, for the Arctic, would include sea-ice conditions. Federal, State and Tribal governments will be able to use this information and the ERMA interface not only to address oil spill planning and response, but also to assess sea-ice and shoreline erosion information.

NOAA is also responsible for administering the Coastal Zone Management Act (CZMA), and the State of Alaska has a NOAA-approved CZMA program. The State's CZMA program includes local districts and Alaska Native tribal governments. NOAA works with the State, districts and Alaska Natives and provides annual grants, management, and technical assistance to help the State build its capacity to address pressures on the State's coastal resources and communities, including planning for climate-related changes and impacts.

In conclusion, NOAA is bringing its diverse capabilities to bear on the cultural, environmental, economic, and national security issues emerging as a result of changes in the Arctic. The breadth and complexity of these impacts require a concerted, systematic and rapid effort with partners from international to local levels. NOAA's scientific capabilities are being deployed to increase understanding of climate and other key environmental trends, to predict the ecosystem response to those trends, and to offer the technical expertise needed to develop policy options and management strategies for mitigation and adaptation to the environmental challenges in the Arctic region. NOAA's service capabilities are supporting safety and security needs for fishing, marine mammal protection, marine and other modes of transportation, energy, infrastructure, and mineral exploration in the unique Arctic environment. The choices we make today can have pivotal impacts on the future state of the Arctic. There is a great deal of work to be done, and NOAA, in collaboration with our partners, is committed to strengthening Arctic science and stewardship, and providing the information, products, and services needed by our Arctic stakeholders. Key to enhancing these efforts will be the coordinated implementation of the Ocean Policy Task Force's Final Recommendations. In addition to the Arctic as an area of special emphasis, there are other key priorities that provide for focused and coordinated actions that will improve our stewardship of the Arctic Region.

NOAA is currently in the process of validating a comprehensive NOAA Arctic Vision and Strategy with our stakeholders that aligns our capabilities in support of the efforts of our international, federal, state and local partners, and within the broader context of our Nation's Arctic policies and research goals. Our next step is to engage our partners and stakeholders, and transform that strategy into actions that will support healthy, productive, and resilient Arctic communities and ecosystems.

Thank you again, Senators Begich and Stabenow, for the opportunity to talk about NOAA's role in the Arctic. We appreciate your leadership and the time and attention the committee is devoting to this important issue, and look forward to working with you further.