U.S. Arctic Marine Transportation System: Overview and Priorities for Action 2013

CMTS

U.S. Committee on the Marine Transportation System

Table of Contents

Executive Summary **1**

Chapter 1: The Case for a U.S. Arctic Marine Transportation System (MTS) **9**
- Policy and Purpose
- Loss of Sea Ice, Change Driving Change
- Examples of Increased Use of Marine Transportation in the Arctic
- Implications of Increased Arctic Marine Transportation

Chapter 2: Current State of the U.S. Arctic Marine Transportation System **32**

Chapter 3: The U.S. Arctic MTS in Depth – Issue Papers **44**
- Places of Refuge for Ships
- Areas of Heightened Ecological Significance
- Ports and Associated Facilities
- Geospatial Infrastructure
- Hydrographic Surveys
- Shoreline Mapping
- Aids to Navigation
- Communications
- Marine Weather and Sea Ice Forecasts
- Oceanographic and Real-Time Navigation Information
- Automatic Identification System
- Vessel Escort and Icebreaking
- Environmental Response Management
- Search and Rescue/Emergency Response
- Polar Code/Guidelines for Ships Operating in Arctic Ice-Covered Waters
- Crew Standards/Training

Chapter 4: A U.S. Arctic MTS – The Way Ahead **78**
- **Recommendations**
  - Rely on CMTS for U.S. Arctic MTS Coordination
  - Join the Law of the Sea Convention
  - Implement U.S. Arctic MTS Improvement Plan – Priorities, Timeframes (Table 3)
  - A U.S. Arctic Strategy and Partnerships

Appendices

A – U.S. Arctic Region Policy (NSPD 66/HSPD 25) **93**
B – *Arctic Marine Shipping Assessment* Recommendations **102**
C – Section 307 of Coast Guard Authorization Act of 2010 **106**
D – Federal Agency Mandates **107**
E – Alaska Northern Waters Task Force January 2012 Recommendations **112**

Acronyms

ADDS	Aerial Dispersant Delivery System
ARC-Sat	Arctic Region Communication Small Satellite
ADOT& PF	Alaska Department of Transportation and Public Facilities
AIS	Automatic Identification System
AK	Alaska
AMAP	Arctic Monitoring and Assessment Program
AMATII	Arctic Maritime and Aviation Transportation Infrastructure Initiative
AMSA	Arctic Marine Shipping Assessment
ANWTF	Alaska Northern Waters Task Force
AtoN	Aids to Navigation
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
C2	Command and Control
CAFF	Conservation of Arctic Flora and Fauna
CANUSNORTH	Canada-U.S. Joint Marine Pollution Contingency Plan-Annex
CAWG	Capabilities Assessment Working Group
CG-533	USCG Office of Incident Management and Preparedness
CMTS	Committee on the Marine Transportation System
CORS	Continuously Operating [Global Positioning System] Reference Stations
DE	Design and equipment
DOD	Department of Defense
DHS	Department of Homeland Security
ECDIS	Electronic chart display
ECS	Extended Continental Shelf
EEZ	Exclusive Economic Zone
EPS	Enhanced Polar System
ERMA	Environmental Response Management Application
ESA	Endangered Species Act
FAB-T	Family of Advanced Beyond LOS Terminals
FOL	Forward Operating Location
GAO	Government Accountability Office
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
HF	High frequency
HLMAR	High Latitude Mission Analysis Report
IARPC	Interagency Arctic Research Policy Committee
IAWG	Interagency Arctic Working Group
IMO	International Maritime Organization
ISO	International Standards Organization
JCTD	Joint Capability Technology Demonstration
LIDAR	Light detection and ranging

LOS	Line of sight
LOSC	Law of the Sea Convention
LRIT	Long range identification and tracking
MARAD	Maritime Administration
MDA	Maritime domain awareness
MOA	Memorandum of agreement
MOU	Memorandum of understanding
MODUs	Mobile offshore drilling units
MTS	Marine Transportation System
MXAK	Marine Exchange of Alaska
NASA	National Aeronautical and Space Administration
NEPA	National Environmental Policy Act
NOP	National Ocean Policy
NSAR	National Strategy for the Arctic Region
NSPD-66/HSPD-25	National Security Presidential Directive 66/Homeland Security Presidential Directive 25
NSR	Northern Sea Route
NSRS	National Spatial Reference System
NWLON	National Water Level Observation Network
NWW3	NOAA Wave Watch 3 (Model domain)
OCS	Outer Continental Shelf
OPA90	Oil Pollution Act of 1990
OSROs	Oil Spill Response Organizations
PAME	Protection of the Arctic Marine Environment Working Group
PARS	Port Access Route Study
PORTS®	Physical Oceanographic Real-Time Systems®
SAR	Search and rescue
SARSAT	SAR satellite aided tracking
SATCOM	Satellite communications
SOLAS	Safety of Life at Sea Convention
SORS	Spilled Oil Recovery Systems
STCW	Standards of Training, Certification, and Watchkeeping
UAS	Unmanned Aerial Systems
USACE	U.S. Army Corps of Engineers
UNCLOS	United Nations Law of the Sea
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USN	U.S. Navy
USNORTHCOM	U.S. Northern Command
VHF-FM	Very high frequency-frequency modulation
VTS	Vessel tracking services
WAMS	Waterway Analysis and Management System

Executive Summary

Introduction

The United States is an Arctic nation. Due to climate change, the Arctic is warming faster than any other region on Earth. As the loss of sea ice creates a more accessible Arctic, we must consider: [1]

- Risks and opportunities for commerce and economic growth;
- Security of our maritime domain;
- Indigenous peoples and their subsistence cultures; and
- Marine resource management, particularly along the Alaskan coast (Figure 1).

Figure 1: The Arctic Region, CIA World Factbook.

Safe marine transportation is fundamental to each of these pursuits. For this reason, the region and the United States need an Arctic Marine Transportation System (MTS). The Arctic MTS should be capable of meeting the safety, security, and environmental protection needs of present and future Arctic stakeholders and activities.

The international Arctic Council, comprising eight circumpolar states (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the United States), has recognized the incontrovertible links among marine transportation, environmental protection, and sustainable Arctic development. In May 2009, the Arctic Council Ministers approved the *Arctic Marine Shipping Assessment* (*AMSA*) Report, a project of the Working Group on the Protection of the Arctic Marine Environment (PAME), co-led by the United States, Canada, and Finland. The *AMSA* highlighted the lack of marine infrastructure available to the region and made a number of recommendations to enhance Arctic marine transportation safety, protect Arctic people and the environment, and build Arctic marine infrastructure (see Appendix B). The *AMSA* recommendations reflect priorities for safety of navigation and protection of the environment

[1] This document utilizes the Arctic Research Policy Act of 1984 definition of the Arctic, in which the term "Arctic" means all U.S. and foreign territory north of the Arctic Circle and all U.S. territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering and Chukchi Seas; and the Aleutian chain.

that are similar to those contained in the January 2009 U.S. Arctic Region Policy, National Security Presidential Directive 66/Homeland Security Presidential Directive 25 (NSPD-66/HSPD-25, see Appendix A).

To support *AMSA* implementation and to ensure safe and secure maritime shipping in the Arctic, Congress directed via the Coast Guard Authorization Act of 2010, that the interagency Committee on Marine Transportation System (CMTS) coordinate the establishment of domestic transportation policies in the Arctic (see Appendix C). In response to the Congressional directive, this CMTS report answers the charge by:

- Identifying existing Arctic MTS policies;
- Assessing present and future uses of the Arctic, and their implications for the United States and a U.S. Arctic MTS;
- Describing the essential components of a U.S. Arctic MTS necessary for safe, secure, environmentally sustainable and reliable navigation;
- Describing components needed to protect maritime commerce, indigenous peoples and communities, and the environment as outlined in U.S. Arctic Region Policy and applicable law;
- Evaluating the current condition of the U.S. Arctic MTS, including physical and information infrastructure and human capital;
- Recommending priority areas for action both in the near and longer term, and
- Recommending action through which CMTS agencies can strengthen the U.S. Arctic MTS to meet the Nation's goals for safe Arctic economic development and environmental protection.

Coast Guard Authorization Act of 2010
SEC. 307. ARCTIC MARINE SHIPPING ASSESSMENT IMPLEMENTATION

…

(c) COORDINATION BY COMMITTEE ON THE MARITIME TRANSPORTATION SYSTEM.—The Committee on the Maritime Transportation System established under a directive of the President in the Ocean Action Plan, issued December 17, 2004, shall coordinate the establishment of domestic transportation policies in the Arctic necessary to carry out the purpose of this section.

U.S. Arctic Transportation Policies Sufficient to Guide Action

Rather than establishing new policies for this increasingly accessible region, this report comprehensively examines existing policies and agency mandates to identify gaps and recommend specific priority areas for action to address policy goals. The rapidly changing Arctic conditions increase the urgency to improve MTS services and infrastructure, both to take advantage of the opportunities presented, and to protect safety of life, property, and the environment.

In addition to U.S. Arctic Region Policy and *AMSA*, a variety of legal and policy considerations govern or guide activities relevant to the U.S. Arctic MTS. Some examples are:

- International Maritime Organization (IMO) instruments, codes, and guidelines;
- Federal mandates (military and civilian);
- Regulations and guidance;

- Federal reports;
- Alaska State interests; and
- Stated priorities of Arctic indigenous peoples.

The body of policy declarations, guidance, and recommendations for U.S. Arctic action has increased since the Administration issued the 2009 Arctic Region Policy. This body includes:

- The Administration's May 2013 *National Strategy for the Arctic Region*
- The March 2013 *Managing for the Future in a Rapidly Changing Arctic, a Report to the President* by the Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska
- The Administration's 2013 National Ocean Policy (NOP) Implementation Plans for *Changing Conditions in the Arctic*, *Ecosystem-Based Management* and *Observations, Mapping and Infrastructure*
- The Interagency Arctic Research Policy Committee's February 2013 *Arctic Research Plan FY2013-2017*
- The January 2012 Alaska Northern Waters Task Force (ANWTF) findings and recommendations
- 2012 and 2010 Governmental Accountability Office (GAO) recommendations related to Federal Arctic efforts
- President Obama's July 2011 Executive Order 13580 on Arctic energy permitting coordination
- The May 2011 international *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic*, and the Arctic Oil Spill and Preparedness Agreement adopted at the May 2013 Arctic Council Ministerial Meeting
- Arctic-specific recommendations in the January 2011 *National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report*
- The U.S. Department of Defense (DOD) *2010 Quadrennial Defense Review*, and
- Legislation introduced in the 112th Congress covering Arctic energy development, ecosystem health and monitoring, and safe marine transportation.

These policies, assessments, and recommendations are sufficient to guide decision-making and action by Federal maritime agencies as they work to support safe, efficient, and environmentally sustainable marine transportation.

Chapter 1 and Table 1 detail the common aspects within these policies that are relevant to a U.S. Arctic MTS. They cover the five major components of an MTS:

- Navigable Waterways
- Physical Infrastructure
- MTS Information Infrastructure
- MTS Response Services
- Vessels

Chapter 1 also captures the many requirement drivers for a U.S. Arctic MTS. The Arctic is an intensely harsh operating environment, with extreme cold, heavy fog, severe storms, unpredictable ice flows and changing ice. These conditions persist even as sea ice has retreated 12 percent each decade since the 1970s. The combination of these elements creates a very challenging environment for those seeking to transit Arctic waters for any purpose.

Growth in human use of the Arctic illustrates the need, in both the short and longer term, for a more robust MTS infrastructure, whether for energy development, spill response, search and rescue, indigenous and environmental protections, or maritime law enforcement. For example, as reported by USCG District 17 for 2008 to 2012, annual vessel traffic transiting the Bering Strait, the entry and exit point to the Western Arctic, increased from 220 vessels a year to 480 vessels a year, a more than 100 percent increase. The growth rate was particularly high for tank vessels; tugs and other cargo vessels were the second and third largest categories of movements. Moreover, Bering Strait transits from 2008 to 2012 rose from 220 to 480, again a more than 100 percent increase. In addition, the *Economist* reported in its June 2012 issue that Russia is escalating interest in its Northern Sea Route (NSR), which may cut transit time between Europe and Asia by a third. The article noted that, while four ships used the NSR in 2010, 34 ships transited in 2011. The expected increase in Arctic marine traffic volume has elevated this area as a strategic chokepoint and heightened the geostrategic importance of the Arctic for national, economic, and homeland security.

Another near-term example of an U.S. Arctic marine transportation driver has been the 2012 exploratory oil drilling in the Beaufort and Chukchi Seas. A July 2012 *Bloomberg* government article reports that Royal Dutch Shell PLC has spent $4.5 billion on Arctic drilling preparations since 2005. This and other indicators of private sector intent to expand exploration in the region, both within and beyond U.S. waters, highlights the potential for economic opportunity in the Arctic, while underscoring the need for emergency preparedness.

In addition, the United States is acquiring Arctic bathymetric and seafloor data to support delineation of the U.S. Extended Continental Shelf (ECS) in the Arctic outer limit (i.e., its continental shelf beyond 200 nautical miles from shore). This includes the seabed resources therein pursuant to the Law of the Sea Convention (LOSC).[2] The likelihood of increased resource extraction in the U.S. Arctic presents a variety of commercial, environmental, and security challenges and concerns. U.S. interest in Arctic ECS (and elsewhere) further underscores the need for the United States to become a party to LOSC to fully secure such rights.

Existing policies are sufficient to permit delivery of Federal MTS services to a changing Arctic. However, the CMTS also concludes that the existing capacity of U.S. marine transportation infrastructure and services is inadequate both to support increased Arctic traffic and to mitigate the risks accompanying economic growth. This is particularly true in the U.S. Chukchi and

[2] United Nations, Law of the Sea Convention, Article 76-77, pages 49-51.

Beaufort Seas. As Chapter 2 describes, there are no harbors of refuge or deep-water port facilities in this region, and virtually no aids to navigation. Large areas of white space on U.S. Arctic nautical charts highlight a disturbing fact: less than 1 percent of charted navigationally significant Arctic waters have been surveyed with modern technology to determine depths and depict hazards to navigation. Day-to-day operations and emergency response are affected by inadequate communications infrastructure. The nearest facilities and vessels supporting the U.S. Arctic for emergency response are located in Anchorage, Kodiak, and Dutch Harbor, which are 635, 800, and 1000 nautical miles, respectively, from the Arctic Circle. These great distances significantly delay SAR and oil spill response times. Arctic weather forecasts and sea ice predictions are only accurate 2 to 3 days out, compared with 5 to 7-day predictive capabilities in the rest of the United States. Such large gaps in data, services, and infrastructure compound the difficulties that Federal agencies face as they attempt to deliver an adequate MTS to a region already challenged by environmental conditions.

The CMTS reviewed the current condition of Arctic MTS components, including activities planned or ongoing, to identify priorities for action. Table 2 summarizes this status assessment. To provide additional detail on critical components, the CMTS also developed issue papers with detailed information for each MTS element. These papers, found in Chapter 3, provide a stand-alone description of the issue, current activities, challenges, future Federal actions needed, and a list of non-Federal partners. The issue papers will also support U.S. input into the Arctic Council's Arctic Maritime and Aviation Transportation Infrastructure Initiative (AMATII). The AMATII is an intermodal assessment of current and future transportation infrastructure needs in the Arctic from an international perspective.

Short Term Priority Recommendations for a U.S. Arctic MTS Improvement Plan

Chapter 4 sets forth a series of specific recommendations and a U.S. Arctic MTS Improvement Plan with actionable milestones. Based on its review of Arctic policies and current Arctic marine transportation conditions (Tables 1 and 2), criteria evaluating necessity for safety of people and the environment, and for sustainable economic growth, and within the context of existing U.S. policy and guidance covering the Arctic, the CMTS makes three primary recommendations:

1) **RELY ON THE CMTS FOR U.S. ARCTIC MTS COORDINATION:** The CMTS has broad interagency representation and expertise in marine transportation, including U.S. Arctic MTS requirements. Therefore, the report recommends that the CMTS take a leadership role in helping to coordinate, monitor, and report on MTS-related priority actions and milestones derived from this report, *AMSA*, the *National Strategy for the Arctic Region*, and the NOP Arctic Implementation Plan. This should occur in conjunction with other major interagency Arctic working groups such as the Interagency Arctic Research Policy Committee, the National Ocean Council, the Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska, and the Arctic Policy Group. Overlapping membership or reporting relationships already exist, or could be easily established, within most of these working groups. The CMTS will also stay attuned to the work of other entities, including those proposing to

reduce the risks from marine transportation and establish appropriate environmental protection policies for the Arctic.

2) **JOIN THE LAW OF THE SEA CONVENTION:** Because a significant part of the Arctic is covered by ocean, the Law of the Sea Convention is an important consideration as the eight Arctic States of the Arctic Council, and other nations, pursue the abundant resources in Arctic waters. The Convention provides the international framework to address activities in the ocean. Acceding to the Convention will allow the United States to fully secure its sovereign rights to the vast resources of the United States' Extended Continental Shelf and will enhance U.S. standing in negotiations related to the Arctic.

3) **IMPLEMENT THE U.S. ARCTIC MTS IMPROVEMENT PLAN – WITH PRIORITIES AND TIMEFRAMES:** In order to meet the greatest number of requirement drivers and support sustainable Arctic growth safely, the CMTS recommends that the United States make it a priority in the next 2 to 3 years to improve the U.S. Arctic MTS, particularly in two of the five MTS component areas: MTS Information Infrastructure and MTS Response Services.

   The CMTS recommends the following specific priority actions for near-term attention:

   - **MTS INFORMATION INFRASTRUCTURE:**
     - **Improve sea ice and marine weather forecasts** with increased observations to facilitate safe navigation and vessel operations throughout Arctic waters, protected marine resources management, community subsistence activities, and homeland and national security activities.
     - **Map and chart U.S. Arctic waters** to improve navigation and situational awareness, enhance the geospatial infrastructure, support maritime commerce, reduce the risk of maritime incidents, loss of life, and environmental damage, help coastal communities develop climate change and storm readiness strategies, and support ecosystem stewardship.
     - **Improve communications** with technological enhancements to facilitate safe maritime operations, effective vessel management, and coordinated responses to maritime incidents and distress calls. These improvements should significantly decrease the risk of environmental damage and loss of life and property at sea. Compatibility with international communications would help ensure effective hand-off of vessels on trans-Arctic voyages, and for response coordination on vessels that do not report in time.
       - A second, but no less important aspect of communications is reciprocal communication with native communities. The Federal Government should understand the risks to their cultures, needs, and values brought on by a changing Arctic, and draw upon their traditional knowledge of this unique environment. At the same time, communities would benefit from knowing about marine traffic that may impact their activities.
     - **Pursue expanded AIS coverage and capabilities,** including building and operating more terrestrial AIS sites and increasing Satellite-AIS coverage, of the entire Arctic

region in order to support maritime domain awareness, for vessel monitoring and vessel management schemes, and, where appropriate, to increase awareness of marine activity, reduce the risk of incidents, enforce applicable requirements, facilitate incident response, and help anticipate and manage potential Arctic MTS user conflict. The AIS capabilities should be expanded to enable two-way AIS digital communications between shore stations and vessels to disseminate environmental and safety information to enhance safety.

- **MTS RESPONSE SERVICES:**
  - **Improve Arctic environmental response management** through coordination, research, prevention, training, mitigation, and cleanup to minimize the risks and impacts of pollution events on protected Arctic communities and marine ecosystems.
  - **Ensure effective search and rescue** and emergency preparedness and response through strategic positioning of facilities and resources.
  - **Increase U.S. icebreaking capacity** in the Arctic in order to extricate vessels beset in ice or otherwise in danger, assist shipping, conduct security and science operations, and provide search and rescue and spill response in ice-laden waters.

Taking near-term action in these two major areas would address aspects of *AMSA* and international agreements, Alaska Northern Waters Task Force and BP Deepwater Horizon Oil Spill Commission recommendations, and Administration and Congressional energy security priorities. In addition, four of the recommendations echo priorities found in the Administration's National Ocean Policy Implementation Plan for *Changing Conditions in the Arctic*. Initiation of such activities on a limited scale can be relatively rapid, as some planning or work is underway. These activities may be hastened or expanded if prioritized for investment by the Administration and Congress.

To aid in accomplishing these priorities and to make progress on all Arctic MTS component areas, Chapter 4 includes a broader U.S. Arctic MTS Improvement Plan (Table 3) with milestones and near-term timeframes to completion, as well as longer term milestones that are not presently resourced.

Long Term Recommendations

The CMTS regards action in all five of the MTS component areas as essential to meeting U.S. needs in the Arctic. But given current resource constraints, not all may be accomplished simultaneously. In particular, three of the areas—Navigable Waters, Infrastructure, and Vessels—require a long lead time for capacity planning, budgeting and execution, as well as a plan for addressing these areas and prioritizing the allocation of limited resources among competing investments. Addressing all the requirements will demand sustained attention and commitment, not only from Federal agencies and Congress, but also from international, State, local, Tribal, and private partners.

The CMTS describes the U.S. Arctic MTS Improvement Plan in Chapter 4. It is the template for immediate and longer-range progress. Achieving all the actions will require broader Federal cooperation and partnerships to leverage resources. These partners should include key stakeholders, such as industry, other Arctic maritime states, the State of Alaska, and U.S. Arctic indigenous peoples. Thus, this report also recommends enhancing State, indigenous and international partnerships, as well as assessment and consideration of public-private funding approaches to ensure that the longer range actions, such as places of refuge for ships, port infrastructure development, vessel design and crew standards, can be taken.

Placing the recommendations in this report on the agendas of upcoming meetings, such as the Arctic Council, the next Arctic Imperative Summit, the AMATII meetings, the U.S. Arctic Interagency Policy Committee, the Interagency Arctic Research Policy Committee, the Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska, and the CMTS would seek to increase visibility, advance adopted recommendations, and increase opportunities for collaboration, particularly among Federal entities, the State of Alaska, and its residents.

Making the Arctic a priority now, and laying the groundwork for continued progress by implementing the U.S. Arctic MTS Implementation Plan, will result in a more robust U.S. Arctic MTS. This strategy will work to reduce risk of accident and injury to people, property, and the fragile Arctic environment. Further, it will support the following: Arctic Ocean and coastal protections; the cultures and communities of U.S. Arctic indigenous peoples; ecosystem-based management and environmentally sustainable use of Arctic resources; the expansion of economic activity in and around the Arctic; scientific research; and national security. Achieving a safe and environmentally sound U.S. Arctic MTS requires strong collaboration and cooperation among Arctic interests from local to international levels. This is particularly true among Federal agencies, with the State of Alaska, and with Alaska indigenous peoples.

Changing conditions in the Arctic afford a rare opportunity for the United States to comprehensively and holistically develop a U.S. Arctic MTS while working to sustainably manage the Arctic. Remote, wild, and unpredictable, the Arctic offers a unique situation for optimal and efficient MTS development within a framework of consensus and partnerships among all stakeholders, each of whom must embrace their respective roles to ensure optimal use of available funding and effort, and to protect indigenous cultures and the environment. The CMTS goal is to provide high-level leadership and improved coordination that promotes safety, security, efficiency, economic vitality, sound environmental integration, and reliability of the MTS for commercial, recreational and national defense requirements. The CMTS agencies believe it is crucial to embrace this goal, pursue this opportunity and, at the very least, develop a comprehensive plan of action to address development of the U.S. Arctic MTS and supporting elements across all areas and stakeholders. An appropriate mix of MTS services, actions, and impacts will bridge existing gaps and provide a safe, secure, and environmentally sound MTS to address the full range of issues impacting the U.S. Arctic and the Arctic region at large. The time to do this is now.

> ***"In the past, the Arctic was largely inaccessible, but increased seasonal melting of the sea ice is opening the region and creating opportunities for oil and gas exploration, maritime shipping, commercial fishing and tourism. We are confronted by a new ocean for the first time in 500 years."***
>
> *Rear Adm. David Titley,*
> *Oceanographer of the Navy*
> *August 2011*

1 -- The Case for a U.S. Arctic Marine Transportation System

Policy and Purpose

Climate change and the loss of Arctic sea ice are driving the rapid increase in human activities in the Arctic, heightening interest in, and concerns about, the region's future. In the coming years, certain issues could cause the Arctic region to become an arena for international cooperation, competition, or conflict. These issues include:

- Commercial shipping to and through the Arctic
- Arctic oil, gas, and mineral exploration, and
- Management of living marine resources and endangered Arctic species.

Acknowledgement: Funding for this map was provided by the National Science Foundation through the Arctic Research Mapping Application (amap.org) and Contract #0520837 to CH2M HILL for the Interagency Arctic Research Policy Committee (IARPC).
Map author: Allison Gaylord, Nuna Technologies. May 27, 2009.
1. The Aleutian chain boundary is demarcated by the 'Contiguous zone' limit of 24-nautical miles.

Figure 2: The geographic area covered by this report consists of all U.S. territory north of the Arctic Circle and all U.S. territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas including the Arctic Ocean and the Beaufort, Bering, Chukchi Seas and the Aleutian Island chain, as defined in § 112 of the Arctic Research and Policy Act of 1984 (ARPA). Source: U.S. Arctic Research Commission

The United States, by virtue of the State of Alaska, is a maritime Arctic nation and has substantial political, economic, energy, environmental, security, and cultural interests in the region. The definition of the U.S. Arctic used here is that delineated by the U.S. Arctic Research Policy Act of 1984 and illustrated in Figure 2.

The prospect of expanded Arctic marine operations underscores the need for near-term action and guidance that will facilitate safe and efficient navigation, prevent loss of life and property, and reduce the risk of environmental damage in the region, while facilitating economic development and employment. Despite the Arctic's remote location on the globe, its economy

impacts the entire nation, whether through oil and gas resources and the cost of fuel, minerals, the security and ease of trade with global markets, the availability of seafood, or the financial and environmental impacts of a major maritime disaster such as an oil spill.[3]

Accordingly, the Federal Government's interest in addressing Arctic-related issues is extensive and growing. Marine transportation is a key area for attention and recommended action in each statement of Arctic policy. In January 2009, the White House updated existing U.S. Arctic Region policy with NSPD 66/HSPD 25 (see Appendix A). The NSPD 66 affirmed six overarching priorities for the U.S. Arctic, stating that it is U.S. policy to:

- Meet national and homeland security needs relevant to the Arctic region;
- Protect the Arctic environment and conserve its biological resources;
- Ensure that natural resource management and economic development in the region are environmentally sustainable;
- Strengthen institutions for cooperation among the eight Arctic nations;
- Involve the Arctic's indigenous peoples and communities in decisions that affect them; and
- Enhance scientific monitoring and research into local, regional, and global environmental and socioeconomic issues.

The NSPD 66/HSPD 25 also presents three specific priorities with regard to maritime transportation in the Arctic:

- Facilitate safe, secure, and reliable navigation;
- Protect maritime commerce; and
- Protect the environment.

Subsequent implementation directives in NSPD 66/HSPD 25 are to:

- Develop additional measures to address issues that are likely to arise from expected increases in shipping into, out of, and through the Arctic region;
- Commensurate with the level of human activity in the region, establish a risk-based capability to address hazards in the Arctic environment;
- Develop Arctic waterways management regimes in accordance with accepted international standards; and
- Evaluate the feasibility of using access through the Arctic for strategic sealift and humanitarian aid and disaster relief.

This interest in Arctic marine transportation extends beyond the United States to all Arctic states, and many non-Arctic states. In May 2009, the Arctic Council Ministerial approved a report produced by its PAME Working group on Arctic marine shipping. The *AMSA* 2009 Report examines Arctic shipping from a number of perspectives, including historical, legal, environmental, and infrastructure.

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[3] Official Blog of the U.S. Coast Guard, CDR Glynn Smith, 8.16.2011, "Admiral Papp Makes Adjustments to Coast Guard Forces in Alaska."

The *AMSA* concludes with 17 recommendations to promote the safety and environmental awareness of current and future Arctic shipping activity (see Appendix B). Key aspects of the recommendations by CMTS for the U.S. Arctic MTS are to:

- Enhance Arctic marine safety, with full participation in:
  - International maritime decisions on operating and vessel safety standards in the Arctic;
  - Harmonizing shipping governance regimes; and
  - Supporting Arctic SAR.
- Protect Arctic people and the environment, with consideration of:
  - Indigenous Arctic peoples' marine uses and engagement with Arctic communities;
  - Protections for sensitive ecological areas, cultural areas, and marine mammals;
  - Oil spill prevention; and
  - Air emission reductions.
- Build the Arctic marine infrastructure by addressing the gaps in MTS infrastructure and services such as:
  - Nautical charts and Aids to Navigation (AtoN);
  - Marine traffic management systems;
  - Oil spill prevention capabilities; and
  - Underlying hydrographic, meteorological, and oceanographic data that supports safe marine transportation in the Arctic.

In response to *AMSA*, Congress directed, through the Coast Guard Authorization Act of 2010, that the interagency CMTS coordinate the establishment of domestic transportation policies in the Arctic (see Appendix C). This coordination requires the consideration of national policies and guidance to ensure safe and secure maritime shipping in the Arctic.

Since *AMSA*, U.S. agencies have continued to work through the Arctic Council to sign an Arctic Search and Rescue Agreement, develop and sign an oil spill preparedness and response agreement, and report annually on *AMSA* progress. In 2012, the Arctic Council's Sustainable Development Working Group began an assessment of the infrastructure deficit in the Arctic through the Arctic Maritime and Aviation Transportation Infrastructure Initiative (AMATII). A variety of U.S. federal reports and interagency efforts, from an Executive Order on Arctic permitting, to the DOD's 2010 Quadrennial Defense Review, as well as GAO reports, also focus on the Arctic. In addition, President Obama adopted the July 2010 NOP *Final Recommendations of the Interagency Ocean Policy Task Force* (Executive Order 13547), which establishes that dealing with "Changing Conditions in the Arctic" is a national priority for action.[4] A NOP Implementation Plan to support this objective identifies key strategies that simultaneously support navigation safety, science-based permitting, effective environmental stewardship decisions, and more resilient ocean economies and commerce. Priority actions include:

[4] E.O. No. 13547, 75 Fed. Reg. 43,023, 7.22.2010.

- Improving Arctic environmental response management;
- Observing and forecasting Arctic sea ice;
- Enhancing communication systems in the Arctic; and
- Advancing Arctic mapping and charting.[5]

In May 2013, the Administration issued the *National Strategy for the Arctic Region* (NSAR), intended to build upon NSPD 66/HSPD 25 and set three U.S. strategic priorities for the Arctic region with supporting objectives:

- Advance United States security interests
  - Evolve Arctic infrastructure and strategic capabilities
  - Enhance Arctic domain awareness
  - Preserve Arctic Region freedom of the seas
  - Provide for future U.S. energy security
- Pursue responsible Arctic region stewardship
  - Protect the Arctic Environment and Conserve Arctic Natural Resources
  - Use Integrated Arctic Management to balance economic development, environmental protection, and cultural values
  - Increase understanding of the Arctic through scientific research and traditional knowledge
  - Chart the Arctic Region
- Strengthen international cooperation
  - Pursue Arrangements that promote shared Arctic State prosperity, protect the Arctic environment, and enhance security
  - Work through the Arctic Council to advance U.S. interests in the Arctic Region
  - Accede to the Law of the Sea Convention
  - Cooperate with other interested Parties.[6]

A number of the NSAR objectives noted above have obvious relevance for safe marine transportation, including maritime domain awareness, infrastructure, freedom of the seas, and charting. These priorities are intended to position the United States to respond effectively to emerging opportunities while simultaneously pursuing efforts to protect and conserve the unique Arctic environment. They are to be advanced in a manner that safeguards peace and stability in the region, utilizes the best available information for decisions, emphasizes the use of innovative arrangements, and underscores the importance of consulting and coordinating with Alaskan Native communities.

Table 1 depicts the MTS-relevant requirements and recommendations established in the above policies, along with other important Arctic guidance documents. Bearing these common requirements in mind, the intent of this report is to provide decision-makers with recommendations for prioritizing MTS investments in the U.S. Arctic. The MTS agencies have

[5] National Ocean Council, National Ocean Policy Implementation Plan, 4.16.2013.
[6] National Security Staff, National Strategy for the Arctic Region, 5.2013.

the necessary mandates to perform their missions and roles in the U.S. Arctic, just as anywhere else in U.S. waters and areas subject to U.S. jurisdiction (see Appendix D for mandates). This report then presents an evaluation of growing uses, an inventory of existing Federal Arctic marine transportation services, and a proposed implementation plan to enable safe and environmentally sound marine transportation in a changing Arctic.

Loss of Sea Ice – Change Driving Change

Retreating summer Arctic sea ice is opening up a once inaccessible region to marine transportation. In September 2012, the National Snow and Ice Data Center reported that the 2012 Arctic sea ice extent was the lowest on record.[7] The 2012 minimum was 18 percent below the previous minimum in 2007 and 49 percent below the mean (Figure 3). The current loss of Arctic sea ice is dramatically altering what was a stable geographic and oceanic region. National Oceanic and Atmospheric Administration (NOAA) studies show that atmospheric temperatures have increased over the last 20 years at a rate at least three times the global average, and as of summer 2011, sea ice thickness was 42 percent below the mean since 1979.[8,9] The U.S. Navy's (USN) August 2011 *Arctic Environmental Assessment and Outlook Report* also summarizes the loss of sea ice. To date the areal extent of sea ice has decreased at a rate of 2.7 percent per decade, and current projections indicate that the Arctic Ocean may experience ice-diminished navigable open water summers by the late 2030s.[10,11]

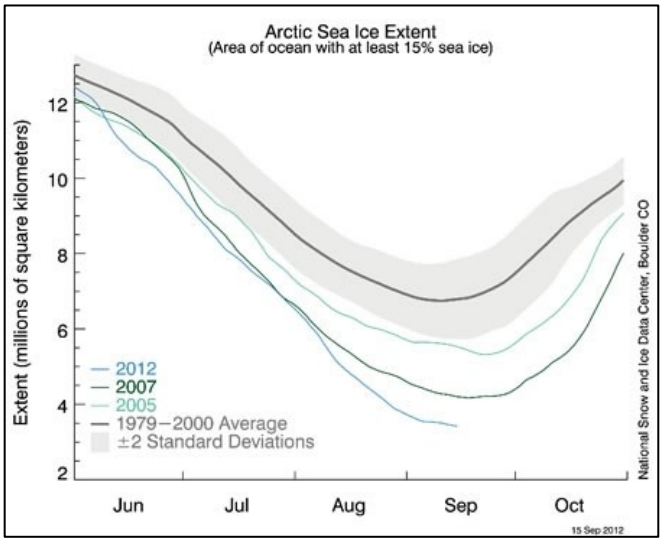

Figure 3: Arctic sea ice extent for September 2012 was 1.32 million square miles, the lowest in the satellite record, and 293,000 square miles below the 2007 record. Both the Northwest Passage and Northern Sea Route were open for a period during summer 2012.
Source: National Snow and Ice Data Center

The region is also experiencing changing weather and thawing permafrost. Implications of these changes include rapid coastal erosion threatening village infrastructure, loss of wildlife habitat, ecosystem instability, and unpredictable impacts on subsistence activities.[12] The combination of the loss of sea ice coverage, thawing permafrost, greater wave action and the

[7] National Snow and Ice Data Center, Arctic Sea Ice News and Analysis, 10.2012.
[8] Overland, J.E., K.R. Wood, and M. Wang, 2011, *Warm Arctic–cold continents: Impacts of the newly open Arctic Sea*. *Polar Res*., 30, 15787, doi: 10.3402/polar.v30i0.15787
[9] Kwok R. & Untersteiner N. 2011, *The thinning of Arctic sea ice*. Physics Today, 64, 36.
[10] Navy Task Force Climate Change, *Arctic Environmental Assessment and Outlook Report*, 8.2011.
[11] Wang, M., and J.E. Overland, 2009, *A sea-ice free summer Arctic within 30 years?* *Geophys. Res. Lett*., 36, L07502, doi: 10.1029/2009GL037820.
[12] Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska. *Managing for the Future in a Rapidly Changing Arctic, A Report to the President*, 3.2013.

effects of diminished sea ice on coastal areas, and increased air and water temperatures, are resulting in rapid erosion of the coast.[13] This in turn affects decisions about infrastructure location, as impacts of continued erosion might include:

- Sedimentation of nearshore navigation routes;
- Failure of traditional ice cellars used by indigenous peoples to freeze subsistence foods;
- Changes in surface and subsurface drainage patterns resulting in ecosystem shifts; and
- Loss of foundation support for shore-based transportation infrastructure, such as port facilities, piers, pipelines, and roads.[14]

Scientists project that these changes will continue through the 21st century. Despite the challenges imposed by permafrost thaw on infrastructure development, ice-diminished waters will contribute to more rapid development of Arctic resources than previously estimated. Figure 4 illustrates how vessels transiting the NSR and the Northwest Passage must pass through the Bering Strait. Although the Arctic will continue to be a harsh and hazardous operating environment, there is substantial private sector interest in global sea route changes and new destinations. Examples of drivers include:

- Commerce and ecotourism;
- Planned Arctic oil, gas and mining expansion; and
- Possible future opening of commercial fisheries.

Figure 4: Northern Sea Route and Northwest Passage
Source: Office of Naval Intelligence

Examples of Increased Use and Implications of Marine Transportation in the Arctic

Oil and Gas

A U.S. Geological Survey (USGS) assessment estimates that the Arctic may contain 22 percent of the world's estimated mean undiscovered, technically recoverable oil and gas resources, 84 percent of which are projected to occur offshore.[15] Promising prospects and decreasing extent of summer sea ice are enabling a longer seasonal window. This is heightening interest for offshore exploration and drilling for Arctic offshore oil and gas resources, and has motivated nations and the petroleum industry to initiate exploration activities for these vast potential

[13] Kinner N.E. et al. *Implications of Climate Change and Research Needs for Coastal Processes in Cold Regions*. 7. 2009.
[14] Lynne M. Carter, *U.S. National Assessment of the Potential Consequences of Climate Variability and Change: Educational Resources Regional Paper: Alaska*, 10.12.2003.
[15] Kenneth J. Bird, et al., 2008, *Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle*, U.S. Geological Survey Fact Sheet.

resources. For example, Russia's state-owned oil company, Rosneft, and Exxon Mobil Corporation have partnered to explore offshore oil fields in the Russian Arctic. Norway is already producing oil and gas from the Barents Sea.[16,17]

Both the President's March 2011 *Blueprint for a Secure Energy Future* and Executive Order 13580, which established an interagency working group to coordinate domestic energy development and permitting in Alaska, have put a renewed emphasis on timely permitting of safe oil and gas activities in the U.S. Arctic to increase domestic energy production. There are 673 active Arctic Alaska Outer Continental Shelf (OCS) leases. Recent lease sales saw industry high bids totaling $2.75 billion for the right to explore in the Beaufort and Chukchi Seas. The U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM) estimates that the U.S. Arctic OCS has a mean potential of over 23 billion barrels of technically recoverable oil and 108 trillion cubic feet of technically recoverable gas, representing over 89 percent of all oil and 82 percent of all natural gas estimated to exist in the Alaska OCS. However, the Arctic OCS remains a lightly explored area with just 35 exploration wells drilled prior to 2012 in the Beaufort and Chukchi Seas, and only one in the last twelve years.[18] In 2012, Shell drilled the upper portion of two wells, one in the Chukchi and one in the Beaufort Sea.

The BOEM estimates that development in the Chukchi Sea of a 1 billion barrel equivalent field could cost $10-15 billion. A large portion of this (approximately 30 percent) would be spent for new onshore infrastructure and pipelines, requiring close coordination with local people, Boroughs, State, and Federal agencies, particularly the Bureau of Land Management. An oil and gas development scenario from a Chukchi Sea discovery would entail:

- Pipelines to shore;
- Coastal infrastructure and logistic bases; and
- Pipelines across the North Slope that flow into the Trans-Alaska Oil Pipeline and the proposed Alaska natural gas pipeline.

Successful ventures will depend heavily on safe marine transportation as destination traffic increases for vessels that supply and staff the drill site, move the resources from site to customer, and, in the event of an incident, support a spill response or other emergency. For example, despite Shell's 2012 success in offshore Arctic exploratory drilling programs in the Chukchi Sea, it experienced MTS related problems including the lost tow and grounding of the *Kulluk* rig near Kodiak Island in late December 2012. Shell has postponed plans for exploration in 2013 to assess 2012 program performance. ConocoPhillips has also postponed its planned 2014 exploratory drilling program.

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[16] Darya Korsunskaya and Braden Reddal, *Exxon, Rosneft tie up in Russian Arctic, U.S.*, 8.31.2011, Reuters.
[17] Atle Staalesen, *New Big Oil Discovery in Barents Sea*, January 9, .2011, Barents Observer.
[18] DOI, BOEM Offshore Exploratory Information, Historical Offshore Drilling on the Alaska OCS, as of 4.16.2011.

TABLE 1: ARCTIC POLICIES and RECOMMENDATIONS Reviewed for MTS FOCUS or INVESTMENT	ARCTIC MTS COMPONENTS				
	Navigable Waterways *(Governance, Harbors of refuge, Areas of Ecological Significance…)*	***Physical Infrastructure*** *(Port facilities, deep draft access, surface/ airlift/sealift capability, GPS, geodetic control…)*	***MTS Information Infrastructure*** *(Nautical Charts, hydrographic surveys, shoreline mapping, tides, currents, aids to navigation, weather/sea ice forecasts, Automatic Identification System, Vessel Traffic System, communications…)*	***MTS Response Services*** *(Search and Rescue, oil spill prevention/ preparedness/ response, ice-breaking capability…)*	***Vessels*** *(Polar Code: passenger vessel rules, invasive species, marine mammal protections, air emissions, crew standards and training…)*
Arctic Marine Shipping Assessment 2009	√	√	√	√	√
U.S. Arctic Region Policy (NSPD 66/HSPD 25)		√	√	√	√
National Strategy for the Arctic Region	√	√	√	√	
Executive Order 13547 (National Ocean Policy)			√	√	√
National Ocean Policy Arctic Implementation Plan		√	√	√	
Executive Order 13580: AK Energy Development and Permitting		√		√	
Alaska Northern Waters Task Force Rec's	√	√	√	√	√
Navy Arctic Roadmap		√	√		
DOD 2010 Quadrennial Defense Review			√	√	
DOD Report to Congress: Arctic Operations, 5/2011		√	√	√	
GAO Reports to Congress 10-870, 12-180		√	√		
USCG Report to Congress: Polar Operations				√	

TABLE 1 cont'd: ARCTIC POLICIES and RECOMMENDATIONS Reviewed for MTS FOCUS or INVESTMENT	ARCTIC MTS COMPONENTS				
	Navigable Waterways	*Physical Infrastructure*	*MTS Information Infrastructure*	*MTS Response Services*	*Vessels*
Managing for the Future in a Rapidly Changing Arctic	√				
USCG High Latitude Region Mission Analysis Report to Congress	√	√	√	√	√
USCG Arctic Strategy	√	√	√	√	√
USGS Circular 1370: Science Needs for Arctic OCS Energy Development	√	√	√	√	√
NOAA Arctic Vision and Strategy		√	√	√	
Congressional Research Service: Changes in the Arctic, 2012			√		
Arctic Council Int'l Search and Rescue Agreement			√	√	
BP Deepwater Horizon Oil Spill 2011 Commission Report to the President				√	
Congressional legislation (indicating AK state interests)		√	√	√	
Interagency Arctic Research Policy Committee 5-year Arctic Research Plan	√		√		
Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic	√	√	√	√	√

The January 2011 *National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report* highlighted a number of concerns with drilling in the Arctic. These include:

- Icy conditions
- Remoteness
- Fragile ecosystem(s)
- Potential impacts to Alaska indigenous peoples, and
- Limited Federal capacity for oil spill response, containment, and SAR.

The Commission emphasized the need for:

- Science and research to understand how oil behaves in ice;
- Comprehensive oil spill preparedness and response plans; and
- International standards on Arctic oil and gas development.[19]

The USCG, BOEM, and BSEE strongly focused on effective well containment strategies after *Deepwater Horizon.* These agencies have stated that they see greater potential for a spill or other emergency arising from the vessels supporting drilling operations, and potential protesters, than a well blow-out. The Arctic Council assessment on *Oil and Gas Activities in the Arctic—Effects and Potential Effects* also reached this conclusion.[20] Regardless, any scenario would rely heavily on the available marine transportation infrastructure to stage a successful response.

To help inform decision-makers and the public on baselines and impacts of drilling operations, President Obama issued Executive Order 13580 in July 2011, which established the Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska (IAWG). The IAWG has begun to establish a centralized hub of scientific information and will prepare a framework for building a more integrated approach to evaluating potential infrastructure development in the Alaskan Arctic. Within this frontier region, energy exploration and development bear close scrutiny, especially given the potential energy resources and the need for delicate balancing of economic, human, environmental, and technological factors.[21]

Commercial Shipping and International Routes

Commercial shipping activity in the U.S. Arctic is primarily regional; it is centered on the transport of natural resources from the Arctic, and the delivery of general cargo and supplies to communities and natural resource extraction facilities, e.g. periodic barge sealift to Prudhoe Bay. But an ice-diminished Arctic is now creating growth potential for commercial shipping on trans-Arctic routes. This could reduce existing transit distance between Europe and Asia by roughly 4,500 nautical miles. For commercial interests, saving a week's time and 40 percent in

[19] National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, Report to the President, 1. 2011.
[20] Arctic Council *Oil and Gas Activities in the Arctic—Effects and Potential Effects*.
[21] *National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report*, 1.2011.

freight shipping costs presents a compelling case to consider routing vessels through the Arctic, even with unpredictable sailing conditions. The NSR, a trans-Arctic route, is one of these (Figure 4). Russia views the NSR as an essential component of its Arctic economic development strategy. Russian law defines it as "a set of marine routes from the Kara Gate in the west to the Bering Strait in the east."[22] Russia is actively working to capitalize on changing conditions in the Arctic by transforming the NSR into a commercial shipping route of global importance, capable of competing with more traditional routes (Suez Canal, Panama Canal) in price, safety, and quality.[23] On July 4, 2012, the Russian Duma passed new legislation creating a single management agency to review NSR transit applications, issue permits with requirements for insurance or bonding, and develop modern infrastructure to ensure safe navigation of vessels, including navigational and hydrographic support, and ice-breaking.[24] Anticipating increases in cargo transport from 1.8 million tons in 2010 to 64 million tons by 2020, Russia is investing heavily in the NSR by:

- Building 10 rescue centers along the NSR by 2015;[25]
- Deploying 18 additional aircraft to the region for emergency response and SAR;[26]
- Contracting with a Russian shipbuilding corporation to build four diesel icebreakers;[27]
- Planning to deploy the orbital monitoring system "Arktika," which will assist in vessel tracking and management;[28] and
- Establishing vessel monitoring in the Barents Sea with Norway.[29]

The year 2012 was the longest navigational season on record for the NSR due to the lack of pack ice.[30] To date, transits along the NSR have increased both in type and number of vessels. *The Economist* reported in its June 2012 issue that Russia is escalating interest in the NSR, which may cut transits between Europe and Asia by a third. The article noted that in 2010 only 4 ships used the NSR, while 34 ships used it in 2011, and 46 used it in 2012 with an increase in cargo of 53 percent over 2011.[31] More recently, the *Barents Observer* states that the NSR Administration has received 89 applications for transit in 2013 of which 54 are already approved.[32] Vessel types included tankers, refrigerated vessels carrying fish and even a cruise liner.

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[22] Arctic Council, Protection of the Arctic Marine Environment Working Group, *Arctic Marine Shipping Assessment 2009 Report.*

[23] Trude Pettersen, *Putin Sees Bright Future for Arctic Transport*, 9. 25.2011, Barents Observer.

[24] "On amendments to certain legislation of the Russian Federation regarding state regulation of merchant shipping in the waters of the Northern Sea Route" http://www.arctic-info.com/News/Page/-bill-on-the-northern-sea-route-passed-at-the-third-reading.

[25] Trude Pettersen, *Russia to have Ten Arctic Rescue Centers by 2015*, 11.18.2011, Barents Observer.

[26] Trude Pettersen, *Russia deploys 18 emergency aircraft to the Arctic*, 3.15.2012, Barents Observer.

[27] *Russia to Build four $640 mln Diesel Icebreakers*, RIANovosti, 12.12.2011.

[28] *Russia to Launch Earth-Scanning Satellite*, UPI, 9.23.2011.

[29] Thomas Nilsen, *Eyes on the Barents Maritime Safety*, 11.24.2011, Barents Observer.

[30] Trude Pettersen, *Law on the Northern Sea Route in the Pipeline*, 11.22.2011, Barents Observer.

[31] [31] Balazs Koranyi. Lower ice levels Rule Changes to Boost Arctic Northern Sea Route, 5.30.2013,, Insurance Journal.

[32] Trude Pettersen, Preparing for Record Season on the Northern Sea Route, 6.6.2013, Barents Observer.

Similarly, the Northwest Passage, which runs through the Canadian archipelago, has been open to navigation during the last five summers. There are jurisdictional issues to address as these routes become more viable for commercial and recreational use. For example, Russia and Canada proclaim authority to regulate transits of the NSR and Northwest Passage. The U.S. and many other countries disagree with such claims and stress that these routes are international straits subject to the right of transit passage as reflective of customary law and practice.[33]

Communications companies are also considering the Arctic as a new home for submarine fiber optic cables. Shorter distances, decreased latency, and reduced likelihood of damage from anchors are compelling reasons for laying cable through the region, despite the harsh conditions.[34]

Regardless of purpose, the Marine Exchange of Alaska reports that commercial vessel traffic increased by 30 percent in the Arctic region from 2008 to 2010. The Marine Exchange's AIS receiving network observed 300 and 333 transits of the Bering Strait in U.S. Arctic waters in 2011 and 2012 by commercial vessels, with many other vessels transiting west of the Date Line (See Figure 5). Growing use of these trans-Arctic routes for a variety of commercial purposes and the requisite dependence on the Bering Strait will lead to increased traffic in U.S. Arctic waters. Increased use also underscores the need for:

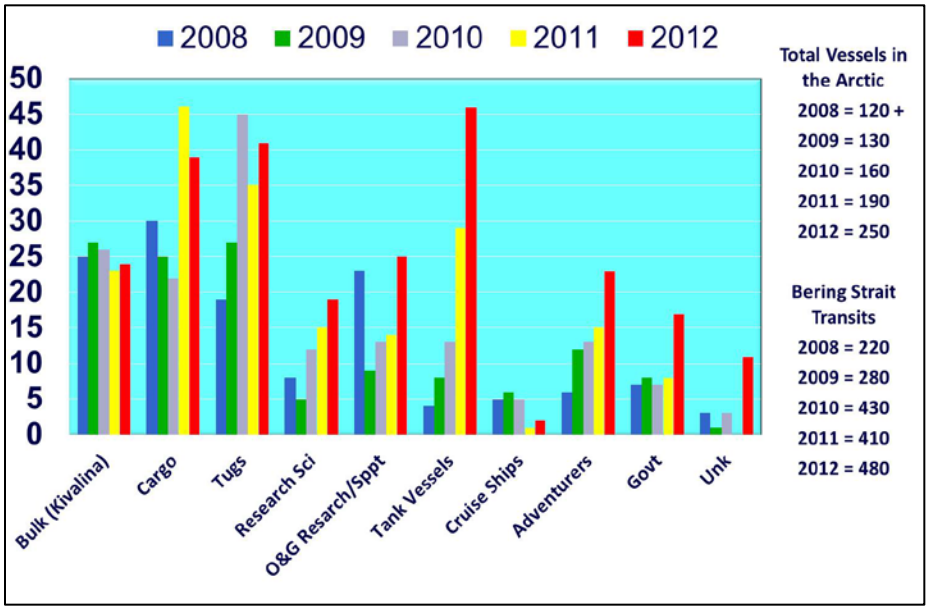

Figure 5: 2008 – 2012 Arctic Activity
Source: USCG District 17

- Vessel management schemes,
- Shipping lanes,
- Navigation aids, and
- Other international navigation conventions.

[33] Ronald O'Rourke, *Changes in the Arctic: Background and Issues for Congress*, 2.2012, Congressional Research Service.
[34] Jeff Hecht, *Fibre Optics to Connect Japan to the UK – via the Arctic*, 3.20.2012, New Scientist.

Mining

The Red Dog Mine, located in the DeLong Mountains about 90 miles north of Kotzebue, Alaska, is the world's largest zinc mine. Since 1989, it has contributed nearly $1 billion in State and regional taxes, as well as serving as a significant source of employment in the surrounding area.[35]

Constrained by geography and climate, the shipping of ore has traditionally been restricted to the summer navigational season. Even then the port's shallow coastal waters require the use of barges to transfer the ore to larger vessels offshore for transport to global markets. But as sea ice recedes, ore shipments will likely extend further into spring and fall, which will increase dependence on vessel transits and risk of accident. This is especially true for transits through the Bering Strait. Furthermore, there are untapped coal deposits along the Chukchi Sea, and massive sulfide deposits with high grades of graphite, copper, silver, and gold in the western Arctic. In addition to known mineral deposits, increased exploration efforts may lead to discovery of more resources. This in turn would lead to a greater dependence on marine transport of equipment, supplies, personnel, and mineral ores. This includes potential seabed resources located on the ECS of the United States.

Commercial Fishing

According to the NOAA National Marine Fisheries Service, commercial fishing in Alaska is a $4.6 billion dollar industry, accounting for over half the total fish and shellfish catch for the entire United States. In the U.S. Arctic, fishing is currently concentrated in the Bering Sea; the North Pacific Fisheries Management Council has closed the Arctic Management Area in U.S. waters in the Beaufort and Chukchi Seas. Fishing north of the Bering Sea would not be authorized until after scientific data needed to manage the fisheries is available in order to ensure sustainable harvests. If increasing temperatures and changing ocean conditions shift distribution of some fish species into the Beaufort and Chukchi Seas, this will likely result in greater interest by U.S. commercial fishermen in moving operations north to maintain sufficient harvest. There will also be greater potential for encroachment by international fishermen into U.S. waters in the quest for catch. Both situations would require law enforcement to enforce fisheries management measures and to protect marine mammals from potential harm from fishing operations. Protection of Arctic fisheries and marine life in the context of a changing Arctic ecosystem will help sustain subsistence livelihoods, e.g. using Integrated Arctic Management approaches that simultaneously evaluate commercial needs and trends in conjunction with environmental trends, ecological processes and cultural considerations.

In the Bering Sea today, and north of the Bering Strait in future, commercial fishermen rely on the USCG for enforcement, emergency response and SAR. However, one major concern is the amount of time it takes to reach a vessel in distress, if the USCG has the capacity to reach it at all. If commercial fishing grows, the need for port facilities to support fishing operations in the Chukchi and Beaufort Seas will also grow, raising further infrastructure and support concerns.

[35] NANA Corporation, Red Dog Operations, as of 1.11.2012.

Tourism

Throughout the Arctic, tourism in the form of traditional and adventure cruises has become more commonplace, and is on the rise. Between 2004 and 2007, cruise ship traffic in the Arctic increased 400 percent, jumping from 50 ships in 2004 to 250 ships in 2007.[36] Passengers from Norway and Greenland reached more than 70,000 in 2008, according to the Greenland tourism bureau. A few thousand other visitors depart from Canada and Russia each year.[37]

Within the U.S. Arctic, marine-based tourism is currently very limited. Only Hapag-Lloyd Cruises offers voyages through the Northwest Passages with stops at ports within the U.S. Arctic in Nome, Point Hope and Barrow, AK.[38] However, the 2007 sinking of the cruise ship *Explorer* after colliding with an iceberg in the Antarctic and the 2010 grounding of the Clipper *Adventurer* in the Canadian Arctic demonstrated the risks inherent in cruising in such cold, remote waters. These incidents have opened the eyes of potential tourists to the possibility of a disaster in some of the world's most untouched waters. Nonetheless, in an ice-diminished Arctic, tourism and passenger traffic will likely increase, along with the potential need for larger scale response and rescue operations.

Tug and Barge Operations

During ice-diminished periods and in ice-free locations, the most economic means of transportation is by barge. Shallow draft Alaska tug and barge businesses haul fuel, gravel, and supplies to Prudhoe Bay, Red Dog Mine and Alaska coastal communities (predominately Alaska Native villages). Tugs support offshore oil and gas operations for ice management and towing duties. Tugs and barges also support pollution response. The need for tug and barge operations will continue as local communities grow and, in some cases, relocate due to coastal erosion. As exploration for and extraction of different types of Arctic resources increase, tug and barge operators will increase their dependence on the Arctic marine transportation infrastructure for their livelihoods and safety.

Scientific Research

Scientific research in the Arctic is typically a cooperative endeavor between multiple government entities (Federal, State, local, Tribal, international), non-governmental organizations, academia, and private industry. Arctic research subjects are similarly diverse, and include:

- Baseline physical and biological oceanography;
- Seabed geology;
- Ice dynamics;
- Marine mammal and fisheries science;
- Socio-economics;
- Local to global impacts of Arctic climate change;

[36] The Arctic, Tourism & Recreation, as of 1.11.2012.
[37] David Rosenfield, Cruising the Arctic, Natural Resources News Service, 7.23.2012.
[38] Hapag-Lloyd Cruises, *Expedition – Northwest Passage*, as of 1.11.2012.

- Effects of increased anthropogenic noise and activity (including marine transportation) on living marine resources; and
- Interaction and behavior of oil in polar climates and best practices for clean-up.[39,40,41]

As the region grows in accessibility, so will the number of research vessels which require all the basic elements of an MTS: accurate nautical charts, good communications, ice-breaking capacity, navigation aids, and other MTS elements.

At present, the scientific community is heavily reliant on the USCG Cutter *Healy* for its capacity as an ice-breaker, as well as other ice-capable vessels such as NOAA's survey ship *Fairweather*, for joint research cruises. There is a substantial need for financial support to operate and replace these specialized and aging vessels. One new ice-capable vessel has recently joined the university science fleet. Operated by the University of Alaska at Fairbanks, the National Science Foundation's research vessel *Sikuliaq* will begin service in the U.S. Arctic in 2014.

International Agreements and Arrangements

The international nature of marine transportation requires international standards and guidance for the promotion of safety, pollution prevention, security and other aspects of shipping and port operations while also ensuring navigational rights and the various rights of coastal States.

Many of the standards that nations have established through the International Maritime Organization (IMO) are applicable to marine transportation irrespective of geographic location and are thus equally applicable in the Arctic. However, the Arctic poses unique challenges to marine transportation that are not necessarily specifically addressed in existing IMO instruments. In facilitating safe, secure, and reliable navigation in the polar regions, the IMO has approved guidelines for vessels operating in Arctic and Antarctic ice-covered waters. These are recommendations only, and apply to passenger vessels and cargo vessels of 500 gross tons or more engaged in international voyages.[42] Recognizing the growing vessel traffic in the Arctic, the IMO has directed that its Ship Design and Equipment Subcommittee complete its work on the draft Polar Code (a proposed international code of safety for ships operating in polar waters) by the end of 2014. When that work is complete, the IMO's Marine Environmental Protection Committee and Marine Safety Committee will then consider the draft, make any changes deemed necessary and finalize appropriate amendments to the Safety of Life at Sea Convention (SOLAS), the International Convention for the Prevention of Pollution from Ships (MARPOL) and other appropriate IMO conventions. The IMO will likely continue working on the project after 2014.

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[39] BSEE Oil Spill Response Division OSR Research.
[40] Arctic Oil Spill Response Technology Joint Industry Programme.
[41] Joint industry program on oil spill contingency for Arctic and ice-covered waters.
[42] IMO 2009 Polar Shipping Guidelines.

In related Arctic Council work, the United States was instrumental in proposing, co-leading, developing and negotiating the *Aeronautical and Maritime Search and Rescue in the Arctic Agreement*.[43] All Arctic maritime governments signed the Agreement in May 2011. The United States co-led an Arctic Council task Force that resulted in the Agreement on Oil Spill Preparedness and Response in the Arctic signed by Secretary Kerry on May 15, 2013. The United States also co-led AMATII with Iceland that was completed in May 2013, and provides an intermodal assessment of current transportation infrastructure in the Arctic from an international perspective. Arctic states will analyze future needs resulting from increased traffic as a result of resource and economic development. They will also conduct a gap analysis. U.S. agency representatives are also active participants in Arctic Council *AMSA* follow-up projects on marine shipping. These include:

- Heavy Fuel Oil Use and Carriage in the Arctic;
- Passenger Ship Safety;
- Areas of Heightened Ecological and Cultural Significance; and
- Specially Designated Arctic Marine Areas.[44,45]

National Security/Maritime Domain Awareness

As the reduction in Arctic sea ice coverage triggers increased interest in and use of the Arctic, national security concerns and the demand for maritime domain awareness (MDA) in the Arctic increase concomitantly. The MDA is the effective understanding of anything associated with the global maritime environment that could affect U.S. security, safety, economy, or environment. Arctic MDA plays a key role in the future of the USN as well. The USN identified MDA as a mission that will increase in importance over the next three decades.[46] The 2009 USN Arctic Roadmap and 2011 DOD *Report to Congress on Arctic Operations and the Northwest Passage* indicate that no current military threats exist in the Arctic region. However, the United States needs assured access to support our national interests and to ensure the strategic end state of a secure and stable region.[47]

National security assets must be equipped to respond to a broad spectrum of challenges and contingencies in the Arctic.[48] For example, an ever-increasing volume of marine traffic through the Bering Strait elevates the prominence of the Bering Strait as a strategic chokepoint and heightens the geostrategic importance of the Arctic region.[49]

Increased Arctic MDA is vital to informing all future policy, plans, and investments in Arctic infrastructure and capabilities in general. Specifically, increased Arctic MDA will facilitate the

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[43] Arctic Council, Aeronautical and Maritime Search and Rescue in the Arctic Agreement, May 2011.
[44] Arctic Council PAME Work Plan 2011-2013.
[45] Arctic Council PAME Heavy Fuel in the Arctic Report, 1.18.2011.
[46] U.S Navy Arctic Roadmap, 11.2009.
[47] DOD Report to Congress on Arctic Operations and the Northwest Passage, 5.2011.
[48] Ibid.
[49] Ibid.

"protection of maritime commerce, critical infrastructure, and key resources." [50] Enhanced MDA is also critical to successful intervention and mitigation of potential safety and environmental incidents.[51] No one nation, department, or agency can attain MDA in isolation. The MDA requires a collaborative network of partners drawing upon their cumulative authorities, capabilities, and experience.[52] The 2011 Nome fuel shortage and resupply efforts involving the USCGC *Healy* and the Russian-flagged tanker *Renda* highlight the unique nature of Arctic maritime operations and the challenges intrinsic to emergency response via the maritime domain. Events like the Nome fuel resupply, the 2004 *Selendang Ayu* oil spill in the Aleutians, and Shell Oil's 2012 operations also reinforce the need for coordination among Federal agencies in maritime operations. This collaboration is noted in the General Accountability Office's 2012 assessment and recommendations on DOD Arctic capabilities.[53] DOD and DHS have since opened discussions on cooperative and complementary capabilities to provide a foundation for future operations in the Arctic. In March 2012, the Commander, United States Northern Command and the Commandant of the United States Coast Guard endorsed the results of the DHS/DOD Arctic Capabilities Assessment Working Group white paper as a guide to inform Arctic investment priorities in both DHS and DOD shared capability gaps in infrastructure, communications, MDA and presence in the Arctic.

Ahead of the 2012 drilling season, the USCG recognized the need for a stronger Arctic presence. As Shell Oil Company planned to move people and equipment into the Beaufort and Chukchi Seas, the USCG also forward-deployed surface and aviation assets to the Arctic to support the increased Arctic maritime activity. In a February 2012 interview with the *American Forces Press Service*, Coast Guard Commandant Admiral Robert J. Papp, Jr., described *Operation Arctic Shield.*[54] He acknowledged that Coast Guard missions in the Chukchi and Beaufort Seas must increase as Shell Oil's operations spin up in summer 2012. "Shell will move 33 ships and 500 people to Alaska's North Slope, and will helicopter some 250 people a week to drilling platforms," the Admiral said. "That activity has the potential to increase Coast Guard workloads in pollution and environmental response, as well as in search and rescue. The North Slope is new territory for the Coast Guard, with most of the service's Alaska infrastructure some 800 miles away."[55] Along with Shell, ConocoPhillips and Statoil are leaseholders in the Arctic OCS, although plans to drill are on hold.

The U.S. goal is to be prepared for a broad range of incidents as risk increases, and to be ready before an incident actually occurs. Preparation must consider:

- SAR;

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[50] NSPD-66/HSPD-25 at Appendix A
[51] DOD/DHS Arctic Capabilities Assessment Working Group (CAWG) White Paper, 3.2012.
[52] U.S. Coast Guard Arctic Strategy, 5.21.2013, p.23, Washington, DC.
[53] GAO, Arctic Capabilities: DOD Addressed Many Specified Reporting Elements in Its 2011 Arctic Report but Should Take Steps to Meet Near- and Long-Term Needs, 12-180, 1.2012.
[54] U.S. Coast Guard, Operation Arctic Shield 2012.
[55] Karen Parrish, American Forces Press Service, Coast Guard Commandant Details Arctic Security Issues, 2.24.2012.

- Oil spill contingencies;
- Security of oil drilling rigs and personnel;
- Safety of vessels supporting OCS oil and gas activities; and
- Persons protesting the presence and activities of the oil companies.

Overall, as vessel traffic increases in the region, comprehensive MDA will become more important to successful execution of safety, security, and environmental protection programs, and defense operations. The U.S. Arctic MTS serves as a foundation to MDA; it must itself be adequately safe and secure to support U.S. interests, including energy and economic security.

State of Alaska

The United States is an Arctic nation by virtue of the state of Alaska's Arctic location. The State of Alaska is the first to acknowledge that marine transportation is vital to its economy and well-being of its people. Marine transportation is not only a primary means of mobility in the State, but also serves the basic needs of many coastal communities, the fisheries industry, tourism, and natural resource development and export sectors. It also plays a larger role for State international commerce and trade. Consequently, the State of Alaska has a clear interest in the safety and economic viability of an U.S. Arctic MTS.

Alaska works with the Federal Government in many areas, including:

- Preparation and periodic update of the Alaska "Unified Plan" (which serves as the State's Federal Regional Plan) and the ten Federal/State subarea contingency plans that describe the strategy for a coordinated Federal, State, and local response to an oil or hazardous substance discharge from a vessel or from an offshore or onshore facility operating within the boundaries of Alaska and its surrounding waters;
- Review and approval of oil discharge prevention and contingency plans for vessels navigating Alaskan waters and for transport of crude oil or petroleum products in bulk upon Alaskan waters;
- Inspection of vessels and response equipment; contingency plan verification drills and exercises;[56]
- Enforcement of Alaska state laws governing the operation and regulation of large cruise ships within Alaska marine waters;[57]
- Designation of potential places of refuge for ships in distress;
- Support for USCG's *Operation Arctic Shield* effort to forward base to Alaska's North Slope;
- Support for the USCG Bering Strait Port Access Route Study (PARS);
- Research partnerships fostered by the U.S. Arctic Research Commission; and
- The U.S. Army Corps of Engineers (USACE) port study, to foster investment in a deep-water port in Western Alaska.

[56] Alaska Dept. of Environmental Conservation, Marine Vessels Section of the Industry Preparedness Program, (as of 1.11.12).
[57] Alaska Dept. of Environmental Conservation, Cruise Ship Program (as of 1.11.12).

The State also operates the Alaskan Marine Highway System, a network of ferries and ports throughout Southeast Alaska and extends to ports in South-central and Western Alaska to Dutch Harbor. This network does not presently extend to Arctic Alaska. However, increased vessel activity might be accompanied by expansion of the Alaskan Marine Highway System now and in the future through new ports, land-based facilities and services, roads, air, and rail, all of which are vital pieces of the MTS.[58] Alaska has committed millions of dollars to a vessel tracking system owned and operated by the Marine Exchange of Alaska, statewide digital mapping initiatives, an Arctic deep-water port study, and deployment of affordable broadband technology throughout the state to advance Arctic safety through communications.[59]

In 2010, the Alaska State Legislature established the ANWTF to assess the challenges and opportunities for Alaska as sea ice retreats and interest in Arctic resources grows. Simultaneously aware of the potential economic benefits and of the need to provide for sustainable communities and environmental protection, ANWTF initiated its work with substantial stakeholder engagement. In January 2012, ANWTF released its report addressing Alaska's interests and recommended engagement in U.S. Arctic policy, including governance, oil and gas exploration and development, marine transportation, planning and infrastructure development, fisheries, and research (see Appendix E).[60] The ANWTF recommended that steps be taken to establish secure and environmentally sound marine transportation in the region as soon as possible. Among other MTS-related recommendations, the ANWTF called for:

- Improving oil spill prevention and response capabilities, including contingency plans and response capabilities for all large commercial vessels operating in Arctic waters;
- Forward-basing the USCG in the Arctic;
- Constructing additional icebreakers and ice-capable vessels for the U.S. fleet;
- Adding aids to navigation in the Arctic and extending AIS vessel tracking across the North Slope;
- Developing deep draft ports and safe harbors in northern waters; and
- Funding Arctic charting and mapping, particularly for coastal navigation routes and entrances to coastal villages.

In testimony before Congress on December 1, 2011, Alaska Lieutenant Governor Mead Treadwell spoke about the need for new polar class icebreakers to respond to shipping traffic increases through the Arctic Ocean and Bering Strait region.[61] He argued that icebreakers are necessary to protect national security interests and the interests and way of life of Alaskan citizens who live in coastal communities. With respect to increasing international ship traffic, the Lieutenant Governor expressed in his statement to the Subcommittee that, "Good policy

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[58] Northern Economics, Inc. Planning for Alaska's Regional Ports and Harbors. 1.2011.
[59] State of Alaska Office of the Lt. Governor, Press Release No. 11-024, 9.22.2011.
[60] Findings and Recommendations of the Alaska Northern waters Task Force, 1.2012.
[61] Alaska Lt. Governor Mead Treadwell Statement for the Record, U.S. House of Representatives Committee Transportation on Transportation and Infrastructure Subcommittee on Coast Guard and Maritime Transportation, 12.1.2011

only goes so far without the infrastructure to act upon it." Alaska State Governor Sean Parnell has also said that ice breakers are a Federal responsibility, with Alaska standing by to explore how it might help.[62]

Alaska's three-member delegation to Congress is also focused on sustainable development of Arctic Alaskan resources. For example, Representative Don Young has proposed legislation to increase hydrographic surveying in the region for navigation safety, delineating ECS and the monitoring and description of coastal change.[63] Representative Young and Senator Lisa Murkowski have both introduced bills to expand oil and gas production in environmentally sound ways to areas of the Arctic National Wildlife Refuge. Senator Mark Begich has also proposed bills supporting:

- Responsible Arctic energy development;
- Science underpinning effective oil spill response and damage assessment;
- Arctic Ocean research, monitoring, and observing to inform decision-making; and
- Expansion of U.S. ice breaking capacity.[64]

Senator Begich held a field hearing in Anchorage in April 2012 on the development of deep-water ports in Arctic Alaska. In July 2012, Senators Begich and Murkowski called on the Administration to create an overall U.S. strategy for the Arctic. They stated that "Developing an American Arctic strategy is especially timely now, with the hope for offshore oil and gas exploration in Alaska's Arctic this summer, the number of cargo ships transiting the Bering Strait are increasing to new record highs and America's indigenous peoples are justifiably concerned with the impacts of these developments and changing conditions on their subsistence ways of life."[65] Senator Begich held another hearing in March 2013 at which CMTS Executive Director Helen Brohl presented testimony.

U.S. Arctic Indigenous Peoples and Alaskan Communities

American Arctic indigenous peoples have continuously adapted to live for thousands of years in one of the harshest environments on the planet. The cultural identity of indigenous peoples in dozens of villages and coastal communities in Northern Alaska is based on ocean transportation (water craft and over ice) to hunt, fish, and gather. Today, these locations have mixed traditional subsistence and cash economies that now include the purchase of firearms, food, fuel, and building materials that are shipped in from outside the state. Changes in sea ice and sea level, permafrost, and tundra, tree and vegetation distribution impact the distribution of land and sea animals, which likewise affect traditional subsistence activities and indigenous peoples' ways of life.[66] The pace of change has increased in the last 200 years, particularly the last 50 years. The key to subsistence adaptability is the ability to move freely across the land and sea to follow the animals and plants needed for survival and to avoid conditions such as

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[62] Alex DeMarban, Parnell: AIDEA could help finance icebreaker if Feds drop ball, 4.13.2012, Alaska Dispatch
[63] H.R. 295, 112th Congress, *To amend the Hydrographic Services Improvement Act of 1998…*, 1.12.2011
[64] S. 1620, 112th Congress, *To ensure the icebreaking capacity of the United States and other purposes,* 9.22.2011
[65] Press release, *Begich, Murkowski Call for a National Arctic Strategy*, 7.12.2012
[66] *See* Carter, *supra* footnote 10.

coastal or river erosion and changes in permafrost or ice conditions. Indigenous peoples are heavily dependent on boats for subsistence, ranging from single person kayaks and skin boats to locally made, wooden, and industrially manufactured, aluminum boats between 14 to 28 feet long. These craft are used for subsistence hunting of whales, seals, and walrus.

Already facing the need to adapt to climate change, indigenous peoples now must prepare to deal with increases in commercial shipping and other economic activities. These activities will likely force additional adaptation or change in their cultural practices. For indigenous peoples, the traditions of daily life include family, language, spirituality, oral history, hunting and fishing, herding, food preparation, clothes making, music, and dancing. These traditions provide a direct link between modern indigenous peoples and their ancestors.

Maritime activity related to energy development, mining, tourism, commercial shipping, or future commercial fishing may have positive impacts on local communities. However, because maritime and marine subsistence activities both occur in the open-water season, increased vessel activity coupled with changes in the environment may also negatively impact people living in these regions. In turn, this may also negatively impact their ability to adapt to the effects of any industrial activity in a direct way and Arctic climate change on a much larger scale. Oil spills and disturbances related to shipping may affect marine subsistence hunting and fishing. Coastal erosion due to longer open water seasons and storm wave action may undermine village vessel docking and offloading facilities needed for resupply. Future shipping lanes adjacent to coastal villages may increase visitors to small communities, stressing limited supplies, and possibly increase the dependence of local inhabitants on imported goods. Because maritime activities have the potential to disrupt, displace, and disturb traditional uses and subsistence activities, it is incumbent upon the Federal Government to ensure that shipping and other MTS activities are pursued in ways that are compatible with traditional indigenous life ways as identified through full and meaningful consultations and partnerships with American Arctic Tribal Governments and Alaska Native Corporations. Development of the U.S. Arctic MTS must be part of a holistic, integrated approach to management that accounts for and balances economic, environmental, and cultural sensitivities and trends in the region.

Areas of Ecological Significance

There are ecologically sensitive areas that may be detrimentally impacted by shipping activities, such as oil spills, noise, ship strikes, and physical presence. These sensitive areas may require protection or mitigation measures within marine transportation regulated navigation areas. To date, *AMSA* follow-up has identified three areas of heightened ecological significance encompassing the Bering Strait and the majority of Alaska's Arctic Coast.[67] In addition, the sea ice retreat is causing changes in ecosystems and loss of some species' habitat that is crucial for survival. Walruses, polar bears, and certain seal species depend on the ice for birthing and as

[67] 4th Draft Report AMSA Recommendations IIC; Identification of Areas of Heightened Ecological and Cultural Significance 2.28.2012. Report to PAME by the Arctic Monitoring and Assessment Program (AMAP) and Conservation of Arctic Flora and Fauna (CAFF) Working Groups of the Arctic Council, www.pame.is

hunting platforms. Early sea ice break-up is disrupting their reproductive and foraging ability.[68] The U.S. Fish and Wildlife Service (USFWS) has listed polar bears as threatened and designated their habitat, which includes sea ice areas out to the edge of U.S. jurisdiction, as critical. The agency did both under the Endangered Species Act (ESA).[69] The USFWS has stated that although the possible impacts from offshore oil and gas operations and shipping have had no significant role in declining populations, "minimizing effects from these activities could become increasingly important for polar bears as their numbers decline." The National Marine Fisheries Service offers a similar cautionary note about the Steller sea lion (Western Distinct Population Segments, or DPS), now listed as endangered under the ESA, with critical habitat designated in the Bering Sea (see Figure 6).[70]

In addition to the Steller sea lion, the following ESA listed species occur in the Arctic: blue whale, bowhead whale, fin whale, humpback whale, North Pacific right whale, sperm whale, spotted seal, and Atlantic salmon. Bearded seal and ringed seals have been listed as threatened species. Federal agencies are required to consult with the National Marine Fisheries Service if any action they authorize, fund, or carry out in the Arctic may affect these species or critical habitat.[71]

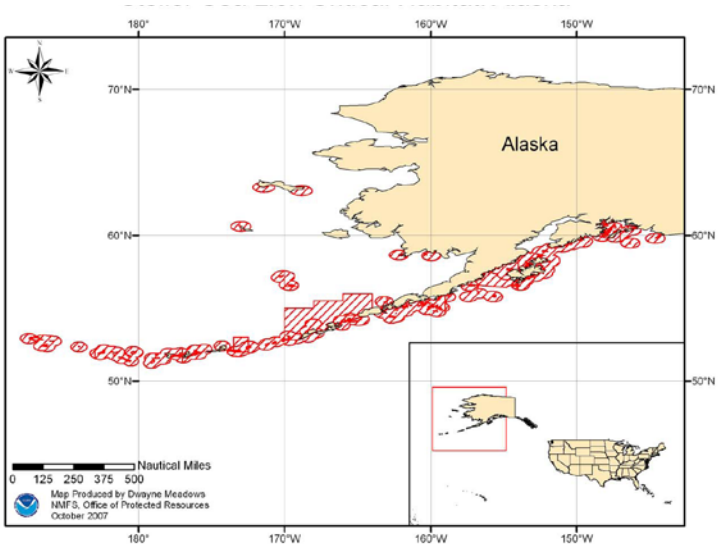


Figure 6: Steller Sea Lion Critical Habitat, NOAA

Conclusions to be drawn from increased Arctic marine transportation

As climate change and loss of sea ice create a more accessible Arctic, there are impacts on human lives, the U.S. economy, national security, and the environment. This reality poses significant challenges and opportunities for maritime commerce, security of our maritime domain, subsistence livelihoods and resource management in Alaska and the Arctic region.

Despite the receding polar ice cap, those who seek to use Arctic waters for transportation still do so at great risk. Compared to the rest of the United States, the Arctic is an intensely harsh operating environment, with extreme cold, heavy fog, severe storms, and the added elements of unpredictable ice flows and changing sea ice conditions. Most vessels currently operating in the Arctic are neither designed nor equipped for the conditions experienced on a daily basis. In

[68] Bartley Kives, *Manitoba, Ontario Polar Bears Doomed, Says Expert*, 11.16.2011, Vancouver Sun.
[69] Press Release, U.S. Fish and Wildlife Service, Announcing Final Designation of Polar Bear Critical Habitat, 11.24.2010
[70] NOAA Office of Protected Resources, Critical Habitat, 2.7.2013
[71] U.S. Code, 16 USC § 1536 - Interagency cooperation.

addition, basic marine navigation infrastructure in the U.S. Arctic is lacking, as noted in the February 2012 Congressional Research Service update on Arctic issues.[72] The 2009 *AMSA* report backs this conclusion, examining Arctic shipping from a historical, legal, environmental, and infrastructure perspective. The *AMSA* recommended specific actions to address this infrastructure deficit, including improving communications, navigational charts, vessel traffic systems, and weather and sea ice information.

[72] Ronald O'Rourke, *Changes in the Arctic: Background and Issues for Congress, 2.2012,* Congressional Research Service.

> ***"The United States Marine Transportation System will be a safe, secure, and globally integrated network that, in harmony with the environment, ensures a free-flowing, seamless, and reliable movement of people and commerce along its waterways, sea lanes, and intermodal connections."***
>
> *CMTS National Strategy for the Marine Transportation System: A Framework for Action*

2 -- *Current State of the U.S. Arctic Marine Transportation System*

On the whole, the U.S. MTS is a large, integrated network comprised of navigable waterways, ports, and harbors. It also includes the connecting railroads, airports, transit, roadways, and pipelines that are critical to the national economy for moving people and commerce. The MTS is remarkably diverse in terms of geography and environmental conditions, the vessel traffic it serves, and the variety of services it provides. A complex public-private partnership with diverse participants, the MTS supports the distribution of our Nation's agricultural and manufactured products. It links our Nation to global commerce via the highways of choice for international trade—our oceans and coastal/inland waterways. The MTS carries 43.5 percent by value and 77.6 percent by weight of all U.S. international trade.

Using the CMTS *National Strategy for the Marine Transportation System* definitions, this report organizes the Arctic MTS into five primary components:

- Navigable Waterways,
- Physical Infrastructure,
- MTS Information Infrastructure,
- MTS Response Services, and
- Vessels.[73]

All of these components contribute to the movement of people and goods to, from, and on the water, and support the exploration and development of natural resources.

The following is an assessment of the condition of these five components within the U.S. Arctic. The assessment includes highlights of current deficiencies. Table 2 provides a comprehensive list of Arctic MTS services and deficiencies first for the Bering Sea and Bering Strait, and then for the Chukchi and Beaufort Seas. Table 2 demonstrates that the Federal MTS infrastructure and service delivery south of the Bering Strait is far more developed than north of the Bering Strait.

[73] CMTS *National Strategy for the Marine Transportation System: A Framework for Action*, 7.2008.

This conclusion is to be expected given that until recently the region was unnavigable virtually year round, supporting only local community and oil industry supply transits. However, what constitutes an MTS in the Bering Sea still falls well short of the comprehensive suite of services, infrastructure, vessels and waterways available to MTS users in the rest of the U.S. Exclusive Economic Zone (EEZ). This includes elements for navigation safety, economic opportunity, national security and environmental protection.

Navigable Waterways

In addition to various statutory definitions, Title 33 of the Code of Federal Regulations defines navigable waterways as generally consisting of:

- Waters of the U.S. EEZ,
- U.S. territorial sea,
- Waters internal to the United States that are subject to tidal influence, and
- Waters internal to the United States that are not subject to tidal influence.

In the case of the Arctic, receding ice has led to the opening of navigable waterways that are sufficiently deep, wide and slow for vessels to pass. Waterways are critically important to the transportation of people and goods throughout the world. The Federal Government may exercise jurisdiction over navigable waters. Generally, the Federal Government determines how the waters are used, by whom, and under what conditions. The Federal Government also has broad authority to manage those navigable waterways.

For the purpose of this report, the navigable waterways of the U.S. Arctic encompass all waters subject to U.S. jurisdiction, including those waters constituting:

- The U.S. EEZ
- U.S. territorial sea, and
- Internal navigable waters in Alaska as defined in the U.S. Arctic Research Policy Act of 1984 Arctic definition.[74]

The Arctic's navigable waterways transport mineral, agricultural and bulk products, as well as other trade goods and passengers to, from and within the United States. They connect the U.S. Arctic region to the rest of the nation, and, depending on the availability of Arctic shipping routes, to the movement of global commerce.

Compulsory regulations for international Arctic waterways do not yet exist. However, U.S. commitments to the international SOLAS Convention and other IMO guidelines provide for navigable waterways management. As part of this management responsibility, the United States should provide places of refuge for ships—pre-established locations for vessels to moor when weather or ice conditions become too severe for safe travel, when a vessel is unable to maneuver, in need of repairs, or related emergencies. Under 46 CFR 175.400, "Harbor of Refuge" is defined as a port, inlet, or other body of water normally sheltered from heavy seas

[74] See Footnote 1.

by land and in which a vessel can navigate and safely moor." The IMO recognized the need for guidance on places of refuge for ships in need of assistance in its November 2003 Resolution A.949 (23), *Guidelines on Places of Refuge for Ships in Need of Assistance.*[75] This Resolution includes guidance for coastal states to review their contingency arrangements so that ships are provided with assistance and facilities that might be required in emergency circumstances. Additionally, the USCG *Places of Refuge Policy* (COMDTINST 16451.9) provides policy and risk assessment guidance to aid the field in preparing for the response to a vessel requesting a place of refuge or similar events in which a vessel, not in need of immediate Search and Rescue assistance, may pose a variety of risks to a port or coastal area. There are no places of refuge north of the Bering Strait. As such, the United States should study potential locations there that may serve as places of refuge for ships in need of assistance.

Areas of Ecological Significance are another aspect of managing our navigable waters. Current mapping and assessments indicate sensitive ecological areas just south of the Bering Strait north, to areas of the U.S. Chukchi and Beaufort Seas and coasts.[76,77] As reflected in the Interagency Arctic Research Policy Committee's (IARPC) 5-year research plan, baseline research is needed in these areas and others to better understand ecosystem level dynamics, including habitats and species populations, in order to assess the need for national or IMO protection designations from vessel traffic and use. [78] Federal actions to address these navigable waterways needs and gaps include:

- Limited support and coordination for Federal science programs and "science of opportunity" research on USCG flights and icebreaker deployments;
- Collection of a variety of observations of the physical oceanographic, geological and biological environments; and
- Scientific support for oil spill response and the Arctic Geospatial Framework

The United States and Russia should consider negotiating and implementing through the IMO an agreement on vessel traffic management and associated ecological protective measures in the Bering Strait.

Physical Infrastructure

Shore-based marine transportation infrastructure provides the physical land-side components that allow for quick and efficient transportation of cargo and passengers. The MTS infrastructure encompasses:

- Ports,

[75] IMO, Guidelines on Places of Refuge for Ships in Need of Assistance, 11.2003.

[76] IMO A.982(24) Revised guidelines for the identification and designation of Particularly Sensitive Sea Areas (PSSAs), 2005

[77] Arctic Marine Shipping Assessment Recommendation IIC, Identification of Areas of Heightened Ecological and Cultural Significance—Report to the Protection of the Arctic Marine Environment Working Group with maps, by Arctic Monitoring and Assessment Program (AMAP) and Conservation of Arctic Flora and Fauna (CAFF) Working Groups of the Arctic Council, (in press) www.pame.is

[78] Interagency Arctic Research Policy Committee, Five Year Research Plan 2012-2017, 11.2012.

- Terminals,
- Piers,
- Berths,
- Intermodal connections and linkages to road, rail, and airport access routes and facilities,
- Cargo handling and passenger/crew facilities, and
- Geospatial infrastructure and Continuously Operating Global Positioning System Reference Stations (CORS) supporting accurate positioning and construction.[79]

In Alaska, the Port of Anchorage serves over 80 percent of the State's population and handles over 90 percent of all consumer goods sold in Alaska.[80] Anchorage is also the State's only large multi-modal port with access to highway, rail, and air transport systems. There are limited deep water port facilities north of the Aleutians and none north of the Bering Strait. Most of the State's 350-plus communities lack road and rail access, therefore air transport or barging becomes the primary mover of supplies and resources.

The Arctic Council and PAME note that the absence of major Arctic ports and other critical infrastructure are significant limitations to proposed Arctic shipping routes and long-term shipping interests in the region. Port infrastructure is needed in northwest and northern Alaska to support shipping and energy development, and to carry out emergency response and search and rescue activities.

The MTS Information Infrastructure

Information is an essential component of any MTS, especially in the Arctic where conditions are often hazardous due to the harsh and changing environment. These services are often dynamic inputs relied on by mariners and other MTS users for situational awareness and safe, secure, and efficient marine transit. Often interdependent, MTS information infrastructure requires a systematic approach to ensure safe and efficient marine transportation. For example, the production of an accurate nautical chart to support safe and efficient marine navigation requires accurate sea level information, hydrographic surveys, geodetic control, shoreline and channel delineation, and aids to navigation data. The MTS information infrastructure includes, but is not limited to:

- Navigational charts with updated hydrographic and shoreline mapping data,
- AtoNs,
- Marine weather and sea ice forecasts,
- Real-time navigation information and water levels,
- AIS, and
- Communications capabilities.

[79] Geodesy is the science concerned with determining the size and shape of the Earth and the accurate location of points upon its surface.

[80] Port of Anchorage Fast Facts, 2012.

Elsewhere in the U.S. MTS, these services have evolved over time into comprehensive capabilities with minimal interruptions and periodic updates where needed. In the Arctic, however, large gaps in data, information, and investment persist. Therefore there is a corresponding gap in Federal agency capacities to deliver information services in a region so challenged by distance, changing environmental conditions, increasing scale of need and lack of resources. For example, there are no AtoNs north of the Bering Strait, except for eight buoys supporting the Red Dog mine. The AIS coverage of vessel movements in the Bering Strait and along the North Slope is a relatively new and developing technology, and not all regions have had AIS coverage for the last four years. Going forward, multi-year AIS data on vessels obtained from terrestrial-based AIS receivers and satellite receivers are needed to demonstrate de facto vessel traffic patterns and areas of high or increasing vessel use. This process would also facilitate year-to-year comparisons of vessel routes which may help plan for variability in weather and ice conditions and proposals for traffic route management and other risk reduction measures. Only through comprehensive Arctic vessel movement data, a direct product of AIS coverage, will viable traffic information, comparison, and management be possible.

On the nautical charting side, less than 1 percent of U.S. Arctic waters classified as navigationally significant have been surveyed with modern technology, which is apparent in the large areas of white indicating unknown depths and hazards to navigation on NOAA nautical charts of the region. There is virtually no communications architecture north of the Bering Strait, impacting both day-to-day operations and emergency response. Receivers and transceivers lack adequate AIS coverage to enable a full picture of traffic in the Arctic. Arctic weather forecasts and sea ice predictions are only accurate two to three days out, compared with five to seven-day predictive capabilities in the rest of the United States.

Many of these MTS services are dependent on atmospheric and oceanographic observations to meet operational requirements. Furthermore, useful forecasts of marine weather and sea ice for the Arctic Ocean require an advanced modeling system of coupled atmospheric, oceanic, wave and sea ice models and access to high performance supercomputing to integrate real time observations with complex predictive models for accurate marine weather and sea ice forecasts with useful lead times. These same observations and derived products also inform Arctic science, research and technology development, economic development, and environmental stewardship decisions. For example, bathymetric data and real-time weather, water levels, ice and currents not only support navigation safety but also U.S. Arctic oil and gas exploration and tsunami and storm surge models to protect coastal communities. Likewise, shoreline imagery can be used for erosion studies and coastal community climate adaptation decisions. Therefore, investing in MTS service delivery adds value for a far larger set of Arctic stakeholders than just immediate MTS users.

The MTS Response Services

The MTS Response Services are those services necessary to respond to marine transportation related emergencies. These include the following services:

- SAR, to find and provide aid to people who are in distress or imminent danger;

- Environmental response management, including oil spill prevention, preparedness and response, and the response technologies and MTS capabilities (vessels, personnel, materials, and equipment) necessary to effectively plan for, prepare for, prevent, respond to, and clean up oil and other hazardous wastes spilled at sea; and
- Ice-breaking capability to free vessels beset in ice or in danger; ice-breakers also support SAR efforts, spill response, and research.

The goal of an effective MTS is to ensure the safety of people and the environment. Addressing the factors that influence the likelihood of accidents and risk of environmental degradation requires a systematic approach with cooperation and partnerships. The Alaska Federal-State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases (Unified Plan) provides the blueprint for government response to oil and hazardous substance spills. The State of Alaska also utilizes the Unified Plan's ten Subarea Contingency Plans, each of which covers a different geographic region of the State including the U.S. Arctic.

Infrastructure to support response is also essential. Currently the lack of aircraft operating locations on the North Slope increases risk of failure for many SAR missions. Due to its limited Arctic presence, the USCG relies heavily on partners to execute SAR missions in the Arctic region. As noted above, communications architecture is very limited above 65°N, making both SAR and response to oil spill events very challenging. The State of Alaska has emergency response communications capabilities including UHF and VHF radios, portable and fixed microwave repeaters, and satellite systems. It has also developed partnerships with local communities to expand Alaska's oil and hazardous substance spill response readiness, and has negotiated over 35 agreements with boroughs and communities. The State of Alaska works with these boroughs and communities to improve preparedness and identify ways local response capabilities may be enhanced through training and equipment.

The USCG has one operating polar ice-breaker, the USCGC *Healy*, with another slated for reactivation in 2014. Several sources indicate a need for increased ice-breaking capability to support future increases in Arctic activity. In addition, the nearest USCG facilities and vessels supporting the U.S. Arctic for environmental response are located in Kodiak and Dutch Harbor, 800 and 1000 nautical miles, respectively, from the Arctic Circle.

The NOAA has one Scientific Support Coordinator for the Alaska/Arctic Region to support emergency spill response. This limits the agency's ability to immediately deploy spill response assets and personnel to cover incidents in the Arctic. Response times are longer and information needed to make informed decisions is not readily available. Although the Minerals Management Service (now BOEM) initiated a body of research in the 1980's, additional research is still needed on the following:

- Behavior, detection, mitigation and fate of oil on and in cold water and ice;
- Cold region shoreline cleanup;
- Baseline and current environmental conditions; and
- Spill prevention, containment, and clean up technologies and techniques appropriate for Arctic conditions and communities.

Federal actions in the near-term to address these MTS response service gaps and needs should include:

- Seeking funding to meet USCG heavy- and medium-duty icebreaker requirements;
- Investing in oil spill research to levels authorized in the Oil Pollution Act of 1990 (OPA90);
- Improving oil spill response readiness and the availability of more prepositioned spill response assets in the U.S. Arctic and training of local community members in spill response;
- Delivering scientific support to decision makers;
- Pursuing common approach to prevention and contingency planning;
- Acquiring and compiling baseline data;
- Collaborating with industry in research and technology transfer;
- Identifying current salvage capabilities and gaps;
- Developing strategies for mobilizing resources to support a large spill response event; and
- Involving local communities in response planning and preparedness.

On the international front, the United States can also continue to work with IMO to finalize the Polar Code by 2014, Maintain coordination with Russia and Canada on spill response, and implement the Arctic Oil Spill and Preparedness Agreement signed by all Arctic nations May 2013 at the Arctic Council Ministerial Meeting in Kiruna, Sweden. The Arctic States together can develop a worldwide inventory of equipment that is available for deployment in support of Arctic response, and develop guidelines for environmental response in broken ice and ice covered environments.

Vessels

Vessels are the mobile platforms necessary to move goods and people throughout the MTS. Vessel types include:

- Commercial oceangoing
- Coastal and inland vessels
- Barges
- Tugs
- Towing vessels
- Bulk carriers
- Container ships
- Military
- Fishing
- Marine mammal hunting craft
- Scientific
- Recreational, and
- Offshore structures.

The harsh Arctic conditions impose unique constraints on vessel operation in the Arctic, especially in the ice-covered waters of the higher latitudes. Icebreakers are needed for Arctic marine safety, security and science. Private companies engaged in maritime operations in the U.S. Arctic also need ice-capable vessels to safely navigate in ice-covered waters. However, at the international level, there are no specialized qualifications, training or certifications in existence for crews of vessels that operate in polar waters. U.S. participation in IMO Polar Code development will ensure guidelines for crew standards and mandatory provisions for a large share of the vessels operating or expected to operate in polar waters. Foreign ice-breaking vessels would otherwise be subject to restrictions on coastal trade operations, but they are allowed to work in ice-covered U.S. waters under an exemption that expires in 2017. Likewise, there are limited standards for crew training for vessels operating in the Arctic.

As noted earlier, Table 2 below depicts the five components of an MTS and the related sixteen elements of a U.S. Arctic MTS. The table includes a description of the activities associated with each MTS element, and provides an assessment of the element.

***Table 2*: Current Status of MTS in the U.S. Arctic**

MTS Components	MTS Element	Bering Sea (incl. Aleutian Islands)	Bering Strait Northward
Navigable Waterways	Places of Refuge for Ships	Sufficient number of ports and natural harbors available in the Aleutian Island Area that Places of Refuge are not needed. Areas near the Bering Strait being studied by USACE include: Savoonga, Gamble, Cape Darby and Port Clarence	- None - USACE is currently evaluating the harbor at Little Diomede - State of Alaska has identified 13 sites along the North Slope as potential places of refuge
	Areas of Heightened Ecological Significance	Two areas: - St. Lawrence Island - Portions of the Bering Strait	Two areas: - Portions of the Bering Strait - Chukchi Beaufort Coast
Physical Infrastructure	Ports and Associated Facilities	Ten facilities: Port of Nome, St. Michael Harbor, Port of Bethel, St. Paul, St. George, Dillingham, Port of Bristol Bay, Dutch Harbor/Unalaska, Adak, and King Cove	One facility: Port of Kotzebue
	Geospatial Infrastructure	- Nine National Continuously Operations Reference Stations (CORS) Network sites along the Aleutian Chain; - Six National CORS Network sites in Arctic coastal areas of the Bering Sea	- Seven National CORS Network sites near three coastal areas
MTS Information Infrastructure	Hydrographic Surveys	2958 nm^2 of 208,530 nm^2 navigationally significant waters	684 nm^2 of 32,470 nm^2 navigationally significant waters
	Shoreline Mapping	12,086 total linear statute miles (measured from 1:80,000 scale): 9507 st. mi. mapped prior to 1960 with obsolete technologies or not at all 559 st. mi. mapped 1960-1990 2020 st. mi. mapped 1990-2010	4827 total linear statute miles (measured from 1:80,000 scale): 2767 st. mi. mapped prior to 1960 with obsolete technologies or not at all 1040 st. mi. mapped 1960-1990 1020 st. mi. mapped 1990-2010
	Aids to Navigation (AtoN)	222 AtoNs located throughout the Bering Sea and Aleutian Islands	Eight AtoNs, mostly in Kotzebue Sound. No AtoNs along the north coast of Alaska

MTS Components	MTS Element	Bering Sea (incl. Aleutian Islands)	Bering Strait Northward
MTS Information Infrastructure	Communications	Line of Sight (LOS) and Satellite communications (SATCOM) architecture sufficient to support voice and data communication needs	- Limited LOS communications above 65°N - Limited SATCOM above 70°N
	Marine Weather and Sea Ice Forecasts	NOAA National Weather Service Forecast Office Anchorage, Alaska provides 5 day sea ice and marine weather forecasting year round; National Centers for Environmental Prediction provides forecast guidance from operational atmosphere, ocean and wave models 4 times daily; National Ice Center provides year round Arctic-wide sea ice analysis and seasonal sea ice outlooks. Arctic weather forecasts and sea ice predictions are only accurate two to three days out, compared with five to seven-day predictive capabilities in the rest of the United States. The United States lacks the capabilities of complex coupled atmosphere-ocean-wave-sea ice model and sufficient capacity of high performance computing that are required to provide accurate sea ice forecast guidance for the Arctic Ocean.	
	Oceanographic and Real-Time Navigation Information	Seven National Water Level Observation Network (NWLON) tidal stations located at Unalaska, Nikolski, Atka, Adak, Port Moller, Village Cove, Nome; 13 gaps identified	Two NWLON tidal stations located at Red Dog and Prudhoe; 13 gaps identified
	Automatic Identification System (AIS)	25 receiving stations operated by the Marine Exchange of Alaska	11 receiving stations operated by the Marine Exchange of Alaska
MTS Response Services	Vessel Escort and Icebreaking	<u>Government</u>: - One medium icebreaker, the USCGC *Healy* - One heavy icebreaker the USCGC *Polar Star*, currently undergoing reactivation, with anticipated readiness for service in late 2013 <u>Industry</u>: Shell Oil has: - In 2012 two multipurpose ice-capable vessels, including the newly built icebreaker MV *Aiviq*	
	Environmental Response Management	- All Federally permitted oil and gas activities require operators to have approved oil spill contingency plans and maintain oil spill response equipment and trained personnel on site - Closest USCG facilities capable of responding to a pollution event are Dutch Harbor, Kodiak, and Anchorage (1000, 800 and 635 nautical miles away from Alaska's Northern Slope, respectively) - Aerial Dispersant Delivery System (ADDS) staged in Anchorage	

MTS Components	MTS Element	Bering Sea (incl. Aleutian Islands)	Bering Strait Northward
MTS Response Services	Environmental Response Management	- State of Alaska has seven Response Equipment Sites south of the Bering Strait (Nome, Unalakleet, Toksook Bay, Bethel, Dillingham, King Cove and Dutch Harbor) and one north in Kotzebue. Two Emergency Towing Systems (ETS), located at Dutch Harbor and Cold Bay - Four Spilled Oil Recovery Systems (SORS) equipped on 225' buoy tenders home-ported in Alaska (*Spar*, *Maple*, *Sycamore* & *Hickory*), and one Vessel of Opportunity Simming System (VOSS) split between Anchorage and Ketchikan - USCG maintains 26 Response Equipment Caches in 19 locations throughout Alaska with three caches in the Arctic located in St. Paul, Unalaska, and King Cove - NOAA Scientific Support Coordinator for Alaska/Arctic Region - Arctic Environmental Response Management Application (ERMA) GIS for common operating picture in event of incident	
		- Two Oil Spill Response Organizations that service Western Alaska and the Aleutian Islands, however they lack open ocean capability	- Two Oil Spill Response Organizations that service the North Slope, with limited open ocean capability
	Search & Rescue/ Emergency Response	- Closest USCG Air station in Kodiak - NOAA SARSAT (satellites relaying distress signals from emergency beacon) contributions appear satisfactory - USCG currently forward deploys helicopters from Air Station Kodiak to Cold Bay, AK, and to St. Paul Island, AK, in support of the red king crab and opilio	- All Federally permitted oil and gas activities require operators to have approved contingency plans and maintain capabilities for emergency response including SAR - NOAA SARSAT contributions appear satisfactory - Limited search and rescue infrastructure and air support in the region - The closest refueling site to Alaska's North Slope for vessels is Dutch Harbor, AK, which is 1,000 nm away. The nearest USCG air facility is at Kodiak, AK, 820 nautical miles from Point Barrow, AK (northernmost point of land) - As able, USCG will forward deploy major cutter and other surface and aviation assets to USCG mission needs during the summer season

MTS Components	MTS Element	Bering Sea (incl. Aleutian Islands)	Bering Strait Northward
MTS Response Services	Search & Rescue/ Emergency Response	crab fisheries, respectively, to ensure adequate SAR response	- The North Slope Borough (NSB) Search and Rescue Department has a Critical Care Air Ambulance Service performing medevac, SAR and emergency missions throughout the North Slope Region - The 11th Air Force has three rescue squadrons capable of providing refuelable H-60s, C-130s and pararescuemen throughout Alaska
Vessels	Polar Code/Guidelines for Ships Operating in Arctic Ice-Covered Waters	- IMO currently has voluntary Polar Guidelines for ships operating in ice-covered waters - IMO is in the process of developing a Polar Code which will include mandatory provisions and recommended guidelines for most vessels operating in polar waters - The International Standards Organization (ISO) Technical Committee 67 has developed design and materials standards for offshore oil and gas structures in ice-covered waters	
	Crew Standards/ Training	- Crew standards and training are under the IMO Standards of Training, Certification and Watchkeeping for Seafarers (STCW) - The Manila amendments to STCW have provisions for standards and training of crew aboard vessels operating in the Arctic - The Polar Guidelines may include recommendations regarding manning/training issues not covered under STCW for Arctic operations	

> ***"The Arctic is not an issue for 10 to 20 years into the future. The Arctic is upon us, now. All federal, State and local agencies must prepare for full seasonal operations in the Arctic."***
>
> *RADM Arthur E. Brooks, former Commander, 17th CG District*

3 -- The U.S. Arctic MTS in Depth – Issue Papers

In the Arctic, unique geography and extreme environmental conditions have combined to shape current marine transportation activities. This chapter discusses, in greater detail, the activities identified in Chapter 2: their current status, challenges, and the future Federal actors and actions necessary to develop and maintain an Arctic MTS commensurate with user activity. These activities are not to be construed as an exhaustive list, but rather as key activities associated with a functioning Arctic MTS. This chapter addresses:

Navigable Waterways

- Places of Refuge for Ships
- Areas of Heightened Ecological Significance

Physical Infrastructure

- Ports and Associated Facilities
- Geospatial Infrastructure

MTS Information Infrastructure

- Hydrographic Surveys
- Shoreline Mapping
- Aids to Navigation (AtoN)
- Communications
- Marine Weather and Sea Ice Forecasts
- Oceanographic and Real-Time Navigation Information
- Automatic Identification System (AIS)

MTS Response Services

- Vessel Escort and Icebreaking
- Environmental Response Management
- Search and Rescue/ Emergency Response

Vessels

- Polar Code/Guidelines for Ships Operating in Arctic Ice-Covered Waters
- Crew Standards/Training

Navigable Waterways: Places of Refuge for Ships

ISSUE and STATUS:
Places of Refuge are designated pre-established locations where vessels may moor when weather or ice conditions become too severe for safe travel. Places of Refuge are also important when a vessel is unable to maneuver, experiences emergencies, or is in need of assistance, and can take action to stabilize its condition and reduce the hazards to navigation, human life, and the environment. Places of refuge can be man-made harbors, ports, natural embayment, or offshore waters that can host ships in need of assistance. A ship in need of assistance is defined as a ship in a situation which could give rise to the loss of the vessel or an environmental or navigational hazard. When a vessel is unable to maneuver, taking on water, or leaking fuel or cargo, it is sometimes best to tow it to the nearest Place of Refuge for stabilization under more controlled conditions. The second key element for effective Places of Refuge is Maritime Assistance Services to receive information and monitor a ship's status.

The M/V *Selendang Ayu*, grounded off the coast of Unalaska Island in the Aleutian Islands, December 2004.

Ports and harbors of refuge play an important role in maritime safety and pollution prevention. The lack of places of refuge and emergency response resources on Alaska's coasts along the Arctic Ocean may become a serious area of concern. This is particularly true if the anticipated increase in number of vessels passing through the Bering Strait and plying the waters of the Arctic Ocean occurs. The vessels are likely to include freighters, cruise ships, oil and gas tankers, dry bulk cargo vessels, and resupply barges.

In coming years, the provision of Arctic port facilities or Places of Refuge suitable for medium to deep draft vessels may become both a national and international imperative. Societal benefits such as national defense, emergency response and the need for avoidance of negative environmental spillover effects may result in ports being developed. Otherwise the development of these ports might not occur because of the small resident populations, modest levels of vessel traffic, and seasonality of the vessel traffic. A desired end-state is a series of ports and Places of Refuge for Ships along Alaska's Arctic Ocean coasts. These ports with associated services are to provide assistance to vessels in distress.

CASE STUDY:
The M/V *Selendang Ayu*, a Malaysian-flagged cargo ship, was carrying a cargo of soybeans from Seattle, Washington to China when it ran aground off the coast of Unalaska Island in western Alaska's Aleutian Islands on December 7, 2004. The crew reported that the vessel had lost power and was adrift off Unalaska Island. Efforts to tow the vessel failed and it went aground and broke apart. In addition to the full cargo of soybeans, the *Selendang Ayu* carried approximately 424,000 gallons of Intermediate Fuel Oil and 18,000 gallons of Marine Diesel, approximately 75 percent of which was spilled.

CHALLENGES:

- Most remote coastal Alaska communities lack the infrastructure and capabilities to respond to vessel disasters. The threat to life and property is most profound when vessels are unable to locate refuge from severe weather along the Alaska coastline.
- Studies point to the many long-term and unexpected negative effects of ship-based pollution, such as oil spills, on Alaska coastal ecosystems.
- Harbors of refuge are not normally required through Southeast Alaska and along the Aleutian Chain because there are a large number of natural anchorages and sheltered bays in these regions. However, the coastlines of the Chukchi and Beaufort Seas are generally too shallow for large deep-draft ships, or even relatively shallow-draft ships, seeking shelter.
- The lack of places of refuge and emergency response resources on Alaska's North Slope, and the coastline from Nome to Wales, is likely to become a particular area of concern.
- Research is needed on Arctic shipping route analysis to identify the critical areas for locating harbors of refuge and port facilities.

CURRENT ACTIVITIES:

In 2008, the first Alaska Regional Ports Conference convened to discuss issues faced by Alaska's ports and harbors. Local, state, and Federal government officials discussed infrastructure and service needs with statewide port and harbor managers, staff, and users. The overwhelming mandate from this group was the need for ongoing collaboration, comprehensive planning, and leadership to meet Alaska's future needs. The second Regional Ports Conference held in 2010 issued a report which provides a summary of research and analysis. It incorporates feedback and suggestions made by the U.S. Army Corps of Engineers (USACE), Alaska Department of Transportation and Public Facilities (ADOT&PF), and the Denali Commission.

A joint effort of the Alaska Department of Environmental Conservation and USCG, working with local borough, city and village leaders, has led to the development of potential places of refuge, (PPOR) documents, which may be found in the Federal/State subarea plans for oil and hazardous substance spills/releases for nine of the ten subareas in Alaska. Theses joint Federal/State subarea plans identify potential places of refuge.

FUTURE FEDERAL ACTIONS NEEDED:

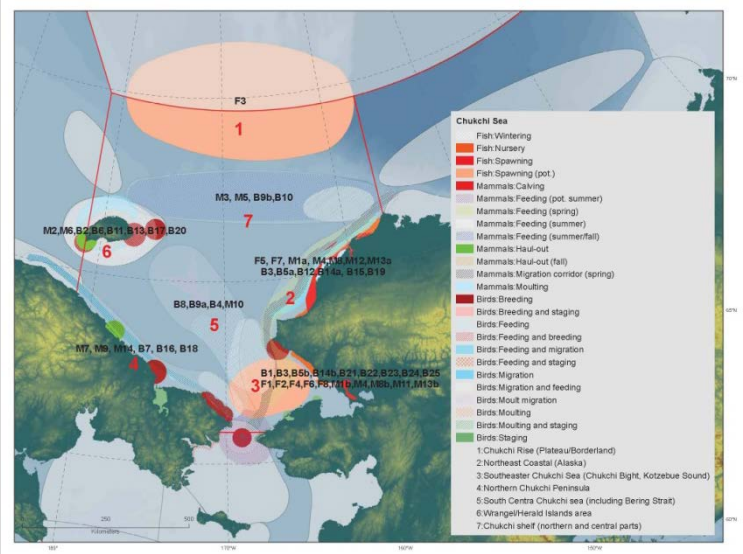
- Continue coordination for the development of an Alaska Regional Ports Planning process with methods developed for prioritization based on public safety (harbors of refuge), economic development, and regional support to communities.
- Consult with Federal agencies and state and local interests to determine what improvements are necessary to designate a potential place of refuge for ships in the Central Bering Sea.
- Develop a whole of government approach and consideration of public-private partnerships for funding the development of port projects.
- Establish a series of ports of refuge along northwestern and northern Alaska with associated services to provide assistance to vessels in distress.

NON-FEDERAL PARTNERS:

- Oil and gas, shipping, and tourism industries
- State of Alaska
- Local coastal communities
- Native Corporations
- Local and Tribal Governments
- University of Alaska

Navigable Waterways: Areas of Heightened Ecological Significance

ISSUE and STATUS:
Areas of ecological significance exist along the Alaskan west, northwest and northern coasts. Utilizing international criteria, one area in the southern region and two areas within the northern region of the U.S. Arctic have been identified as having heightened ecological significance: the St. Lawrence Island area in the south and the Bering Strait and the Chukchi-Beaufort Coast areas in the north (see Figure). The St. Lawrence Island and the Bering Strait areas span both U.S. and Russian Federation waters while the Chukchi Beaufort Coast area lies completely within U.S. waters.



Areas of ecological significance in the Bering Strait, Chukchi Sea, and western Beaufort Sea. (*AMSA* IIC, 2012)

These are important habitats and ecosystems at risk from possible impacts of vessel activity and shipping, such as physical presence, noise and oil spills.

CASE STUDY: *(from AMSA IIC report)*

- Area 1 -- St. Lawrence Island area: The majority of the world's population of spectacled eiders resides in the St. Lawrence Island area for six months of the year. Additionally, the region provides key habitat for alcids, kittiwakes, shearwaters, overwintering Pacific walrus, bowhead whales, ice seals, and polar bears.
- Area 2 -- Bering Strait: The unique oceanographic conditions supports key breeding, pupping and calving, feeding and/or migratory habitat for many species of marine mammals including bearded, ringed and spotted seals; Pacific walrus; and, gray, bowhead and beluga whales. It supports large populations of forage fishes and seabirds.
- Area 3 -- Chukchi-Beaufort Coast: This transitional system between landfast and drifting ice provides migratory corridors for bowhead, beluga and gray whales, polar bears, and Pacific walrus. It also supports productive subsistence fisheries, benthic communities and various seabird populations, particularly under rapidly changing environmental conditions.

CHALLENGE:
A better understanding of the ecosystem level dynamics as well as habitats and species populations requires more baseline research.

CURRENT ACTIVITIES:

The Alaska Federal / State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/ Releases (Alaska Unified Plan) identifies sensitive marine and coastal areas of the U.S. Arctic. The Alaska Unified Plan coordinated response to discharges or releases anywhere within the boundaries of Alaska and its surrounding waters, includes Sub-area plans for the Bering Sea, the Aleutian Islands, and the Arctic Ocean. The ongoing Aleutian Islands Risk Assessment being conducted by the National Fish and Wildlife Foundation, U.S. Coast Guard (USCG) and State of Alaska Department of Environmental Conservation will also assess risks to resources from maritime transportation in the Bering Sea and the Aleutian Archipelago. The Alaska Department of Environmental Conservation, working with local borough, city and village leaders, and the USCG, is developing geographic response strategies for the shorelines of the Western Alaska and the Northwest Arctic Subareas. These strategies identify the environmentally and culturally sensitive locations along the Alaskan coast. In addition, the North Slope spill response cooperative Alaska Clean Seas has mapped approximately 200 locations as "priority protection areas." Lastly, in response to the Arctic Council's AMSA 2009 Report recommendations, the Arctic Council and other organizations have been involved in mapping ecologically significant areas in the Arctic, including Alaska.

FUTURE FEDERAL ACTIONS NEEDED:

- Continue support of the Bureau of Ocean Energy Management (BOEM) Environmental Studies program, U.S. Geological Survey Alaska Science Center research, and NOAA research efforts including more coordination between BOEM and NOAA under the Research Memorandum of Understanding (MOU).
- Continue to conduct "science of opportunity" flights during operational C-130 patrols in the Arctic.
- Continue to support research agencies during icebreaker deployment in the Arctic.
- Increase government and industry collaboration and information/data sharing such as facilitated by the MOU between NOAA and Shell, ConocoPhillips, and Statoil for collaboration in coastal and ocean science in U.S. Arctic waters.
- Increase collaboration between government and academic coastal and marine science programs such as the agreement between BOEM and the Coastal Marine Institute of the University of Alaska.
- Increase observations: e.g., in-situ atmospheric profiles, stream real-time water level data from tide gauges; tidal measurements to enable development of seamless bathymetric - topographic digital elevation models.
- Negotiate, fund, and implement an agreement with Russia on Particularly Sensitive Sea Areas, vessel traffic management, and associated protective measures for identified areas of heightened ecological or cultural significance in the Bering Strait under IMO.

NON-FEDERAL PARTNERS:

- Non-Governmental Organizations including:
  - International Union for the Conservation of Nature
  - Natural Resources Defense Council
  - World Wildlife Fund
  - Village and Regional Native Corporations
  - National Fish and Wildlife Foundation
- University of Alaska
- State of Alaska
- Local and Tribal Governments
- Arctic Council
- IMO
- Russian Federation
- Oil/gas and other industries

Physical Infrastructure: Ports and Associated Facilities

ISSUE and STATUS:
Ports and harbors and their associated infrastructure are extremely important in Alaska for both export and import of cargo, raw materials and natural resources. Inbound cargo far exceeds all outbound cargo. Inbound cargo includes groceries, medical supplies, retail goods, vehicles, and construction materials. The Port of Anchorage serves over 80 percent of the state's population and handles over 90% of all consumer goods sold in Alaska. Anchorage is also the State's only large multi-modal port with access to highway, rail, and air transport systems. Most of the State's 350-plus communities lack road and rail access; therefore air transport or barging are the primary movers of supplies and resources.

The Arctic Council and its Protection of the Marine Environment working group note that the absence of major Arctic ports and other critical infrastructure pose significant limitations to proposed Arctic shipping routes. Northwest and northern Alaska need port infrastructure, including port reception facilities, to support shipping and carry out emergency response and Search and Rescue (SAR) activities. Mariners also need places of refuge so that vessels have a safe place to wait out storms, handle emergencies, and receive assistance.

The geographic characteristics of Alaska pose a challenge to regional deep water port development, especially in the more northern regions. For example, shallow coastal waters occur along much of the Bering Sea (including Norton Sound), Chukchi Sea, and Beaufort Sea. Nearly all potential port development locations in these areas would require a dredged channel at least one to two miles in length to accommodate vessels that are Panamax-size or larger. For example, Teck Alaska, Inc., is considering constructing a direct load facility for zinc concentrate from the Red Dog mine. The facility would require a 3- to 4-mile long ship channel dredged to about 53 feet. Dredging is also required in other parts of Alaska to maintain ship passage into port facilities. At the Port of Dutch Harbor, containerships often have to operate at weights below their full capacity to access port facilities. As shipping companies employ larger containerships in the future, the need for dredging will increase.

Constructing and maintaining infrastructure projects across Alaska is expensive, particularly in rural areas. The cost of constructing buildings in remote areas is on the order of twice as much per square foot as in Anchorage. The higher construction costs in rural Alaska are due to higher costs of construction aggregate (often barged in because they are difficult to source locally); limited road and rail networks resulting building materials having to be barged or flown in; limited supplies of local specialty labor (mechanical, electrical); permafrost soils resulting in challenging foundation conditions; weather delays; remote logistics; and the high cost of fuel. Moreover, the harsh winter climate of Alaska significantly shortens both the construction season and the useful life of roads and other infrastructure.

State and Federal funding for port construction and maintenance often requires contributions from private industry either in initial development costs or through user fees. In some cases, private industry

CHALLENGES:
- High construction costs and intense competition for limited statewide funding.
- Pressure from global trends in shipping and maritime transportation.
- Rural coastal communities have small populations and financial bases and lack existing infrastructure due largely to geographic and seasonal constraints.
- Poor communication among stakeholders; poor alignment of agency policies and priorities.
- The absence of a long-term marine and riverine transportation plan.

is the development agent (Prudhoe Bay and Red Dog Mine ports). The planned oil exploration activities in the Chukchi Sea point to the need for partnership in planning and construction of future port and related infrastructure projects, such as the deep draft ports being considered for the City of Nome, Port Clarence, and Cape Riley as part of the State of Alaska's and the U.S. Army Corps of Engineers' (USACE) Alaska Deep-Draft Arctic Ports Study begun in 2012. A significant oil or gas discovery leading to production would result in the development of at least one major port facility on the Arctic coast. New infrastructure associated with the production facilities and pipelines would likely be linked to other development projects and result in increases in Arctic maritime traffic.

CURRENT ACTIVITIES:

- In 2008, the first Alaska Regional Ports Conference convened to discuss issues faced by Alaska's ports and harbors. Local/state/federal government officials discussed infrastructure and service needs with port and harbor managers, staff, and users. The 2010 Regional Ports Conference further defined needs raised by USACE, the Alaska Department of Transportation, and the Denali Commission.
- The USACE has continued this effort with the identification of regional hub and sub-regional ports throughout Alaska. South of the Bering Strait, the regional ports include Nome, Unalaska/Dutch Harbor, and Emmonak/Alakanuk with sub-regional ports at Adak, Dillingham, Naknek, and Port Clarence. North of the Bering Strait, regional ports include Kotzebue, Barrow, and Prudhoe Bay with no sub-regional ports identified.
- A master project list was developed of all current and future port requirements with a system of prioritization for funding developed based on criteria (in order) of public safety, economic development, regional support and impact to the communities, existing infrastructure needs, operations and maintenance, cost/benefit, sustainability, and intermodal access.
- In 2013, the United States will participate in the Arctic Council's Arctic Maritime and Aviation Transportation Infrastructure Initiative (AMATII). The AMATII will conduct an intermodal assessment of current transportation infrastructure in the Arctic from an international perspective; analyze needs resulting from increased traffic, resource and economic development; and conduct a gap analysis.
- Also in 2013, USCG will follow the USACE port study with additional analysis on the feasibility of establishing an Arctic deepwater port in the context of strategic U.S. interests in the region.

FUTURE FEDERAL ACTIONS NEEDED: Several impediments to port and harbor development were identified and most are directly impacted by funding. Future actions include:

- Continue USACE/ADOT&PF study process on feasibility and planning for a deep-draft Arctic port.
- Continue building coordinated/prioritized list of ports/harbors for development.
- Review and incorporate AMATII baseline guidance into infrastructure development decisions.
- Modify USACE's Benefit-Cost Ratio (which favors large population centers) to allocate Federal funding.
- Explore greater use of public-private partnerships, especially with resource development projects to ensure that infrastructure development occurs with all aspects of the Arctic MTS considered.
- Develop a system of regional hub and sub-regional ports to facilitate resource development, shipping of goods and services, and carry out emergency response and SAR activities.

NON-FEDERAL PARTNERS:

- State of Alaska
- Local coastal communities
- Oil and gas, shipping, tourism, mining and other industries
- University of Alaska
- Village and Native Corporations
- Local and Tribal Governments

Physical Infrastructure: Geospatial Infrastructure

ISSUE and STATUS:

Climate change in Alaska and the Arctic is causing loss of sea ice and permafrost thaw, changes in sea levels and eroding coasts. These changes have implications for a host of coastal and marine activities such as shipping, oil/resource development, fishing, tourism, subsistence livelihoods and scientific exploration, as well as impacts on existing infrastructure, adaptation plans, new construction and supporting work such as mapping and nautical charting for navigation safety.

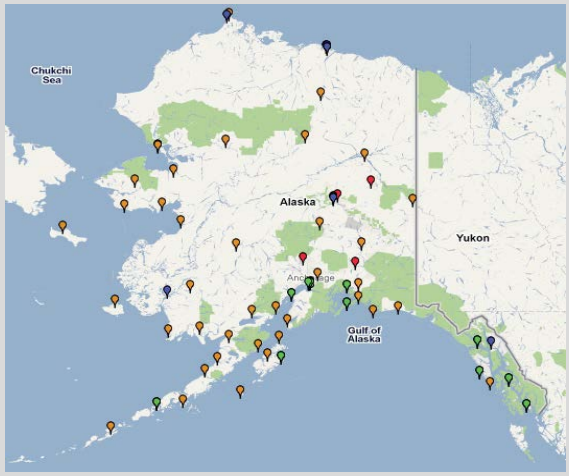


Figure: NOAA's Alaska Continuously Operating Reference Stations (CORS) receiver installations.

One important aspect underlying every one of the activities above is the need for accurate positioning through geodetic and tidal control. There are two major components: spatial reference (through geodetic datums) and vertical water levels reference (through tidal datums). However, because the U.S. Arctic has been relatively inaccessible, this region lacks the same basic geospatial infrastructure provided by NOAA to the rest of the Nation (see Figure). In particular, elevations relative to sea level can be off by more than a meter in the Arctic.

Because the region lacks the gravity data necessary for a modern vertical reference system, NOAA is working to improve the Arctic geodetic framework to ensure greater accuracy and precision in positioning for latitude, longitude and height. This precision is particularly important for hydrographic surveying and shoreline mapping to produce nautical charts and other products necessary for safe marine transportation. Highly accurate positions (both horizontal and vertical) of water depths, critical hazards, aids to navigation, shoreline, water levels and other features are essential for navigation. This same geodetic control is also important for coastal communities racing to adapt to the changing Arctic conditions, as Arctic residents seek to monitor sea levels, make decisions to harden or abandon infrastructure, and develop emergency plans in the face of stronger coastal storms and eroding coastlines.

CASE STUDY:

There is a gap in Arctic geospatial positioning capability, resulting in a lack of information for safe marine transportation, sea-level change, erosion, and permafrost thaw impacts to coastal infrastructure, energy development, and storm surge modeling. As noted above, the Arctic region currently faces substantial positioning errors of a meter or more. To improve positioning in all three dimensions, NOAA must continue to collect gravity data and to add CORS and NWLON stations. Co-locating CORS with new NWLON stations would significantly improve the extremely limited coverage in northern and western Alaska for precise positioning and water levels.

CHALLENGES:
Improving infrastructure in the Arctic is more difficult than in the continental U.S. because of the narrow window available for field work and mobilizing to these remote Arctic areas is expensive. The NOAA has the ability to increase the density of the infrastructure in the Arctic, but it lacks the resources.

CURRENT ACTIVITIES:

- The NOAA defines, manages, and provides public access to the National Spatial Reference System (NSRS), the coordinate system and framework for all positioning activities in the Nation (defining latitude, longitude, and elevation, scale, gravity, and orientation).
- The NOAA is working to collect airborne gravity data across Alaska as the most cost-effective way to establish vertical geodetic control in these areas (i.e. the GRAV-D program).
  - New gravity data will enable improved elevation measurement accuracy from one meter (or worse) to approximately two centimeters.
  - NOAA expects to cover most of Alaska, with the exception of the Aleutians, by 2013.
- The NOAA also manages the CORS network of highly accurate GPS receivers to support three dimensional positioning, meteorology, space weather, geophysical applications and other applications requiring precise positioning such as navigation.
  - The NOAA is working with partners to add CORS stations to the network to fill critical gaps in coverage for Alaska.
  - However, CORS stations serving the Alaskan Arctic are very few, with only nine CORS Network sites along the Aleutian Chain, six in Arctic coastal areas of the Bering Sea, and seven serving the North Slope.
- The NOAA operates and maintains the National Water Level Observation Network (NWLON) that provides the vertical reference for tidal datums along the Nation's coasts.
  - The NOAA operates only nine long-term NWLON stations in the Arctic, with a minimum of 18 more needed.

FUTURE FEDERAL ACTIONS NEEDED:

- Work with Federal partners such as the Federal Aviation Administration and Navy to collect gravity data.
- Improve geoid accuracy in Arctic focus areas from one meter or greater to centimeter accuracy.
- Fill critical CORS and NWLON gaps in Alaska/Arctic, and co-locate them along the coast, should resources materialize.
- Install a subset of foundation CORS in the region to improve the accuracy of the International Terrestrial Reference Frame to a level capable of measuring absolute global sea level rise on the order of millimeters per year. This system describes procedures for creating reference frames suitable for use with measurements on or near the Earth's surface.

NON-FEDERAL PARTNERS:

- Plate Boundary Observatory
- University of Alaska-Fairbanks/other academia
- BP Exploration (Alaska)
- State of Alaska
- Other CORS partners

MTS Information Infrastructure: Hydrographic Surveys and Nautical Charts

ISSUE and STATUS:

As Arctic transits and access to Arctic resources become more feasible, national security and commercial interests, including the cruise and eco-tourism industry; oil, gas, and mining industries; shipping; and fishing, represent the primary drivers for Federal delivery of adequate navigation services in U.S. Arctic waters. Ships operating in the Arctic environment must contend with difficult weather, sea states and variable ice conditions that can impact stability and navigation. Poor communications, navigation aids, and nautical charts exacerbate these difficulties.

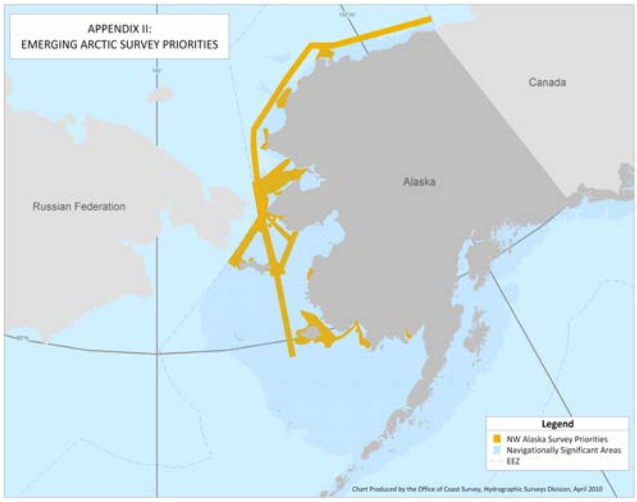


Figure: Alaska's navigationally significant waters and NOAA priority survey areas

As the agency responsible for charting all U.S. waters in support of safe and efficient navigation and maritime commerce, NOAA conducts hydrographic surveys, analyzes the data, and produces nautical charts showing water depths, aids to navigation, dangerous obstructions, shoreline, and other key elements to improve a mariner's situational awareness. These data are also useful for many other purposes, such as coastal ocean science, community climate change adaptation strategies, emergency response and coastal zone management. However, NOAA lacks sufficient data to provide the same level of navigation services to the Arctic as in other parts of the Nation. Old data are the norm, and there are large gaps in the information that NOAA does have, illustrated by empty white space on nautical charts of the region. Stakeholder dialogues and U.S. Coast Guard (USCG) cutter expeditions in 2007 and 2008 validated the need for more accurate and up-to-date nautical charts in the region, as well as the shortcomings of NOAA's existing data.

CHALLENGES:

Overall, NOAA has the capability and expertise to survey and chart Arctic waters, but is challenged by lack of resources. Most Arctic waters that are charted were surveyed with obsolete technology, some dating back to the eighteenth century, before the region was part of the United States. Although a third of U.S. Arctic waters are classified as navigationally significant (roughly 242,000 square nautical miles, see Figure), only about 3200 square nautical miles (less than 1 percent) have been surveyed with modern multi-beam technology. Research and development into new underwater and airborne technologies able to withstand the rigors of the Arctic environment will help to fill gaps in hydrographic datasets.

CURRENT ACTIVITIES:

- The NOAA plans to survey about 500 square nautical miles in the Arctic each year using the NOAA ship *Fairweather* and/or contracts, with data archive/accessibility via NOAA's National Geophysical Data Center for multiple uses.
- The NOAA is also developing an Arctic surveying partnership plan, where Navy, USCG, State of Alaska vessels and other ships of opportunity would acquire survey data en-route between Dutch Harbor and the Arctic Ocean to send to NOAA for analysis and charting.
  - Employing this Integrated Ocean and Coastal Mapping (IOCM) concept would result in more accurate data along the most utilized Arctic open water routes.
  - The NOAA could then focus its resources on the more challenging coastal areas in need of survey for harbors of refuge, port access and coastal community resilience.
- Prioritizing survey and charting work is underway to make best use of existing resources.
  - In 2011, NOAA conducted an assessment of the existing Arctic nautical charts to validate the demand for additional chart coverage. The NOAA produced the Arctic Nautical Charting Plan to better address user needs for larger scale charts of the region as resources are available.
  - In 2012, the NOAA ship *Fairweather* completed a 30-day reconnaissance survey from Dutch Harbor through the Bering Strait and east through the Chukchi and Beaufort Seas to the U.S.-Canadian maritime boundary. The mission was to help determine future charting survey projects in the Arctic; it covered sea lanes that were last measured by Captain James Cook in 1778.
  - The NOAA will also factor in the results of ongoing USCG Waterway Analysis and Management System (WAMS) assessments and Port Access Route Studies (PARS) of the Arctic region to support decisions on mapping and charting priorities.

FUTURE FEDERAL ACTIONS NEEDED:

- Establish mapping guidelines, standards, vessel of opportunity protocols, and standard operating procedures to facilitate IOCM and acquisition of Arctic hydrographic, shoreline, habitat mapping, and water column data in the Bering, Chukchi, and Beaufort Seas.
- Survey a minimum of 500 square nautical miles a year in U.S. Arctic waters.
- Update nautical charts, environmental sensitivity indices, and other Arctic feature maps with mapping data acquired during annual field seasons.
- Consult coastal communities for input to enhance Coast Pilot in Alaska.
- Refine, with stakeholders and traditional knowledge, survey priority list of Arctic maritime regions.
- Conduct coordinated interagency ocean and coastal mapping operations and incorporate results into the Ocean and Coastal Mapping Inventory.
- Conduct WAMS and PARS of the Arctic region, beginning with ongoing PARS for the Bering Strait, and incorporate into decisions on mapping and charting priorities and waterways management.
- Complete electronic navigational chart coverage as agreed to by the Arctic Regional Hydrographic Commission.
- Should resources come available, NOAA would task the Survey Vessel *Rainier* to the Arctic, use a NOAA fishery research vessel to survey, or contract for hydrographic data in the region.

NON-FEDERAL PARTNERS:

- State of Alaska
- Research Institutions/Academia
- Private Sector
- Local and Tribal Governments

MTS Information Infrastructure: Shoreline Mapping

ISSUE and STATUS:

One of NOAA's critical missions is to survey and map U.S. coastal regions to provide the Nation with an accurate, consistent, up-to-date national shoreline. This supports navigation safety, maritime security, and environmental protection from oil spills and other hazardous events, as well as effective climate adaptation, coastal community resilience, coastal erosion and marine spatial planning strategies. The national shoreline provides the critical baseline data for demarcating U.S. marine territorial limits, including its Exclusive Economic Zone, as measured from the low-water line depicted on large-scale nautical charts. NOAA compiles and attributes shoreline and associated features (piers, jetties, potential hazards to navigation, etc.) from tide-coordinated stereo photography, satellite imagery, and Light Detection and Ranging (LIDAR) data, and maintains national standards for shoreline mapping. NOAA regularly uses both government and commercial satellite imagery to support nautical charting and shoreline verification.

Wrangell, Alaska. Features added include Mean High Water, Mean Low Water, obstructions, dangers, and aids to navigation.

Accurate shoreline is a key feature of Maritime Domain Awareness and waterways management. It not only supports oil spill response and navigation from a charting standpoint, but it is also the basis for application and enforcement of maritime laws and regulation of foreign-flagged vessels. Shoreline and topographic features are an essential element of the nautical chart, enabling mariners to pinpoint where they are relative to the coast, navigate to

CASE STUDY: At nearly 50,000 miles long, Alaska represents over half of the U.S. coastline. Of this, approximately 36,000 miles were mapped prior to 1960 with obsolete technologies. 3500 miles were mapped in the 1980's and 4300 miles have been mapped since 2000.

CHALLENGES:

As noted above, most of the shoreline in the Arctic along Alaska's northern and western coasts has not been mapped since 1960, if ever, and confidence in the shoreline depicted on the region's nautical charts is extremely low. Less than 10% of Alaska has contemporary shoreline data and less than 1% is mapped annually. To best support the U.S. Arctic MTS and other activities, mapping data is needed to understand baseline conditions and put more accurate navigation tools into the hands of mariners, resulting in reduced risk of maritime incident, loss of life, and environmental damage. Access to additional sources of shoreline imagery and development/use of new technologies such as Unmanned Aerial Systems (UAS) are both gaps and potential strategies for increasing the quantity of new shoreline data acquisition.

and from ports safely, and find harbors of refuge when in need. Many other activities rely on NOAA shoreline mapping, such as emergency response, long-term sea level trends, storm surge/tsunami modeling and warnings, floodplain mapping, coastal zone management, and climate services, but the Arctic is clearly deficient in shoreline updates.

Understanding and managing effectively in a regime of Arctic change requires significant and accurate shoreline mapping data, not only for safe marine transportation. The 2008 Alaska Climate Impact Assessment Commission observed that "accurate shoreline maps are essential to develop accurate coastal erosion and storm surge forecasts, and address land-use issues." The commission went on to state: "updates to technical maps require an accurate vertical datum—airborne sensors and topographic lidar technology would produce accurate shoreline measurements to address sea level rise and coastal erosion issues." As Arctic access increases, the evidence of NOAA's resource limitations for regional shoreline mapping grows.

CURRENT ACTIVITIES:

The NOAA has the capabilities needed to support Arctic shoreline mapping requirements for safe navigation and coastal stewardship, but lacks the resource capacity to acquire the significant amount of data needed. Current resources enable NOAA to acquire approximately 390 statute miles of Arctic shoreline a year. The NOAA will also continue its strategy of leveraging opportunities to map if/as they materialize, including using imagery made available by other parties. For example, NOAA maintains ties to federal partners such as NASA, the U.S. Army Corps of Engineers and the U.S. Geological Survey to coordinate on their mapping efforts for maximum gain.

FUTURE FEDERAL ACTIONS NEEDED:

- Map a minimum of 390 miles of shoreline annually for more accurate Arctic nautical charts and national shoreline delineation (ongoing; more resources will acquire more data).
- Process and compile for nautical charts and other shoreline-dependent uses.
- Pursue leveraging opportunities to acquire and/or validate Arctic shoreline imagery.
- Refine, in collaboration with stakeholders, a priority list of Arctic shorelines for mapping.
- Continue exploring use of new technologies such as Unmanned Aircraft Systems for shoreline data acquisition.
- Incorporate into standard operating procedures if technology proves feasible and affordable.
- Continue support for ShoreZone-Shoreline Mapping of the North Slope of Alaska.

NON-FEDERAL PARTNERS:

- State of Alaska
- University of Alaska-Fairbanks
- Non-governmental organizations

MTS Information Infrastructure: Aids to Navigation

ISSUE and STATUS:

The International Association of Marine Aids to Navigation and Lighthouse Authorities defines the term "Marine Aids to Navigation" (AtoN) to be a device, system or service, external to vessels, designed and operated to enhance safe and efficient navigation of individual vessels and/or vessel traffic. Aids to navigation systems are developed, established, operated and maintained for navigators to: (1) assist in determining their position, (2) assist in determining a safe course, (3) warn of dangers and obstructions, (4) promote the safe and efficient movement of commercial vessel traffic, (5) promote the safe and efficient movement of military vessel traffic, and cargo of strategic military importance.

Aid to Navigation Tower established 4 miles South of Point Hope, AK, on August 2, 2010.

In the United States, the AtoN system includes visual, audio, radar, radio and radio-augmented aids to navigation, Global Positioning System (GPS), AIS and long-range tracking, Vessel Traffic Services, and various marine information services. The U.S. AtoN system is operated and maintained primarily by federal means, with some provisions for privately maintained AtoN, and some services operated commercially (e.g., AIS receiving stations).

CASE STUDY:

Following a 2009 WAMS, the establishment of the only AtoN North of the Arctic Circle was approved for Point Hope, Alaska, on the Chukchi Sea coast. The 15 foot structure was completed on August 2, 2010, and will enhance safety of area subsistence users, as well as increase safety for maritime traffic. This structure replaces the Point Hope Light that was that was decommissioned in 1985.

CHALLENGES: Application of effective AtoN measures in the Arctic is a complex endeavor requiring:

- Adequate charts, which rely on geodetic control infrastructure, hydrographic survey, etc.;
- Prioritization of potential locations for ports, associated marine traffic routes, and harbors of refuge;
- Port Access Route Studies (PARS) for any potential ships' routing measures;
- Waterways Analysis and Management Study;
- Development of technology for Arctic AtoN and guidelines for application in the Arctic;
- Coordinative efforts through the International Maritime Organization (IMO);
- AIS coverage of the Arctic; and
- Filling the gap in AtoN services for the northern coast of Alaska, which is expected to see increased vessel variety and activity. Channel marking buoys and other visual aids to navigation cannot be used where moving ice masses would render them off-station or unusable.

CURRENT ACTIVITIES:

At this time, there are no visual aids to navigation along the north coast of Alaska. However, there are limited AtoN (8) north of the Bering Strait in support of the Red Dog mine, and 222 AtoN from the Bering

Strait to the Aleutian Islands chain due to greater number of ships transiting this area along the Great Circle route between North America and Asia, and vessels transiting the Northern Sea Route. In addition, there is 100 percent GPS coverage, 30 AIS receiving stations, and the NOAA National Weather Service Forecast Office Anchorage, Alaska, provides five-day sea ice and marine weather forecasting year round. Finally, NOAA has surveyed just over 3600 nm^2 of the 242,000 nm^2 of navigationally significant U.S. Arctic waters.

The USCG is conducting a Waterways Analysis Management System (WAMS) assessment along the western and northern coasts of Alaska, and a PARS study for the Bering Strait. The WAMS ensures that current aids are necessary elements of the AtoN system in particular waterways. It also evaluates the aids to determine their effectiveness and identification of aid alterations and establishment or disestablishment of aids in order to meet changing needs in waterways. The PARS will evaluate and recommend routing and related safety of navigation measures for ships in the Bering Strait. Completion of the PARS is the first step toward IMO promulgation of ships' routing measure in international waters and straits. After the PARS is completed, the United States, in cooperation with the Russian Federation, expects to present recommendations to the IMO for routing measures and other controls for the Bering Strait designed to reduce navigation risks from increased shipping. Such measures may also reduce potential adverse impacts to environmentally sensitive areas and disturbances to marine mammals.

FUTURE FEDERAL ACTIONS NEEDED:

In conjunction with PARS in the region, future Federal action should consider geographic, navigational, and user requirements to evaluate the range of services that are needed.

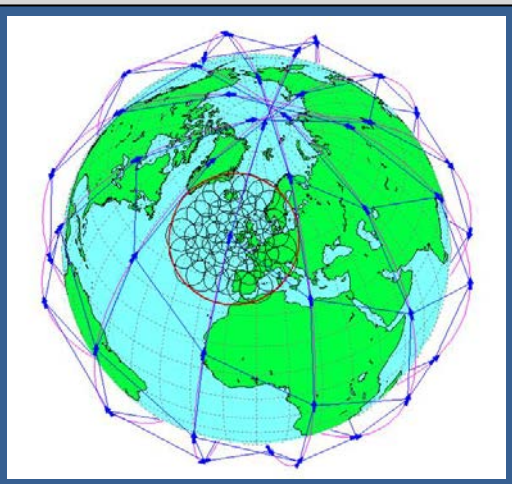
- Near Term
  - Prioritize hydrographic survey efforts, and publish updated charts;
  - Continue Extended Continental Shelf data collection, as required;
  - Improve daily to weekly sea ice forecasts and delivery means including use of AIS; and
  - Complete PARS and WAMS for the Bering Strait.
- Long Term
  - Establish Geodetic Control Infrastructure, as able, throughout U.S. Arctic;
  - Implement measures resulting from PARS and WAMS in the Bering Strait, coordinating with the Russian Federation and Canada to ensure compatibility in accordance with international standards/agreements;
  - Execute ongoing strategy for hydrographic survey;
  - Continue developing nautical chart portfolios for U.S. Arctic as survey efforts progress;
  - Initiate PARS and/or WAMS) assessment for areas in the U.S. Arctic deemed necessary or appropriate;
  - Pursue technological solutions/alternatives to physical AtoN in areas of the Arctic where ice is present (e.g., "Virtual" AtoN) and promote international standards for deployment Coordinate Vessel Routing Measures, as appropriate, via IMO.

NON-FEDERAL PARTNERS:

- State of Alaska
- Native Corporations
- Local coastal communities
- Energy, Shipping, and other industries
- Scientific and academic communities
- Marine Exchange of Alaska
- Russian Federation
- Canada
- IMO for traffic separation schemes or other routing measures in the Bering Strait and its approaches

MTS Information Infrastructure: Communications

ISSUE and STATUS:
Reliable communications will become increasingly important in the Arctic Region as activity grows. The U.S. Government has wide-ranging responsibilities in the region, such as defending and protecting U.S. interests, search and rescue, and environmental response. Vast distances, lack of communications architecture, harsh weather conditions, and high latitude ionic disturbances combine to make communications in the Arctic difficult. Stakeholders have identified a need for improved vessel-to-vessel and ship-to-shore communication capabilities, to include satellite communications.



Iridium Commercial SATCOM are reasonable alternatives for communications in the Arctic.

Currently, there is very limited terrestrial and Line of Sight (LOS) communications architecture above 65ºN. Atmospheric factors that affect radio wave propagation limit and degrade all LOS communications methods supporting voice and data circuits. Terrestrial communications architecture was constructed to serve small local populations, with limited expansion capability. Little to no architecture exists in the region to communicate with mariners as most U.S. Department of Homeland Security (DHS) equipment is concentrated in southern Alaska for the purpose of communicating with the large commercial fishing fleet.

There are limited options to obtain high capacity, assured communications in the region. High Frequency (HF) communication is a part of the DHS and U.S. Department of Defense (DOD) current architecture, but the HF coverage is sporadic and generally considered to be unreliable in the Arctic. Most satellite communications (SATCOM) systems are not designed to provide coverage in the high-latitudes, with most systems stopping at 65N (Fairbanks), and a few to 70N (Deadhorse). In the mid latitude region, DHS and DOD can share a common DOD/commercial diverse satellite architecture. However, in the Arctic, DOD has limited capability designed to only support critical Command and Control (C2), and will not support the full range of interoperable networks between DOD forces and its mission partners (DHS, other nations, local, commercial).

CHALLENGES: Without adequate LOS communications capabilities in the Arctic, DHS is hindered in its ability to support Security and Safety of Life at Sea (SOLAS) and environmental response missions. Communications failure during a SOLAS mission may result in loss of life, property, and increased environmental damage. The inability to provide C2 will significantly impair DHS's ability to respond.

As DHS and DOD expand Arctic operations (e.g. improving maritime domain awareness, tracking and responding to potential threats, and ensuring C2 of theater and national forces, interfacing with mariners, and responding to regional disasters), the planned architecture does not have sufficient coverage, capacity, latency or diversity to meet the demand of increased activity. The lack of beyond LOS communications architecture already impacts current operations, a situation expected to worsen.

CURRENT ACTIVITIES:

High-data-rate SATCOMs are sparse, but commercial low-rate service is available over an Iridium satellite network. Although 15 satellites are currently in polar orbit with another 7 in development, the majority of satellites support the collection of scientific data and not communications. Shell Oil, operating offshore in the Alaskan Arctic, uses a navigation assistance program, Blue Sky, to provide voice, vessel tracking, and/or two-way messaging to ensure reliable maritime communication over an Iridium satellite network.

The DOD and DHS have established an Arctic Capabilities Assessment Working Group (CAWG). Both DOD and DHS long-term strategies focus on establishing a robust communications architecture based on studies completed in the near-term, and on ensuring communications equipment is designed to work in the Arctic environment, while maximizing interoperability with each other and other mission partners.

FUTURE FEDERAL ACTIONS NEEDED:

- General
  - Complete inventory of existing DHS, DOD and partner communication capabilities in the Arctic region.
  - Continue pursuit of partnerships with State, borough, Tribal, industry, and other Arctic nations to enhance Arctic communications capability.
  - Coordinate with Alaska Statewide Broadband Task Force and National Public Safety Broadband Network.
- For LOS communications
  - Identify needed improvements in both voice and video data transmission.
  - Assess the possibility for the use and pre-staging of cell towers in key locations to increase local coverage and capacity during expanded or contingency operations in the region.
  - Continue to engage private industry to discuss Arctic communication capability needs.
  - Align Arctic communication strategies with the President's National Public Safety Broadband Network and continued pursuit of partnerships with other State, borough, Tribal, industry, and countries to enhance DHS and DOD's communications capability.
- For beyond-LOS communications
  - Develop sufficient communications architecture to support Arctic user needs.

NON-FEDERAL PARTNERS:

- State of Alaska Statewide Broadband Task Force
- Industry
- Bering Strait Native Corporation
- Local and Tribal Governments
- Other Arctic Nations

MTS Information Infrastructure: Marine Weather and Sea Ice Forecasts

ISSUE and STATUS:
Sea ice forecasting is one of the most urgent and timely safety issues in the Arctic region. The loss of sea ice affects marine access, regional weather, global climate, marine and terrestrial ecosystems, and coastal communities. Furthermore, severe ocean storm conditions in the Bering Sea and Arctic waters can pose very complex weather and oceanographic hazards, threatening mariner safety, ships offshore and Alaskan communities onshore. Frequent ocean storms over an ice-diminished Arctic will bring severe coastal erosion and flooding to Alaska's coastal areas due to the shallow continental shelf, underscoring the need for storm surge forecasts to protect coastal communities.

Even as Alaska's strategic location and waterways present opportunities in terms of marine transportation, homeland security, and economic development, weather and sea ice are a limiting factor. In particular, Arctic populations rely on aviation and marine transportation for access to goods and services and for their livelihoods. 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. At sea, Alaska's $4.6 billion fishing industry is one of the most dangerous in the Nation, primarily due to weather. Good weather forecasts are essential; however, the Arctic weather products currently available have changed very little in terms of accuracy, reliability, and availability over the last several years. Sea ice forecasts are particularly crucial. As the Arctic Council's *Arctic Marine Shipping Assessment 2009* report states, "Operators need to know where the ice is and isn't; where it's going to be, how closely packed it is and how thick and strong it is; generally, how difficult it will be to go around or, when necessary, go through. These parameters [are] needed on a variety of space and time scales—from the hemispheric to the local, from months and weeks to daily or even hourly—to support tactical and strategic route planning for ships, scientific study and the development of policy and regulations to ensure safe marine practices." Improved weather and sea ice maps, analyses, and forecasts will support the management of protected marine resources, community and subsistence activities, homeland and national security, and safe ship operation and navigation through Arctic waters.

CHALLENGES: Environmental observations and studies supporting weather and ice forecasts are highly limited in both geographic scope and frequency. For example, there is insufficient real-time meteorological data in U.S. Arctic waters to support accurate forecasting of fall sea storms. This situation threatens marine transportation, offshore oil and gas operations, and the Arctic coastal communities. Mariners still rely primarily on voice broadcasts over HF radio and facsimile weather charts for information. Improvements in weather and water information will lead to increased safety and efficiency in these important sectors.

The NOAA must improve its observing, modeling, and forecasting capabilities to meet evolving customer needs in the Arctic, with particular emphasis on marine weather and sea ice conditions. This includes implementing new in situ, airborne, and satellite observing technologies to help fill gaps in meteorological and oceanographic observation fields, such as High Frequency Radar deployment for Coast Guard search and rescue, and developing a capability to deliver Arctic Ocean sea ice outlooks on time scales of weekly, monthly, seasonal, and interannual for decision support. The U.S. also needs a high resolution, operational coupled atmosphere-ocean-wave-sea ice prediction system/models with advanced data assimilation capability and High Performance Computing capacity to run the operational forecast models.

CURRENT ACTIVITIES:

The NOAA provides forecasts, warnings, and information for surface, marine, and aviation weather interests twenty-four hours a day, seven days a week, 365 days a year, with emphasis on high-impact events such as extra-tropical storms and polar lows, storm surge and other coastal hazards such as tsunamis, blizzards, hurricane force winds, heavy precipitation, floods, droughts, volcanic ash, ice shoves, and space weather. The NOAA also delivers detailed sea ice analysis and a 5-day forecast 3 days a week, as well as seasonal outlooks directed primarily at coastal communities, infrastructure and industry for insight into freeze-up, and break-up for marine transportation. The National Ice Center (NOAA/Navy/USCG) provides year round Arctic-wide sea ice analysis and seasonal sea ice outlooks. NASA and The Office of Naval Research are also sea ice research partners, and together with NOAA are working on Integrated Arctic Research Policy Committee sea ice research activities. The BOEM Environmental Studies Program has ongoing meso-scale meteorological, ocean current, and ice edge mapping studies in the Beaufort and Chukchi Seas.

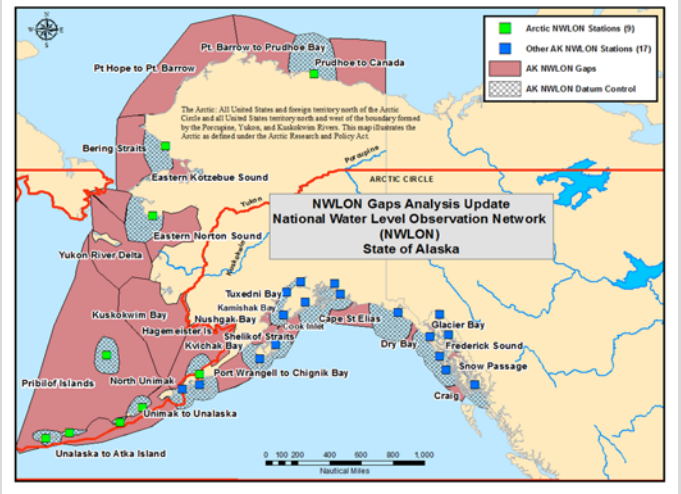
FUTURE FEDERAL ACTIONS NEEDED:

- Initiate international activity to improve sea ice forecasting through generalization of buoy/mooring data from a single point to a broader area and satellite data calibration using this buoy/mooring data.
- Initiate a study of the marginal ice zone to better measure the rate of sea ice melt and regrowth.
- Initiate data cataloging to improve and update the existing U.S. Arctic Sea Ice Atlas.
- Train and expand Volunteer Observing Ship and coastal community participation in the sea ice observation program, and catalog user requirements for sea ice products, services, and delivery.
- Deliver tactical-scale sea ice analysis and forecasts in GIS-enabled broad-scale format to meet USCG and other user requirements.
- Develop better maps of the ice edge, and make field data available early enough in the year to be useful for seasonal ice forecasts.
- Extend NOAA National Data Buoy Center Coastal-Marine Automated Network and Yellow Buoy network coverage into the Arctic Ocean for wave height.
- Ensure continued access to Synthetic Aperture Radar (SAR) data for ice advisory and search and rescue needs, oil spill monitoring, and coastal wind observations.
- Expand the operational NOAA Wave Watch 3 (NWW3) Model domain from 75ºN to the North Pole to cover the Arctic Ocean.
- Sustain and grow external/international satellite partnerships for weather and sea ice data.
- Improve observing, modeling, and forecasting capabilities to meet evolving customer needs in the Arctic, with particular emphasis on marine weather and sea ice conditions. This includes a high resolution, operational coupled atmosphere-ocean-wave-sea ice prediction system/ models and new *in situ*, airborne, and satellite observing technologies to help fill gaps and improve:
  - Meteorological and oceanographic observation fields, such as HF radar deployment for the USCG SAR
  - Capability to deliver Arctic weekly/monthly/seasonal/inter-annual time scales for decision support.

NON-FEDERAL PARTNERS:

- Alaska Ocean Observing System
- Oil and gas industry
- International partners (Canada, Russia, Japan, India)

MTS Information Infrastructure: Oceanographic and Real-Time Navigation Information



National Water Level Observation Network Gap Analysis

ISSUE and STATUS:
The NOAA is responsible for providing real-time and short term forecasts of water levels, currents, and other oceanographic data, including water temperature and air pressure to support safe and efficient navigation in U.S. waters. For effective situational awareness and safe navigation, mariners require real-time access to water level and current data. Water level information helps mariners properly load their vessels and assists with knowing underkeel and air gap clearance. Tidal current predictions assist mariners with making decisions about traveling through an area, using increased current speeds to decrease travel time and using the knowledge of slack water times to best maneuver through a port or harbor. Knowledge of tidal currents also assists with dispersion models such as those necessary for predicting oil spill trajectories. Tides (water levels) and current information is also important for energy development, coastal zone management, fisheries research and coastal ocean science, emergency planning and response, search and rescue, sea level monitoring, storm surge/tsunami modeling and warnings, floodplain mapping, and climate services to coastal communities. The NOAA is responsible for providing real-time and short term forecasts of water levels, currents and other oceanographic data such as water temperature, air temperature and air pressure to support safe and efficient navigation in U.S. waters.

The NOAA's delivery of these services in the Arctic, however, is very limited due to the challenging environment and lack of infrastructure. Tidal currents in the Arctic region of Alaska have not been measured since the early 1950s, resulting in predictions with high uncertainty. Furthermore, NOAA operates only nine long-term National Water Level Observation Network (NWLON) tide stations in the Arctic. Adequate NWLON coverage is necessary for establishing dependable water level reference datums in conjunction with NOAA's geodetic control framework (the National Spatial Reference System, or NSRS). Inadequate coverage impacts Arctic navigation, shoreline boundary definition and mapping, hydrographic surveying for nautical charting, and storm surge models and forecasts. The NWLON gaps also affect the understanding of sea level variation and trends, which is important for coastal community climate adaptation strategies, and for economic development decisions.

CASE STUDY:
During the Bering Sea Storm in November 2011, NWLON data in Nome, AK captured a high water measuring 2.964m above Mean Lower Low Water. Data like these are used to assist emergency planners as well as to groundtruth storm surge models. However, with many NWLON gaps on the Arctic coast of Alaska, these data points are few and far between.

CHALLENGES:

The Arctic region has very sparse tide, current and water-level prediction coverage. Although there are nine existing long-term NWLON stations in the U.S. Arctic, NOAA has identified 18 priority gaps in NWLON Arctic coverage (13 located below the Bering Strait and five above). These gaps are in areas that encompass most of the Arctic region, resulting in inadequate control to determine tidal zoning parameters and datums, and inadequate knowledge of relative sea level variation and trends. The NOAA has also identified an additional 86 sites in the Arctic where short-term water level stations would benefit hydrodynamic model development, the National Vertical Datum transformation tool (VDatum), and NOAA hydrographic surveys and shoreline mapping activities, as well as other marine transportation services in the Arctic. Accurate tidal current predictions require at least 35 days of data collection on site and a majority of Arctic locations need new predictions. There may be some leveraging potential through stronger partnerships with the U.S. Coast Guard, the U.S. Army Corps of Engineers and non-federal partners to expand NWLON and current observations.

CURRENT ACTIVITIES:

NOAA generally provides tides, currents and oceanographic data nationally through five programs:

- NWLON;
- The National Current Observation Program, for predictions of times and speeds of tidal currents;
- Operational Nowcast and Forecast Hydrodynamic Model Systems;
- Port-based Physical Oceanographic Real-Time Systems (PORTS®); and
- The NOAA Data Buoy Center

In the Arctic, NOAA is focusing its efforts on improving water level datum coverage, with some work to improve currents data, when resources are available. Short term water level gauges are being deployed to support hydrographic surveying as well as the NOAA VDatum project to develop models for a transformation tool to seamlessly transfer between tidal and geodetic datums. Recognizing that harsh Arctic conditions and ice accumulation are impediments to observing, NOAA has worked in the past with partners to develop a system to collect water level data in remote cold climate regions. In August 2008, two specially designed bottom-mounted water level gauges were deployed off the coast of Barrow in approximately 100 feet of water. The systems collected water level, temperature, and conductivity data until 2010, resulting in a two-year continuous time series and datum determination. This water level data will support NOAA applications such as hydrographic surveys, remotely sensed data acquisitions, marine boundary determination, dredging activities, habitat restoration, and safe, efficient and environmentally sound maritime commerce. The NOAA is also developing new portable ruggedized tide gauge technology to support short-term water level data collection in the harsh Arctic environment.

FUTURE FEDERAL ACTIONS NEEDED:

- Reduce NWLON gaps in Alaska/Arctic if resources materialize.
- Co-locate new and/or existing NWLON stations with Continuously Operating Reference Stations to improve water level/elevation determination and geodetic control.
- Install short-term tide gauges to support Arctic hydrographic projects.
- Deploy current meters and calculate predictions in the Arctic and Alaska approaches to support navigation in the western Aleutians, Bristol Bay, Bering Strait, Norton Sound, Kotzebue, Chukchi Sea, and Barrow.
- Explore additional partnership efforts with federal/non-federal partners.

NON-FEDERAL PARTNERS:

- State of Alaska
- Native Corporations and communities
- Alaska Ocean Observing System
- Academia and Private Sector
- Oil and gas, and other industries

MTS Information Infrastructure: Automatic Identification System (AIS)

ISSUE and STATUS:

The Automatic Identification System (AIS) is an internationally adopted very high frequency-frequency modulation (VHF-FM) radio communication protocol for the autonomous and continuous exchange of identity, position, voyage-related and other pertinent navigation safety information amongst similarly AIS-equipped ships, Search and Rescue (SAR) aircraft, shore stations and Aids to Navigation. The International Maritime Organization (IMO) defines the purpose of AIS as a tool for collision avoidance and to assist vessel traffic services (VTS), and as a means for authorities to track vessels and their cargoes in transit. The Safety of Life at Sea Convention (SOLAS) mandates AIS use on all tankers and passenger ships regardless of size, and all other ships of 500 gross tonnage or greater (or of 300 gross tonnage or greater if engaged in international voyages) — estimated to be over 65,000 ships worldwide. A number of nations have expanded these requirements to their domestic fleet and waters, including the United States, European Union, China, Turkey, Malaysia, and India. The AIS populations are expected to continually grow for the foreseeable future. This is a result of decreasing AIS operating costs and the 2008 introduction of interoperable lower-cost AIS Class B devices.

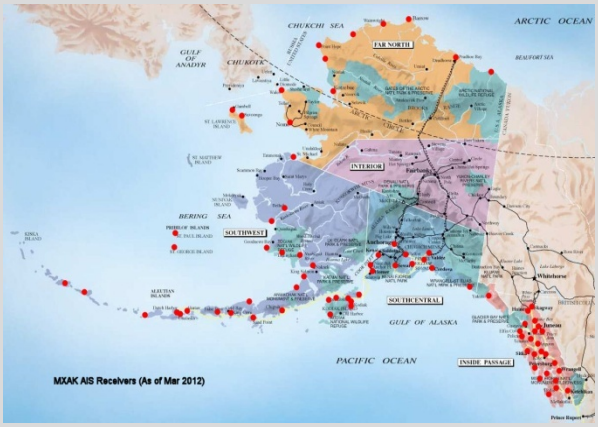


Figure: Red dots indicate locations of the 95+ stations in the Marine Exchange of Alaska's AIS network.

The AIS information supplements marine radar, which continues to be the primary method of collision avoidance for water transport. Information provided by AIS equipment such as unique identification, position, course and speed can be displayed on a screen or an electronic chart display (ECDIS), and is intended to assist a vessel's watchstanding officers and maritime authorities track and monitor vessel movements. The AIS integrates a standardized VHF communications transceiver with a positioning system, such as GPS, and other electronic navigation sensors. Ships outside AIS radio range can be tracked with the Long Range Identification and Tracking (LRIT) system with less frequent transmission.

The AIS supports a variety of MTS services, particularly maritime domain awareness, movement reporting, VTS, SAR, accident investigation, waterways management, and other services for which vessel location is a key component. Additionally, AIS can be used to monitor and enhance physical Aids to Navigation (AtoN), and via applications-specific messaging, can also provide marine safety information such as hydrological and meteorological data, alerts and notices, etc. The Alaska Ocean Observing System will partner with the Marine Exchange of Alaska to implement Automatic Identification System (AIS) transmitters to disseminate real-time weather data, buoy data, and weather forecasts to vessels.

CASE STUDY: The majority of AIS receiver stations in Alaska are installed and maintained by the Marine Exchange of Alaska (MXAK, see Figure). This non-profit group provides the maritime community with information and communications services to ensure safe, efficient, and environmentally sound maritime operations. Currently, the U.S. Coast Guard (USCG) relies on the MXAK to supply vessel AIS data in support of many prevention and response missions, including the many search and rescue missions that occur.

The AIS has also opened the door for two new AtoN concepts: Synthetic and Virtual AtoN. The latter provides for an electronic signal to denote a hazard where there is no physical AtoN there to do so, while the former provides real-time information for an aid that is physically present but is not at its charted position. These efforts will be of value in establishing an AIS AtoN system, which would be most applicable in the Arctic where ice movement requires active monitoring of AtoN performance and can, at times, render physical aids unusable and/or unreliable.

CHALLENGES:

- Given its expanse and the lack and distance for responders in the U.S. Arctic, a more robust real-time, long-range system may be necessary for tracking vessels operating beyond the range of AIS receiving sites and along the north coast of Alaska to the Canadian border.
- Need for full AIS coverage in U.S. Arctic waters, but bandwidth availability is limited
- Determine the need for expanded AIS carriage requirements for vessels operating in the Arctic.
- AIS enhancements for expanded functionality, e.g. utility of virtual AtoN.

CURRENT ACTIVITIES:

- The USCG maintains a Nationwide AIS shore stations network of over 200 receiver or transceiver sites, including five AIS receivers in Prince William Sound, Alaska.
- In addition, the Coast Guard augments this network by purchasing AIS data from private entities where it lacks data. For example, the primary source for AIS data for Alaska, including the U.S. Arctic, is MXAK, which operates over 95 AIS receiving stations.

FUTURE FEDERAL ACTIONS NEEDED:

- In conjunction with Port Access Route Studies (PARS) and in the region, consider geographic, navigational, and user requirements that would indicate areas where expanded AIS-based e-navigation services may be necessary in support of the broad range of maritime services.
- AIS capabilities should be expanded to enable two way AIS digital communications between shore stations and vessels to disseminate environmental and safety information to enhance safety.
- Continue AIS roll-out in Bering Strait/Sea.
- Address local needs in considering AIS coverage, incl. Shishmaref, Wales, Gambell, Little Diomede.
- Analyze and include northern coast/waters of Alaska in National AIS plan.
- As marine traffic increases with diminishing ice and increased accessibility, conduct risked-based evaluation for expanded AIS carriage requirements for vessels operating in U.S. Arctic waters.
- Pursue establishment of Arctic-wide Vessel Traffic Monitoring and Reporting system, to ensure seamless transition for mariners as dictated by PARS and WAMS.
- With international partners, participate in follow-up project to the Arctic Council's 2009 *Arctic Marine Shipping Assessment* recommendation III (B) on Arctic Marine Traffic systems, compiling an inventory of systems and defining data sharing and access issues.
- Implement capability to transmit weather, environmental and safety information to vessels over the AIS network, similar to what is done in Europe.

NON-FEDERAL PARTNERS:

- State of Alaska
- Native Corporations
- Local and Tribal governments
- Energy, Shipping, and other industries
- Scientific and academic communities
- Marine Exchange of Alaska
- Canada
- Russian Federation
- Arctic nations for discussions addressing AIS satellite resourcing and data sharing

MTS Response Services: Vessel Escort and Icebreaking Services

ISSUE and STATUS:
An appropriate mix of legal regimes, partnerships and icebreakers and /or ice capable ships are essential for promoting safe navigation in the Arctic Region, specifically where ice is present or could be present as weather conditions may influence. This capability can be afforded through federal, commercial or private means. This capability is important for: conducting operations in ice-covered waterways; extricating vessels beset in ice or in danger; mitigating hazardous conditions; and assisting shipping and other reasons. They are important to our ability to afford accessibility to ice-laden waters to provide Search and Rescue and spill response. The status of the nation's icebreakers in the Arctic includes:

USCG Cutter *HEALY* escorts Russian oil tanker *RENDA* to Nome, AK, through sea ice up to several feet thick.

- One medium icebreaker, *USCGC HEALY*, is primarily dedicated to Arctic research.
- One heavy icebreaker, *USCGC POLAR STAR*, is currently undergoing reactivation and is anticipated to be service ready late 2013.
- The Arctic Region Research Vessel *R/V SIKULIAQ* currently being built and will be ready for service in 2014.
- Shell Oil:
  - One vessel capable of breaking ice, but designed for specific assistance to oil rigs and support vessels.
  - One vessel under construction that will be capable of breaking ice, but designed for specific assistance to oil rigs and support vessels.

CASE STUDY: During the fall of 2011, the community of Nome, Alaska, population 3,500, missed a final and critical diesel and gasoline delivery due to a major storm. The supply interruption demanded a solution, as Nome has always depended on barge deliveries during ice-free months. On January 12, 2012, with the escort and icebreaking services of the USCG Cutter *HEALY*, the 370-foot Russian-flagged tanker *Renda* delivered 1.3 million gallons of diesel fuel and unleaded gasoline to the community. The roundtrip escort was more than 1,400 miles (600 in sea ice) and three weeks, but provided much-needed relief to the hospital and schools in the community that would have faced shortfalls before the spring thaw when normal barge deliveries could resume. This marked the first time petroleum products have been delivered to a Western Alaska community during winter.

CHALLENGES:
- Recent studies have indicated current icebreaking capabilities are insufficient to meet future Arctic mission requirements.
- There is no comprehensive national plan to bridge the gap. Note that there is a long lead time to build a vessel suitable for Arctic Service and can extend to eight to ten years in the case of an icebreaker.

CURRENT ACTIVITIES:

- Numerous studies and reports recommend the need for icebreakers and ice-capable ships, most notably:
  - 2007 National Academies Study entitled *Polar Icebreakers in a Changing World*.
  - 2009 – 2011 Congressional Research Service Report to Congress *Coast Guard Polar Icebreaker Modernization: Background, Issues, and Options for Congress*
  - 2010 -- The Coast Guard High Latitude Study
  - 2011 -- The Coast Guard Business Case Analysis
  - 2013 -- The Coast Guard to assess the needs of additional USCG presence in the high latitude.

FUTURE FEDERAL ACTIONS NEEDED:

- Near term
  - Capitalize on the results of the Port Access Route Studies (PARS) in the region, to consider whether geographic, navigational, and user requirements that would indicate areas where icebreaker assistance (icebreaking, vessel escort, preventative track grooming) may be appropriate.
- Long Term
  - Act on the results of the High Latitude Mission Analysis Report and associated material to identify and advocate for the necessary capability and support requirements for mission execution in the Arctic.

NON-FEDERAL PARTNERS:

- State of Alaska
- Native Corporations
- Local coastal communities
- Energy, Shipping and other industries
- Scientific and academic communities
- Canada
- Russian Federation
- IMO for vessel routing measures in Bering Straits and approaches

MTS Response Services: Environmental Response Management

ISSUE and STATUS:

Response Technologies and Techniques: Oil spills in ice are more complicated to address than other spill types. Challenges include interference of ice with mechanical, chemical, and burning response methods, and potentially greater hazardous effects due to a slower emulsification rate and longer toxic components persistence. Responding to oil spills in ice covered waters currently requires a combination of many tactics rarely tested in real Arctic marine and ice environments.

Pollution Response Capabilities: The State of Alaska has a Community Spill Response Program for local response with limited agreements and containment equipment sites. There are four Oil Spill Response Organizations (OSROs) that support members in the U.S. Arctic with personnel, materials, equipment and training capability for preparing for, and responding to oil spills. None of the OSROs are classified for open ocean response capability. In the northern region, response facilities and equipment are located at Kotzebue, Barrow and Prudhoe Bay. The closest U.S. Coast Guard (USCG) facilities capable of pollution response throughout the Arctic are located in Anchorage, Kodiak or Unalaska. Current capabilities include four Spilled Oil Recovery System (SORS) equipped on 225' buoy tenders (*Spar*, *Maple*, *Sycamore* and *Hickory*) home-ported in Alaska (Kodiak, Sitka, Cordova and Homer respectively); an Aerial Dispersant Delivery System (ADDS) staged in Anchorage as a back-up to commercial vendors; one Vessel of Opportunity Skimming System (VOSS) split between Anchorage and Ketchikan; 26 Response Equipment Caches in 19 locations throughout Alaska with three caches in the Arctic located in St. Paul, Unalaska, and King Cove; and, Federal on Scene Coordinators located in Juneau, Anchorage and Valdez with incident management expertise and limited pre-positioned oil response equipment. The U.S. Navy Supervisor of Salvage also maintains a spill response capability in Anchorage, with assets available in the event of a major oil spill. Additionally, the Coast Guard Pacific Strike Team based in Novato, CA, maintains response equipment and specially trained personnel who can be deployed on short notice.

Certain significant factors have limited development in the Arctic: extreme cold, extensive ice, intense storms, and limited industrial infrastructure. These same factors require that drilling and extraction of hydrocarbons receive higher levels of caution and oversight in these seas than in other offshore areas of the United States. These conditions also make response to and control of an oil spill or blowout more challenging than in other areas of the country.

CASE STUDY: Shell Oil submitted oil spill contingency and response plans for its 2012 exploratory drilling operations in the U.S. Chukchi and Beaufort Seas to the U.S. Department of the Interior's Bureau of Safety and Environmental Enforcement (BSEE) for review and approval. Nearly two dozen industry ships were involved, including oil spill recovery and storage vessels. The USCG conducted full-scale Coast Guard cutter patrols as well as helicopter and small-craft operations in the area of the drilling.

CHALLENGES:

- Research is needed in methods for detection and mitigation of oil on water and in ice, and cold region shoreline cleanup that are tested and validated in the Arctic or under Arctic conditions to better understand the challenges of spill response and the most effective tools and techniques to utilize in such environments.
- Recent studies, such as U.S. Geological Survey Circular 1370, indicate that more information is needed to determine how oil will behave in icy environments or when it sinks below the surface.
- Understanding of baseline conditions, modeling for spill response and a better understanding of the current environmental conditions are needed in order to conduct injury assessments and develop restoration strategies.
- A large response effort in the shoulder seasons will likely face extreme environmental conditions that may reduce its effectiveness.
- The nearest USCG facilities and vessels supporting the U.S. Arctic for environmental response are located in Anchorage, Kodiak and Dutch Harbor; 635 nm, 800 nm and 1000 nm, respectively, from Barrow, Alaska.
- Remote distances, asset availability, and environmental conditions will likely hinder response times throughout the entire U.S. Arctic.

CURRENT ACTIVITIES: There are currently many research and development activities underway and planned for oil spills in cold and icy water. The USCG, BSEE, NOAA, other Federal agencies, industry and academic organizations as well as other Arctic nations are conducting research on response to marine oil spills in ice and broken ice. The USCG Office of Incident Management and Preparedness(CG-5RI) and the USCG Research and Development Program work together to verify and validate environmental models, traditional response equipment performance, and environmental response procedures for use in response and contingency planning efforts in the Arctic environment. The BSEE and the Bureau of Ocean Energy Management (BOEM) conduct spill trajectory modeling, baseline data collection, and in collaboration with industry and a wide array of entities, also conduct oil spill response and technology research in Arctic waters, ice, and broken ice. The NOAA is funding the expansion of the Alaska Ocean Observing System and the Arctic Observing Network, and, with BSEE, is developing a geospatial decision-support tool (ERMA, the Environmental Management Response Application) to prepare for Arctic oil spill response, assessment, and restoration situational awareness requirements. The BSEE approved oil spill contingency plans for 2012 exploration activities in the Beaufort and Chukchi Seas, and will review response plans from other companies proposing to conduct exploration in the Arctic.

In addition, the United States is working with other Arctic nations in the Arctic Council in the Emergency Prevention, Preparedness and Response (EPPR) and Protection of the Arctic Marine Environment (PAME) working groups on several programs and projects for guidance and recommendations to prevent and respond to pollution incidents and was a co-leader of the Arctic Council Task Force on Marine Oil Pollution Preparedness and Response that developed the Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic, recently signed at the May 2013 ministerial meeting.

- The USCG continues cooperation in conducting spill drills under the Canada-U.S. Joint Marine Pollution Contingency Plan--CANUSNORTH Annex with Russia in the US Coast Guard-Russian Ministry of Emergency Situations in meetings of the Russian-American Joint Planning Group.
- The USCG is assisting in Phase B of the Aleutian Island Risk Assessment, available at http://www.aleutianriskassessment.com/.

FUTURE FEDERAL ACTIONS NEEDED:

- Continue support for the BOEM Environmental Studies Program research into oil weathering in Arctic environments and collection of baseline chemical and biological data.
- Continue support for the BSEE Oil Spill Response Research and Offshore Engineering and Technology Research Programs.
- Continue to support the NOAA Office of Response and Restoration in work on Arctic Environmental Response Management Application, spill response and training support, and preparing for Natural Resource Damage Assessments.
- Continue involvement in Joint Industry Programs on Arctic spill response.
- Seek funding for oil spill research to levels authorized in the Oil Pollution Act of 1990.
- Seek to provide local oil spill response training and equipment to be locally available.
- Maintain coordination with Russia and Canada on spill response through USCG and Russian Federation in the Russian-American Joint Planning Group and the Canada-U.S. Joint Marine Pollution Contingency Plan: CANUSNORTH Annex.
- Work with IMO to develop the Polar Code as mandatory guidelines on ship safety, pollution prevention and other provision aimed at protection of the Arctic environment.
- Develop cooperative agreements regarding sharing across the Arctic in the event of a large spill event, including communications and coordination strategies as well as detailed cost, logistics, customs and trade procedures and guidelines to support expedited movement of personnel and equipment across national boundaries.
- Improve oil spill response readiness; deliver scientific support for Arctic pollution response such as contingency plans, place-based drills and community workshops, and spill trajectory modeling to decision makers.
- Acquire baseline data to inform post-incident damage assessment and resource restoration efforts. In collaboration with industry, support research and technology transfer to prevent, prepare for, respond to and restore impacts of oil release into Arctic waters.
- Identify current salvage capabilities and gaps.
- Develop strategies for mobilizing and flowing resources from other areas to support a large spill response event.
- Apply consensus risk assessments tools and processes to ensure community awareness of and involvement in spill planning and preparedness.
- Develop a worldwide inventory of equipment that is available for deployment in support of Arctic response.
- Develop international guidelines for spill response in broken ice and ice covered environments.
- Construct Arctic area infrastructure and forward deploy adequate response assets to facilitate appropriate response to shipping and other offshore industry accidents that involve spills of oil and hazardous materials.

NON-FEDERAL PARTNERS:

- Oil and gas industry
- State of Alaska
- Local coastal communities
- Native Corporations
- Local and Tribal Governments
- University of Alaska

MTS Response Services: Search and Rescue

ISSUE and STATUS:
The U.S. Coast Guard (USCG) is the primary Federal agency responsible for Search and Rescue (SAR) in the U.S. maritime SAR regions. Additionally, the International Convention for the Safety of Life at Sea (SOLAS), among other provisions, makes it an obligation for all vessel masters to offer assistance to those in distress. Emergency response is challenged by the remoteness and vast distances in region, impacts of cold and lack of shore infrastructure and reliable communication. From the northern most point of land at Point Barrow, Alaska, the closest refueling site for vessels is Dutch Harbor, AK, 1,000 nm away. The nearest USCG air facility is at Kodiak, AK, which is 820 nautical miles away.

Recognizing "the remoteness and limited resources in the region," The Arctic Marine Shipping Assessment (AMSA) recommended the Arctic nations develop and implement a comprehensive, multi-national SAR agreement. On 12 May 2011, in response to the AMSA recommendation, an Arctic Search and Rescue Agreement was concluded among the member states of the Arctic Council – Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States. The treaty coordinates international SAR coverage and response in the Arctic and establishes the area of SAR responsibility of each state party.

"What I found last summer, and reconfirmed by spending additional time up there [Arctic] this year, is a lack of infrastructure. When you look at doing a search and rescue response … there's no [USCG] aircraft on the North Slope so you have to bring one from Kodiak, which is about 900 miles away and it takes the better part of a day to get there. If you get an aircraft up, do you have communications? … Do you have the ability to fuel, hangar and service the aircraft? What about hospitals? What I see is a very limited infrastructure that is somewhat supportive of the people who live there but cannot support an influx of people into the Arctic or a response of any size."
Admiral Robert J. Papp, Jr., Commandant, USCG, USCG Forum, October 2011, Volume 3, Issue 5

CASE STUDY: A USCG Air Station Sitka MH-60 Jayhawk helicopter crew medevac'd a 65-year-old man from St. James Bay to Juneau after reportedly suffering back and head injuries from a fall on June 3, 2011. The helicopter crew arrived in Juneau and safely transferred the man to awaiting emergency medical services for further medical care at Bartlett Regional Hospital.

CHALLENGES:
- The lack of aircraft operating locations on the North Slope increases risk of failure for many SAR missions. The USCG relies heavily on partners to execute SAR missions in the Arctic region.
- Communications architecture very limited above 65°N. Line of Sight communications are limited and degraded by atmospheric factors that affect radio wave propagation, but LOS is more reliable than High Frequency or Satellite Communications (SATCOM). Communications failure during a SAR case may result in loss of life, property, and increased environmental damage.
- Insufficient capacity to track surface vessels across the entire U.S. Arctic in order to maintain a comprehensive maritime common operating picture and respond as necessary to SAR incidents.
- Insufficient shoreside infrastructure to provide basic logistics and support functions, e.g., medical facilities and shelters for SAR missions and emergency response.

CURRENT ACTIVITIES:

- The NOAA Search and Rescue Satellite Aided Tracking (SARSAT) System relays distress signals from emergency beacons and greatly improve emergency notification.
- The USCG currently forward deploys helicopters from Air Station Kodiak to Cold Bay and St. Paul Island, AK, in support of two crab fisheries to ensure adequate SAR response. The USCG is developing a seasonal SAR response posture in the Arctic waters starting in summer 2012 to forward deploy aviation and surface assets to the North Slope to support increased Arctic maritime activity.
- The U.S. Department of Defense and USCG are conducting assessments examining aircraft, maintenance and personnel requirements for safety and security missions in the Arctic.
- Domestic SAR coordination efforts are underway between USCG, the U.S. Northern Command (USNORTHCOM), the U.S. Pacific Command (USPACOM), and the State of Alaska, which all have SAR responsibilities in the Alaska and U.S. Arctic region. Appropriate elements of these organizations currently cooperate and coordinate together to fulfill their SAR responsibilities.
- Canada hosted an Arctic SAR table top exercise in Whitehorse, Yukon Territory, in October 2011 for delegations from the eight Arctic Council States with focused discussions on potential SAR events in the Arctic that would require international cooperation and resources under the auspices of the recently completed Arctic SAR agreement.
- The USCG is field testing a commercial satellite AIS system that provides a vast increase in vessel tracking in the Arctic over currently fielded AIS products. This new satellite system bolsters the current terrestrial and satellite AIS systems being utilized by the USCG in the Arctic, greatly improving the unclassified Common Operational Picture, which would be used in support of SAR response.

FUTURE FEDERAL ACTIONS NEEDED:

- Near Term
  - Develop and validate response plans for a mass maritime SAR incident.
  - Leverage partnerships to facilitate use of existing infrastructure to support operations.
  - Develop estimates for the budget process to support Arctic initiatives, to include recurring funding for temporary Forward Operating Locations.
  - Engage in multilateral and bilateral discussions to expand SAR cooperative agreements and strategies and better promote U.S. interests in the Arctic.
  - Develop risk-based short, medium and long-term national, regional, and local level actions to support SAR activities with respect to environmental laws (e.g., National Environmental Policy Act, Endangered Species Act, etc.).
- Long Term
  - Increase facilities and infrastructure investments to support Arctic activities.
  - Develop sufficient communications architecture to support Arctic user needs.
  - Explore options for expanded AIS carriage, capability, and additional Long Range Identification Tracking capabilities for non-government vessels to facilitate SAR operations.
  - Continue promoting use of Automated Mutual-Assistance Vessel Rescue search and rescue ship reporting system for use by ships transiting in Arctic.

NON-FEDERAL PARTNERS:

- State of Alaska Air and Army National Guard
- Native Corporations
- Local and Tribal Governments
- Energy, Shipping, and other industries
- Essential services (hospitals, clinics, etc.)
- Scientific and academic communities
- Canada
- Russian Federation
- IMO for traffic separation schemes in Bering Straits and approaches.
- Other Arctic nations under the Arctic SAR agreement

Vessels: Polar Code/Guidelines for Ships Operating in Arctic Ice-Covered Waters

ISSUE and STATUS:
Many Arctic governmental bodies with interests in shipping determined by the end of the 1980s that climate change and sea ice melt would spur increased shipping, oil and gas development and other concomitant effects in Arctic waters. Over the years, countries such as Canada and the USSR (subsequently Russia) had developed separate but similar rules guiding shipping and polar operations for vessels in the Arctic region. States with an interest in shipping in the Arctic determined that a common set of rules and regulations were necessary before an increase in vessel traffic made any such harmonization impossible. The International Maritime Organization (IMO) held a series of meetings in the early 1990s. The meetings included officials from all Arctic states with an interest in Arctic shipping and those associated with various insurance companies.

The intent of these meetings was originally to discuss:

- Harmonizing the different approaches toward polar ship construction,
- Safety,
- Design standards, and
- Operating procedures.

A common set of rules would ensure that any increase in Arctic shipping would take place efficiently, and ensure the best environmental standards. These initial Polar Code discussions attempted to cover vessels that operated in both Polar Regions.

Negotiations focused on developing voluntary guidelines for Arctic shipping, with the recognition that "[s]hips operating in the Arctic environment are exposed to a number of unique risks." In effect, the Polar Code had become a guide, and hence was adopted in 2009 by the 26th IMO Assembly as "Guidelines for Ships Operating in Arctic Ice-Covered Waters." The main features were:

- Requirements for ship construction, equipment, operation and environmental protection;
- Application extended to all polar waters, i.e. Arctic and Antarctic, and not only ice-covered;
- Only partially or totally enclosed lifeboats allowed;
- Qualifications of ice navigators;
- High standards for environmental protection; and
- New damage stability provisions per revised International Convention for the Safety of Life (SOLAS) at Sea Convention chapter II-1.

CURRENT ACTIVITIES:
The IMO is now working on a Mandatory Polar Code for Ships Operating in Polar Waters (Polar Code), which will cover the full range of design, construction, equipment, operational, training, search and rescue and environmental protection matters relevant to ships operating in Polar waters.. The Polar Code is being developed to take legal effect as amendments to SOLAS, the International Convention for the Prevention of Pollution from Ships (MARPOL Convention) and other existing treaties rather than as a stand-alone new IMO treaty. The Polar Code is expected to have provisions requiring ships to develop and implement comprehensive voyage plans when navigating in Polar Waters. Such planning is expected to reduce risks to ships and their crews and to minimize disturbances from shipping to coastal areas. Work has progressed through the IMO's Sub-Committee on Ship Design and Engineering and Marine

Environment Protection Committee, which meets annually and through a Polar Code "Correspondence Group" which conducts its work year-round.

FUTURE FEDERAL ACTIONS NEEDED:

- Coordinate designs for icebreaking ships and double acting vessels (designed to run ahead in open water and thin ice, but turn around and proceed astern in heavy ice conditions).
- Conduct National Environmental Protection Act/Endangered Species Act coordination with Federal partners regarding vessel air emissions, noise, and other possible impacts associated with routine ship operations.
- Pursue Federal coordination of interagency MOA and international partnerships for vessel design standards.
- Participate with the USCG-led delegation to the IMO addressing formulation of the Polar Code.
- Develop cooperative initiatives between industry and Federal partners to support shipping in the Arctic.
- Collaborate with industry, Federal, State, and local governments and other stakeholders, particularly tribal governments, regional Alaska Native non-profit organizations, and Alaska Native Claims Settlement Act corporations, on requirements for oil spill preparedness and response capabilities for vessels transiting the Arctic.
- Contract for formulation of design standards for Arctic vessels.
- Facilitate development of life saving and survival equipment tailored for use in Polar waters.
- Arrange meetings with industry and responsible government agencies to discuss risk, insurance and bonding; follow through with appropriate actions.
- Continue support for BSEE Offshore Engineering and Technology Research Program studies into ice engineering for offshore structures.
- Continue work with International Organization for Standardization Technical Committee 67 (Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries) on Standards for Mobile Offshore Drilling Units (MODUs) for Arctic offshore oil and gas operations.
- Conduct a Formal Safety Assessment on Arctic drilling for MODUs.

NON-FEDERAL PARTNERS:

- State of Alaska
- Local and Tribal Governments
- University of Alaska-Fairbanks
- Non-Governmental Organizations

Vessels: Crew Standards

ISSUE and STATUS:

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) sets qualification standards for masters, officers and watch personnel in seagoing merchant ships. These standards are just as applicable in Arctic waters as any other region. The STCW was most recently amended in 2010; the new changes, known as the Manila Amendments, took effect on January 1, 2012. New provisions include voluntary training guidance for personnel serving aboard ships operating in polar waters, particularly those in charge of navigation and engineering watches. This guidance was developed in support of the International Maritime Organization's (IMO) 2009 "Guidelines for Ships Operating in Arctic Ice-Covered Waters," which provide guidance on the operational requirements for both Arctic and Antarctic waters. The decision to make the STCW text non-mandatory was based on the IMO's decision to work on the Polar Code. The STCW text may require modification and transfer to the mandatory sections after the Polar Code is finalized.

The M/V EXPLORER of Liberia sinking near the South Shetland Islands on November 23, 2007.

CASE STUDY: On November 23, 2007, the Liberian registered M/V *Explorer* struck a wall of compact ice and sank after taking on water through a 9-foot gash in the hull. All 54 crew and 100 passengers abandoned ship and were rescued by the Norwegian vessel *Nordnorge*. Reports state that due to a lack of training and experience dealing with polar ice, the captain made a bad choice to transit in ice instead of open water. This and many other examples demonstrate the need for uniform qualifications and operational requirements captured in the forthcoming Polar Code.

CHALLENGES:

At the international level, no specialized mandatory qualifications, training or certifications exist for crews of vessels that operate in polar waters including the Arctic. As a result, crews can be comprised of individuals unfamiliar, untrained, and ill-equipped to deal with the increased concerns and dangers associated with operating a vessel in the Arctic. International standards are needed to ensure uniformly qualified crews are operating in the Arctic regardless of where individuals received their training.

CURRENT ACTIVITIES:

Efforts are currently underway at the IMO to develop a Polar Code which would set forth operational requirements for vessels operating in the Polar Regions. It is expected and envisioned that once the Polar Code is finalized, the IMO will be engaged in the development of mandatory training, qualifications and certification requirements for inclusion into the STCW Convention. These training requirements will only follow the finalized operational requirements.

FUTURE FEDERAL ACTIONS NEEDED:

- With international partners, pursue development and negotiation of the Polar Code.
- Incorporate domestically any mandatory provisions of the Polar Code.
- Develop standardized personnel training curricula for officers and crew aboard vessels operating in polar waters.
- Examine applicability of training and safety standards to the U.S. fishing fleet.

NON-FEDERAL PARTNERS:

- State of Alaska
- Native Corporations
- Local coastal communities
- Energy, Shipping, and other industries
- Scientific and academic communities.
- Canada
- Russian Federation
- IMO for traffic separation schemes or other routing measures in the Bering Strait and its approaches.

> ***"Coordinate the establishment of domestic transportation policies in the Arctic necessary to ensure safe and secure maritime shipping in the Arctic."***
> *Coast Guard Authorization Act of 2010*
> *§ 307*

4 -- A U.S. Arctic MTS: The Way Forward

As one of the five coastal states encircling the Arctic Ocean, the United States has significant interests in the Arctic. Within the United States and internationally, there is genuine recognition of a growing need to address marine transportation issues that arise due to the changing conditions in the Arctic. Increasing accessibility to navigation routes, the quest for resource development, and the need to protect and sustain subsistence lifestyles call for a vigilant, proactive and integrated approach to vessel traffic in the Arctic. Establishing a safe, secure and reliable MTS in the U.S. Arctic will:

- Support the protection of valuable Arctic coastal and ocean resources;
- Maintain subsistence use by native communities integral to their cultural identity; and
- Reduce the risk of oil spills, air emissions and other potential events that could negatively impact the environment and coastal communities,

There is sufficient Arctic policy in the guidance of NSPD-66/HSPD-25, the National Ocean Policy, the NSAR, and recommendations coming from AMSA, ANWTF, the Oil Spill Commission and other sources to implement a comprehensive Arctic MTS improvement plan proposed here by the CMTS. Progress on Arctic MTS priority actions will significantly impact the full range of U.S. interests and user needs noted in Chapter 1, and the gaps identified in Chapter 2. The next steps for the CMTS are the promulgation of guidance to implement the plan, and working to ensure coordination among the various federal agencies to address Arctic issues in a timely and cost-effective manner. For example, a Federal agency action that may have a significant bearing on the recommendations is the USCG's Bering Strait Port Access Route Study, which may consider many proposals including designated ship routes, increased AIS monitoring, speed restrictions, and electronic AtoN, to make the Bering Strait safer.

RECOMMENDATIONS

1. Rely on CMTS for U.S. Arctic MTS Coordination

Bridging existing gaps in Arctic marine transportation requires a holistic government/industry/community approach to implement appropriate MTS services and actions efficiently and effectively. The Arctic claims a broad array of stakeholders, ranging from federal, state, local and tribal governments, to industry and non-governmental organizations, academic institutions and non-profit organizations, all with varying and overlapping interests and resources. The CMTS is an optimal forum through which periodic updates on the U.S.

Arctic MTS Improvement Plan actions may be coordinated and developed in conjunction with participating federal agencies.

Likewise the CMTS could also help coordinate or inform the MTS-related Arctic Region Policy concerns of the Arctic Integrated Policy Committee. Other workgroups such as the Integrated Arctic Research Policy Committee, the Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska, and the recently formed Alaska Arctic Policy Commission may also increase efficiency by utilizing CMTS expertise on MTS issues relevant to their own objectives. Efficiencies will be realized through coordinated action by federal lead and support agencies with state, tribal, academic and Industry partners, elimination of redundancies, and optimized funding. The unique position of the CMTS as a cabinet-level Congressionally-established interagency body to improve federal marine transportation coordination and plans is an additional reason why it can play an active role in engaging these stakeholders and focusing their myriad efforts into contributions to the Arctic MTS Improvement Plan. The CMTS can also bring a unified voice to the National Ocean Council, where it can track and report on MTS-related priorities shared between the NOP Implementation Plans and the CMTS Arctic MTS Improvement Plan. Moreover, the CMTS was engaged in the development of the National Strategy for the Arctic Region and will play a key role in the development of an NSAR implementation plan.

2. Join the Law of the Sea Convention

It is important for the United States to pursue ratification of LOSC. Because a significant part of the Arctic region is covered by ocean, LOSC will provide an important framework as the eight Arctic States and other nations pursue the abundant resources contained therein. Acceding to LOSC can enhance U.S. standing in negotiations regarding the Arctic and ECS claims, particularly as the United States takes on the chairmanship of the Arctic Council in 2015. The United States has consistently supported LOSC principles and virtually all provisions; however, other countries view the United States as outside the "community" of countries that have joined the Convention. Continued non-accession to UNCLOS will impact to the relationships between the United States and other countries in addressing many critical Arctic issues.

3. Implement the U.S. Arctic MTS Improvement Plan – Priorities and Timeframes

Table 3 extracts the milestones from Chapter 3 to construct a U.S. Arctic MTS Improvement Plan, an implementation plan for adequately addressing safe and secure marine transportation in the Arctic. The steps laid out in this Improvement Plan involve various lead agencies and include coordination with Alaska natives, appropriate federal, state, and local stakeholders, and industry and other MTS users. Most milestones have near-term deliverables in the 2013-2015 timeframe to track progress, but work will continue in each component area after 2015. In some cases the milestones require proper sequencing for effective Arctic MTS development. Implementing this plan now is essential to adequately address measures requiring long lead

times, investment and infrastructure development.[81] Analyses, studies and coordination meetings may determine further necessary refinement of the action items. The Plan does include some recommended milestones that are not currently resourced within agency budgets or out-year planning.

Using evaluation criteria, the CMTS prioritized the U.S. Arctic MTS Improvement Plan actions according to levels of urgency (red, yellow, green in Table 3). The criteria included an assessment of actions that:

- Are identified as requirements by other expert reports;
- Can be achieved or positively impacted with existing resources;
- Are regionally significant;
- Are interdependent, building on each other in a systematic approach to developing an Arctic MTS;
- Immediately increase safety for the mariner; and/or
- Establish the foundation for sustainable federal Arctic support and safe operations.

Based on the assessment, which included review of Arctic policies and current Arctic marine transportation conditions (Tables 1 and 2), and within the context of existing U.S. policy guidance covering the Arctic, the CMTS recommends that the United States first focus effort to improve the Arctic MTS in two primary MTS component areas:

- MTS Information Infrastructure, and
- MTS Response Services.

Steps taken in 2013 and coming years to strengthen key elements within these two components will meet the greatest number of requirement drivers, as shown in Table 1. Improvements in information infrastructure and response services will also most immediately impact safe and efficient navigation in the Arctic. Limited federal baseline resources do support some aspects of Arctic marine transportation, though additional resources would speed implementation. Future funding requirements may be signaled by:

- Projected completion of tasks, especially sequential tasks;
- Current and projected quantifiable user demand; and
- Quantifiable increase in risk associated with increased user demand.

[81] Congressional Research Service report, "Coast Guard Polar Icebreaker Modernization: Background, Issues, and Options for Congress,"11.3.2011, cites the 2011 USCG High Latitude Study, the 2011 DHS Office of Inspector General Report and the 2007 National Research Council Report to demonstrate consensus on the need to maintain an icebreaking capability in the Arctic. The full process will require 8-10 years from acquisition initiation and delivery of the first ship; thus, acquisition should be initiated to ensure availability before icebreaking services are necessary, in advance of future expansion of oil and gas exploration to production, and the associated increase in related vessel activity and risk of pollution and environmental impacts.

The CMTS recommends the following specific priority actions for near-term attention:

- **MTS INFORMATION INFRASTRUCTURE:**
  - **Improve sea ice and marine weather forecasts** with increased observations to facilitate safe navigation and vessel operations throughout Arctic waters, protected marine resources management, community subsistence activities, and homeland and national security activities.
  - **Map and chart U.S. Arctic waters** to improve navigation and situational awareness, enhance the geospatial infrastructure, support maritime commerce, reduce the risk of maritime incidents, loss of life, and environmental damage, help coastal communities develop climate change and storm readiness strategies, and support ecosystem stewardship.
  - **Improve communications** with technological enhancements to facilitate safe maritime operations, effective vessel management, and coordinated responses to maritime incidents and distress calls. These improvements should significantly decrease the risk of environmental damage and loss of life and property at sea. Compatibility with international communications would help ensure effective hand-off of vessels on trans-Arctic voyages, and for response coordination on vessels that do not report in time.
    - *A second but no less important aspect of communications is reciprocal communication with native communities. The Federal Government should understand the risks to their cultures, needs and values brought on by a changing Arctic, and draw upon their traditional knowledge of this unique environment. At the same time, communities would benefit from knowing about marine traffic that may impact their activities.*
  - **Pursue expanded AIS coverage,** including Satellite-AIS coverage, of the entire Arctic region in order to support maritime domain awareness, for vessel monitoring and vessel management schemes, and, where appropriate, to increase awareness of marine activity, reduce the risk of incidents, enforce applicable requirements, facilitate incident response, and help anticipate and manage potential Arctic MTS user conflict.

- **MTS RESPONSE SERVICES:**
  - **Improve Arctic environmental response** capacity and capability through strategic coordination, research, prevention, mitigation, and cleanup to minimize the risks and impacts of pollution events on protected Arctic communities and marine ecosystems.
  - **Ensure effective search and rescue** and emergency preparedness and response through strategic positioning of facilities and resources.
  - **Increase U.S. icebreaking capacity** in the Arctic in order to extricate vessels beset in ice or otherwise in danger, assist shipping, conduct security and science operations, and provide search and rescue and spill response in ice-laden waters.

Four of the above recommendations echo those found in the NOP Implementation Plan for *Changing Conditions in the Arctic*. All the actions address aspects of NOP, *AMSA* and international agreements, ANWTF and Oil Spill Commission recommendations, and Administration and Congressional energy security priorities. CMTS recommendations for Navigable Waterways, Physical Infrastructure, and Vessels should be pursued also, but on an extended timeframe due to lead times, greater resource constraints, and in some cases a lesser degree of urgency than the priority actions noted above.

Additional Recommendations

- **Pursue CMTS Partnerships with State of Alaska, Alaska Natives and the International Community**

The State of Alaska and Alaska Natives have the most at stake as Arctic accessibility and development activity increase. The CMTS closely studied the January 2012 ANWTF recommendations to ensure alignment between ANWTF and CMTS Arctic action items. The overlap in priorities is evident for critical areas of oil, gas and mineral development, marine transportation, Arctic research and Arctic infrastructure. For these reasons, it is critical that the CMTS continue to engage with Alaska representatives (from state and local governments and Alaska Natives) on Arctic interests, and also build a two-way communication path through CMTS agencies such as USCG and NOAA to America's Alaska indigenous peoples with the goal of considering and utilizing their traditional knowledge, and ensuring that the concerns of Arctic indigenous peoples are heard and understood. Concerns that have been brought to the attention of the CMTS include: the potential for vessel traffic interfering with subsistence activities and disrupting marine mammal habitat and migratory patterns, and impacts of spills and waste from foreign innocent passage vessels. The CMTS agencies can also collaborate to support U.S. engagement in the Arctic Council AMATII meetings and on IMO decisions. This CMTS coordination role will ensure efficiency of effort, and resource and funding optimization with state, local, tribal and foreign governments.

- **Pursue Opportunities for Private-Public Partnerships**

With resource exploration and development, shipping, and tourism currently driving increased MTS activities in the Arctic, there may be opportunities to pursue public-private partnerships for MTS development and/or leverage the existing infrastructure. Models such as the St. Lawrence Seaway System, a partnership between the United States and Canada in the Great Lakes, should be explored. Creative approaches between industry and government to meet the infrastructure requirements of the private sector in the current austere budget climate will stretch scarce dollars further and benefit all Arctic MTS users.

Conclusion

Changing conditions in the Arctic present the United States with a rare opportunity to comprehensively and holistically develop an Arctic MTS in order to sustainably manage the Arctic. Remote, wild, and unpredictable, the Arctic presents a unique situation to develop a U.S. Arctic MTS optimally and efficiently, building consensus and partnerships among all

stakeholders, each embracing their respective role to ensure optimal use of available funding and effort, and with collective dedication to protect indigenous cultures and the environment. The CMTS goal is to provide high-level leadership and improved coordination that will promote safety, security, efficiency, economic vitality, sound environmental integration, and reliability of the MTS for commercial, recreational and national defense requirements. The CMTS agencies believe it is crucial to embrace this goal and, at the very least, develop a comprehensive strategy to address development of the Arctic MTS and supporting elements across all MTS components and stakeholders. An appropriate mix of MTS services, actions and impacts will bridge existing gaps and provide a safe, secure and environmentally sound MTS to address the full range of issues impacting the U.S. Arctic and the Arctic region at large. The time to do this is now.

An Arctic Risk Modeling Tool

Greater access to the Arctic and increased activity presents additional risks for people, vessels, and the environment in this fragile region. Managing that risk requires in-depth understanding of the issues and trade-offs associated with key decisions.

A simple model for determining relative risk is:
Total Risk = Threat*Vulnerability*Consequence
Where:

- *Threat is the cumulative indication of the likelihood of adverse events actually occurring;*
- *Vulnerability is the openness of a system to damage should an incident actually occur; and*
- *Consequence is relative impact or importance of an event damaging a system.*

Government management of the MTS is a process where the risk associated with marine transportation is mitigated by lessening threats, reducing vulnerability, or minimizing the consequences of adverse events. Limited Access Areas and restrictions on authorized activities reduce the threat of adverse events occurring. MTS services such as AtoNs, accurate weather forecasts and nautical charts reduce vulnerability to marine casualties, while response capabilities like search and rescue lessen the consequences of casualties when they occur. Taken together, these government services afford an MTS with an acceptable level of risk.

The challenge for the nation is to develop an assessment tool that accounts for the unique elements posing risk in the Arctic MTS and that will provide a quantifiable level of risk and an acceptable level of risk.

Compared to the rest of the U.S, a significantly higher overall risk exists in the Arctic. The threats are higher (extreme operating environment), the existing MTS components are more vulnerable (e.g. vessels not designed to handle such conditions), and the consequences are higher (relatively pristine environment, search and rescue challenges, etc.). Given the rate at which other nations are progressing with Arctic shipping and development, the U.S. should decide the acceptable degree of risk for Arctic operations.

Table 3: U.S. Arctic MTS Improvement Plan			
MTS Components	**MTS Element (Lead Coordinator)**	**Milestones**	**Timeframe**
Navigable Waterways	Places of Refuge for Ships (USACE)	• Facilitate "Whole of Government" approach to ports/harbors planning and development. • Continue coordination between the State of Alaska and the USCG to develop additional potential places of refuge documents as needed. • Continue coordination for the development of an Alaska Regional Ports Planning process with methods developed for prioritization based on public safety (harbors of refuge), economic development, and regional support to communities. • Pursue planning for a series of ports of refuge along northwestern and northern Alaska with associated services to provide assistance to vessels in distress. • Increase awareness of the emergency towing systems that are available to assist ships in distress.	• Govt/Private Industry Task Force by 2014 • 2013 and ongoing • Recommended but not resourced
	Areas of Heightened Ecological Significance (BOEM/NOAA)	• Continue support of the BOEM Environmental Studies program, USGS Alaska Science Center research, and NOAA research efforts including more coordination between BOEM and NOAA under the Research MOU. • Conduct "science of opportunity" flights during operational C-130 patrols in the Arctic. • Provide support to agencies during icebreaker deployment in the Arctic. • Increase government and industry collaboration and information/data sharing such as facilitated by the MOA between NOAA and Shell, ConocoPhillips and Statoil for collaboration in coastal and ocean science in U.S. Arctic waters. • Increase collaboration between government and academic coastal and marine science programs such as the agreement between BOEM and the Coastal Marine Institute of the University of Alaska. • Increase observations: e.g., in-situ atmospheric profiles, stream real-time water level data from bubblers; tidal measurements to enable development of seamless bathymetric - topographic digital elevation models. • Negotiate, fund and implement an agreement with Russia on Particularly Sensitive Sea Areas, vessel traffic management and appropriate associated protective measures for identified areas of	• 2013 and ongoing • With USCG; opportunistic • With USCG; opportunistic • 2013 and ongoing • NOAA, with BSEE/BOEM/MARAD; 2013-2014 • NOAA/BOEM/BSEE - ongoing and to be established • NOAA/State/USCG – recommended but not resourced

		heightened ecological or cultural significance in the Bering Strait under the IMO. • Develop additional geographic response strategies to address the protection of areas of environmental and cultural sensitivity in the Arctic and western Alaska.	
Physical Infrastructure	Ports & Associated Facilities (USACE)	• Continue building coordinated/prioritized list of ports/harbors for development. • Continue study process on feasibility and planning for a deep-draft Arctic port. • Modify the USACE Benefit-Cost Ratio which favors large population centers to allocate Federal funding. • Explore greater use of public-private partnerships, especially with resource development projects to ensure that infrastructure development occurs with all aspects of the Arctic MTS considered. • Develop a system of regional hub and sub-regional ports to facilitate resource development, shipping of goods and services, and carry out emergency response and search and rescue activities.	• Biennial port and harbor conference; 2013 • With AK DOT; 2013-2014 • 2014 • Recommended but not resourced • Recommended but not resourced
	Geospatial Infrastructure (NOAA)	• Work with federal partners, such as FAA and Navy, to collect gravity data. • Improve geoid accuracy in Arctic focus areas from one meter or greater to centimeter accuracy. • Fill Critical Operating Reference Station (CORS) and National Water Level Observation Network (NWLON) gaps in Alaska/Arctic, and co-locate them along the coast as resources become available. • Install a subset of foundation CORS in the region to improve the accuracy of the International Terrestrial Reference Frame to a level capable of measuring absolute global sea level rise on the order of millimeters per year.	• 2013; Aleutians after 2019 • 2022 • Recommended but not resourced • Recommended but not resourced
MTS Information Infrastructure	Hydrographic Surveys and Nautical Charts (NOAA)	• Establish mapping guidelines, standards, vessel of opportunity protocols, and standard operating procedures to facilitate integrated ocean and coastal mapping and acquisition of Arctic hydrographic, shoreline, habitat mapping, and water column data in the Bering, Chukchi, and Beaufort Seas. • Survey a minimum of 500 square nautical miles a year in U.S. Arctic waters • Update nautical charts, environmental sensitivity indices, and other Arctic feature maps with mapping data acquired during annual field seasons. • Refine, in collaboration with stakeholders, a priority list of Arctic maritime regions for survey • Conduct coordinated interagency ocean and coastal mapping operations and incorporate results	▪ 2013 ▪ 2013 and ongoing ▪ 2013 and ongoing ▪ 2013 ▪ 2013 and ongoing

		into the Ocean and Coastal Mapping Inventory • Complete electronic navigational chart coverage as agreed to by the Arctic Regional Hydrographic Commission.	▪ 2015
	Shoreline Mapping (NOAA)	• Map a minimum of 390 miles of shoreline annually for more accurate Arctic nautical charts and national shoreline delineation. ▪ Process and compile for nautical charts and other shoreline-dependent uses. • Leverage opportunities to acquire and/or validate Arctic shoreline imagery. • In collaboration with stakeholders, refine prioritized list of Arctic shorelines for mapping. • Continue ShoreZone mapping of the western and Arctic coasts of Alaska. • Continue exploring use of new technologies, such as Unmanned Aircraft Systems, for shoreline data acquisition. ▪ Incorporate into standard operating procedures if technology proves useful and resources materialize.	▪ 2013 and ongoing ▪ 2013 and ongoing ▪ 2013 ▪ 2013, as resources available ▪ 2013 and ongoing
	Aids to Navigation (USCG)	• Conduct WAMS and PARS of the Arctic region, beginning with ongoing PARS for the Bering Strait, and incorporate into decisions on mapping and charting priorities and waterways management. • Pursue technological solutions/alternatives to physical AtoN in areas of the Arctic where ice is present (e.g., "Virtual" AtoN) and promote international standards for employment. • Coordinate Vessel Routing Measures, as appropriate, via IMO. • In conjunction with Port Access Route Studies (PARS) in the region, consider geographic, navigational, and user requirements for evaluating the entire range of navigational services that may be needed and/or appropriate. Coordinate closely with Alaska government and other stakeholders (including native groups) and consider traditional knowledge, as appropriate, in routing and safe measures. • Develop appropriate capabilities with sufficient capacity to execute U.S. missions at an acceptable level of risk, and in a manner that is adaptive to environmental conditions.	▪ Bering Strait PARS 2013; others TBD ▪ Recommended but not resourced ▪ 2013 and ongoing ▪ Recommended but not resourced ▪ Recommended but not resourced

	Communications (DOD/USCG)	• General ▪ Complete inventory of existing DHS, DOD, and partner communicatgion capabilities (satellites, land-based systems, and submarine cables) in the Arctic region. ▪ Establish and strengthen partnerships with industry, other governments, and Alaska Native organizations to build on existing and new Arctic communications solutions and capabilities. • For line of sight communications: ▪ Identify needed improvements in both voice and video data transmission ▪ Assess the possibility for the use and pre-staging of cell towers in key locations to increase local coverage and capacity during expanded or contingency operations in the region. ▪ Establish baselines of: (a) the performance capabilities at all frequencies for air and surface units; (b) the performance of air-, surface-, and shore-based sensors. ▪ Continue to engage private industry to discuss Arctic communication capability needs; request proposals for possible commercial solutions to those capability needs. ▪ Align Arctic communication strategies with the President's National Public Safety Broadband Network. ▪ Pursue partnerships with other State, borough, Tribal, industry, and countries to enhance DHS and DOD's communications capability. • For beyond line of sight communications: ▪ Develop sufficient communications architecture to support Arctic user needs	• 2013 and ongoing (all)

	Marine Weather & Sea Ice Forecasts (NOAA)	• Initiate international activity to improve sea ice forecasting through generalization of buoy/mooring data from a single point to a broader area and satellite data calibration using this buoy/mooring data. Coordinate efforts and collaborate with the International Ice Charting Working Group (IIWG). • Initiate a study of the marginal ice zone to better measure the rate of sea ice melt and re-growth. • Initiate data cataloging to improve and update the existing U.S. Arctic Sea Ice Atlas. • Train and expand Volunteer Observing Ship and coastal community participation in the sea ice observation program, and catalog user requirements for sea ice products, services, and delivery. • Deliver tactical-scale sea ice analysis and forecasts in GIS-enabled broad-scale format to meet USCG and other user requirements. • Develop better maps of the ice edge, and make field data available early enough in the year to be useful for seasonal ice forecasts. • Extend NOAA National Data Buoy Center Coastal-Marine Automated Network and Yellow Buoy network coverage into the Arctic Ocean for wave observations. • Ensure continued access to Synthetic Aperture Radar (SAR) data for ice advisory and search and rescue needs, oil spill monitoring, and coastal wind observations. • Expand the operational NOAA Wave Watch 3 (NWW3) Model domain from 75ºN to the North Pole to cover the Arctic Ocean. • Sustain and grow external/international satellite partnerships for weather data. • Continue BOEM Environmental Studies on sea ice, ocean currents and meteorology such as: Beaufort/Chukchi Seas Mesoscale Meteorology Modeling Study Phase II; Chukchi Sea Surface Current Circulation Mapping; and Satellite-Tracked Drifter Measurements in the Northeast Chukchi Sea.	▪ With DOD; 2013 ▪ With DOD; 2013 ▪ Recommended but not resourced ▪ 2013 and ongoing ▪ 2013 and ongoing ▪ With NASA; 2013 ▪ Recommended but not resourced ▪ Recommended but not resourced ▪ Recommended but not resourced ▪ 2013 and ongoing ▪ BOEM and UAF; 2013 and ongoing

	Oceanographic and Real-Time Navigation Information (NOAA)	• Reduce National Water Level Observation Network (NWLON) gaps in Alaska/Arctic if resources allow (NOAA). ▪ Co-locate new NWLON stations with Continuously Operating Reference Stations to improve water level/elevation determination and geodetic control. • Install short-term tide gauges to support hydrographic projects in the Arctic. • Deploy current meters and calculate predictions in the Arctic area and approaches of Alaska to support navigation in the western Aleutians, Bristol Bay, Bering Strait, Norton Sound, Kotzebue, Chukchi Sea, and Barrow. • Explore additional partnership efforts with federal and non-federal partners.	• Recommended but not resourced • 2013 and ongoing • Recommended but not resourced • 2013 and ongoing
	Automatic Identification System (USCG)	• In conjunction with PARS and in the region, consider geographic, navigational, and user requirements, currently and in the future, in support of the broad range of maritime services. • Continue ongoing Arctic analytical products and technical intelligence processing and analysis related to ship tracking. Evaluate the utility of such products (including AIS, LRIT and related data) in providing real-time information to federal and state agencies and to other stakeholders in Alaska (as appropriate) in assessing risks from ships navigating in or transiting the region. • Continue AIS roll-out in Bering Strait/Sea • Analyze and include northern coast/waters of Alaska in National AIS plan. • As marine traffic increases with diminishing ice and increased accessibility, conduct risked-based evaluation of the need for expanded AIS carriage requirements for vessels operating in U.S. Arctic waters. • With international partners, participate in follow-up project to *AMSA* 2009 recommendation III (B) on Arctic Marine Traffic systems, compiling an inventory of systems and defining data sharing and access issues • Pursue establishment of Arctic-wide Vessel Traffic Monitoring and Reporting system, to ensure seamless transition for trans-Arctic mariners, as dictated by PARS and WAMS	• Bering Strait PARS 2013; others TBD • 2013 • 2013 • Recommended but not resourced • Recommended but not resourced • DOS/DHS/MARAD/NOAA/DOI/DOE; 2013 • Recommended but not resourced

MTS Response Services	Icebreaking (USCG)	• Capitalize on the results of the PARS in the region, consider geographic, navigational, and user requirements that would indicate areas where icebreaker assistance (icebreaking, vessel escort, preventative track grooming) may be appropriate. • Develop appropriate capabilities with sufficient capacity to execute U.S. missions at an acceptable level of risk, and in a manner that is adaptive to environmental conditions.	• Bering Strait PARS 2013; others TBD • Acquisition Process initiated in 2012
	Environmental Response Management (USCG/NOAA)	• Continue support for the BOEM Environmental Studies Program research into oil weathering in Arctic environments and collection of baseline chemical and biological data. • Continue support for the BSEE Oil Spill Response Research and Offshore Engineering and Technology Research Programs. • Continue to support the NOAA Office of Response and Restoration in work on Arctic Environmental Response Management Application, spill response and training support, and preparing for Natural Resource Damage Assessments. • Continue involvement in Joint Industry Programs on Arctic spill response. • Seek funding for oil spill research to levels authorized in the Oil Pollution Act of 1990. • Maintain coordination with Russia and Canada on spill response through USCG and Russian Federation in the Russian-American Joint Planning Group and the Canada-U.S. Joint Marine Pollution Contingency Plan: CANUSNORTH Annex. • Work with IMO to develop the Polar Code as mandatory guidelines on ship safety, pollution prevention and other provision aimed at protection of the Arctic environment. • Develop cooperative agreements regarding sharing across the Arctic in the event of a large spill event, including communications and coordination strategies as well as detailed cost, logistics, customs and trade procedures and guidelines to support expedited movement of personnel and equipment across national boundaries. • Improve oil spill response readiness; deliver scientific support for Arctic pollution response such as contingency plans, place-based drills and community workshops, and spill trajectory modeling to decision makers will help to reduce risk of accident and injury to protected resources and ecosystems as commercial vessel traffic in and through the Arctic increases. • Acquire baseline data to inform post-incident damage assessment and resource restoration efforts. In collaboration with industry, support research and technology transfer to prevent, prepare for, respond to and restore impacts of oil release into Arctic waters. • Identify current salvage capabilities and gaps.	• BOEM; 2013 and ongoing • With BOEM/BSEE/DOS/DOJ; 2013 • With BSEE; 2013 and ongoing • With BOEM; 2013 and ongoing • NOAA, with BSEE, 2013 • USCG, with BSEE/BOEM/EPA; 2013 • With MARAD; 2013 and ongoing • With BSEE, EPA and State; 2013 and ongoing • 2013 and ongoing • Recommended but not resourced • Recommended but not resourced

		• Develop strategies for mobilizing and flowing resources from other areas to support a large spill response event. • Apply consensus risk assessments tools and processes to ensure community awareness of and involvement in spill planning and preparedness. • Develop a worldwide inventory of equipment that is available for deployment in support of Arctic response. • Develop international guidelines for spill response in broken ice and ice covered environments. • Construct Arctic area infrastructure and forward deploy adequate response assets to facilitate appropriate response to shipping and other offshore industry accidents that involve spills of oil and hazardous materials. • Continue to support the Alaska Regional Response Team and the subarea committees in the periodic review and update of the Alaska Unified Plan and the ten subarea contingency plans.	• With BSEE; 2013 and ongoing • 2013 and ongoing • With BSEE and DOE; 2013 and ongoing • 2018 • Recommended but not resourced • 2013 and ongoing
	Search and Rescue/ Emergency Response (USCG)	• Strengthen existing Search and Rescue (SAR) agreements • Develop and validate response plans for a mass maritime SAR incident • Leverage partnerships to facilitate use of existing infrastructure to support operations • Develop estimates for the budget process to support Arctic initiatives, to include recurring funding for temporary Forward Operating Locations (FOL) • Conduct a logistics analysis of the existing Arctic SAR region, to include needs associated with "surge" operations and a major search and rescue cases (mass rescue). • Engage in multilateral and bilateral discussions to expand SAR cooperative agreements and better promote U.S. interests in the Arctic • Work with other Arctic nations to develop, implement and sustain Arctic region-wide response strategies • Develop risk-based prioritized short, medium and long-term national, regional, and local level actions to support maritime response (SAR) activities in the Arctic, with due adherence to environmental statutes and regulations (e.g., NEPA, ESA, etc.) • Pursue resources, as necessary and feasible, to ensure adequate facilities and infrastructure to support activities in the Arctic region • Develop sufficient communications architecture to support C4I needs of users in the Arctic	• With DOS, others; 2013 and ongoing • 2013 • 2013 and ongoing • Recommended but not resourced • Recommended but not resourced • With DOS, others; 2013 and ongoing • With DOS; 2013 and ongoing • Recommended but not resourced • 2013 and ongoing • Recommended but not resourced

		• Explore an international mandate for AIS carriage by all non-government vessels, complete deployment of AIS transceiver capability in the Arctic, and Long Range Identification Tracking (LRIT) capabilities for non-government vessels so government agencies can easily locate vessels in order to facilitate SAR operations • Continue to promote the use of Automated Mutual-Assistance Vessel Rescue (AMVER) search and rescue ship reporting system for use by ships transiting in Alaskan and Arctic waters.	• Recommended but not resourced • With MARAD, NOAA; 2013 and ongoing
Vessels	Design Standards for Polar Operations (MARAD/BSEE)	• Coordination of designs for icebreaking ships – double acting vessels • Conduct NEPA/ESA coordination with Federal Partners regarding vessel air emissions and noise. • Pursue federal coordination of interagency Memoranda of Agreement and international partnerships for vessel design standards. • Participate with the USCG-led delegation to the IMO addressing development of the Polar Code • Develop cooperative initiatives between industry and federal partners to support shipping in the Arctic region • Collaborate with industry, state and local governments, and federal stakeholders on requirements for shipboard oil spill preparedness and response capabilities for vessels transiting the Arctic. • Contract for development of design standards for Arctic vessels. • Facilitate development of life saving and survivability equipment tailored for use in Polar waters. • Meet with industry to discuss risk, insurance and bonding. • Continue support for BSEE Offshore Engineering and Technology Research Program studies into ice engineering for offshore structures. • Continue work with ISO TC 67 on Standards for MODUs for Arctic offshore oil and gas operations. • Conduct a Formal Safety Assessment (FSA) on Arctic Drilling (for MODUs).	• 2015 • 2014 • 2014 • With NOAA, 2013 • 2013 • 2013 • 2014 • 2013 • 2013 • 2013 and ongoing • Tentative for 2013-14 • 2013
	Crew Standards/ Training (MARAD/USCG)	• With international partners, pursue development and negotiation of the Polar Code. • Incorporate domestically any mandatory provisions of the Polar Code. • Develop standardized personnel training curricula for officers and crew aboard vessels operating in polar waters • Examine applicability of training and safety standards to the U.S. fishing fleet.	• 2015 • 2015 • 2015 • 2015

Appendix A

NATIONAL SECURITY PRESIDENTIAL DIRECTIVE 66/HOMELAND SECURITY PRESIDENTIAL DIRECTIVE 25

MEMORANDUM FOR THE VICE PRESIDENT
THE SECRETARY OF STATE
THE SECRETARY OF THE TREASURY
THE SECRETARY OF DEFENSE
THE ATTORNEY GENERAL
THE SECRETARY OF THE INTERIOR
THE SECRETARY OF COMMERCE
THE SECRETARY OF HEALTH AND HUMAN SERVICES
THE SECRETARY OF TRANSPORTATION
THE SECRETARY OF ENERGY
THE SECRETARY OF HOMELAND SECURITY
ASSISTANT TO THE PRESIDENT AND CHIEF OF STAFF
ADMINISTRATOR OF THE ENVIRONMENTAL PROTECTION AGENCY
DIRECTOR OF THE OFFICE OF MANAGEMENT AND BUDGET
DIRECTOR OF NATIONAL INTELLIGENCE
ASSISTANT TO THE PRESIDENT FOR NATIONAL SECURITY AFFAIRS
COUNSEL TO THE PRESIDENT
ASSISTANT TO THE PRESIDENT AND DEPUTY NATIONAL SECURITY ADVISOR FOR INTERNATIONAL ECONOMIC AFFAIRS
ASSISTANT TO THE PRESIDENT FOR HOMELAND SECURITY AND COUNTERTERRORISM
CHAIRMAN, COUNCIL ON ENVIRONMENTAL QUALITY
DIRECTOR OF THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
COMMANDANT, U.S. COAST GUARD
DIRECTOR, NATIONAL SCIENCE FOUNDATION

SUBJECT: Arctic Region Policy

I. PURPOSE

A. This directive establishes the policy of the United States with respect to the Arctic region and directs related implementation actions. This directive supersedes Presidential Decision Directive/NSC-26 (PDD-26; issued 1994) with respect to Arctic policy but not Antarctic policy; PDD-26 remains in effect for Antarctic policy only.

B. This directive shall be implemented in a manner consistent with the Constitution and laws of the United States, with the obligations of the United States under the treaties and other international agreements to which the United States is a party, and with customary international law as recognized by the United States, including with respect to the law of the sea.

II. BACKGROUND

A. The United States is an Arctic nation, with varied and compelling interests in that region. This directive takes into account several developments, including, among others:
   1. Altered national policies on homeland security and defense;
   2. The effects of climate change and increasing human activity in the Arctic region;
   3. The establishment and ongoing work of the Arctic Council; and
   4. A growing awareness that the Arctic region is both fragile and rich in resources.

III. POLICY

A. It is the policy of the United States to:
   1. Meet national security and homeland security needs relevant to the Arctic region;
   2. Protect the Arctic environment and conserve its biological resources;
   3. Ensure that natural resource management and economic development in the region are environmentally sustainable;
   4. Strengthen institutions for cooperation among the eight Arctic nations (the United States, Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, and Sweden);
   5. Involve the Arctic's indigenous communities in decisions that affect them; and
   6. Enhance scientific monitoring and research into local, regional, and global environmental issues.

B. **National Security and Homeland Security Interests in the Arctic**
   1. The United States has broad and fundamental national security interests in the Arctic region and is prepared to operate either independently or in conjunction with other states to safeguard these interests. These interests include such matters as missile defense and early warning; deployment of sea and air systems for strategic sealift, strategic deterrence, maritime presence, and maritime security operations; and ensuring freedom of navigation and overflight.
   2. The United States also has fundamental homeland security interests in preventing terrorist attacks and mitigating those criminal or hostile acts that could increase the United States vulnerability to terrorism in the Arctic region.
   3. The Arctic region is primarily a maritime domain; as such, existing policies and authorities relating to maritime areas continue to apply, including those relating to law enforcement.[1] Human activity in the Arctic region is increasing and is projected to increase further in coming years. This requires the United States to assert a more active and influential national presence to protect its Arctic interests and to project sea power throughout the region.
   4. The United States exercises authority in accordance with lawful claims of United States sovereignty, sovereign rights, and jurisdiction in the Arctic region, including sovereignty within the territorial sea, sovereign rights and jurisdiction within the United States EEZ and on the continental shelf, and appropriate control in the United States contiguous zone.
   5. Freedom of the seas is a top national priority. The Northwest Passage is a strait used for international navigation, and the Northern Sea Route includes straits used for

international navigation; the regime of transit passage applies to passage through those straits. Preserving the rights and duties relating to navigation and overflight in the Arctic region supports our ability to exercise these rights throughout the world, including through strategic straits.

6. Implementation: In carrying out this policy as it relates to national security and homeland security interests in the Arctic, the Secretaries of State, Defense, and Homeland Security, in coordination with heads of other relevant executive departments and agencies, shall:
    a. Develop greater capabilities and capacity, as necessary, to protect United States air, land, and sea borders in the Arctic region;
    b. Increase Arctic maritime domain awareness in order to protect maritime commerce, critical infrastructure, and key resources;
    c. Preserve the global mobility of United States military and civilian vessels and aircraft throughout the Arctic region;
    d. Project a sovereign United States maritime presence in the Arctic in support of essential United States interests; and
    e. Encourage the peaceful resolution of disputes in the Arctic region.

C. **International Governance**

1. The United States participates in a variety of fora, international organizations, and bilateral contacts that promote United States interests in the Arctic. These include the Arctic Council, the International Maritime Organization (IMO), wildlife conservation and management agreements, and many other mechanisms. As the Arctic changes and human activity in the region increases, the United States and other governments should consider, as appropriate, new international arrangements or enhancements to existing arrangements.
2. The Arctic Council has produced positive results for the United States by working within its limited mandate of environmental protection and sustainable development. Its subsidiary bodies, with help from many United States agencies, have developed and undertaken projects on a wide range of topics. The Council also provides a beneficial venue for interaction with indigenous groups. It is the position of the United States that the Arctic Council should remain a high-level forum devoted to issues within its current mandate and not be transformed into a formal international organization, particularly one with assessed contributions. The United States is nevertheless open to updating the structure of the Council, including consolidation of, or making operational changes to, its subsidiary bodies; to the extent such changes can clearly improve the Council's work and are consistent with the general mandate of the Council.
3. The geopolitical circumstances of the Arctic region differ sufficiently from those of the Antarctic region such that an "Arctic Treaty" of broad scope -- along the lines of the Antarctic Treaty -- is not appropriate or necessary.
4. The Senate should act favorably on U.S. accession to the U.N. Convention on the Law of the Sea promptly, to protect and advance U.S. interests, including with respect to the Arctic. Joining will serve the national security interests of the United States,

including the maritime mobility of our Armed Forces worldwide. It will secure U.S. sovereign rights over extensive marine areas, including the valuable natural resources they contain. Accession will promote U.S. interests in the environmental health of the oceans. And it will give the United States a seat at the table when the rights that are vital to our interests are debated and interpreted.

5. Implementation: In carrying out this policy as it relates to international governance, the Secretary of State, in coordination with heads of other relevant executive departments and agencies, shall:
   a. Continue to cooperate with other countries on Arctic issues through the United Nations (U.N.) and its specialized agencies, as well as through treaties such as the U.N. Framework Convention on Climate Change, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on Long Range Transboundary Air Pollution and its protocols, and the Montreal Protocol on Substances that Deplete the Ozone Layer;
   b. Consider, as appropriate, new or enhanced international arrangements for the Arctic to address issues likely to arise from expected increases in human activity in that region, including shipping, local development and subsistence, exploitation of living marine resources, development of energy and other resources, and tourism;
   c. Review Arctic Council policy recommendations developed within the ambit of the Council's scientific reviews and ensure the policy recommendations are subject to review by Arctic governments; and
   d. Continue to seek advice and consent of the United States Senate to accede to the 1982 Law of the Sea Convention.

D. **Extended Continental Shelf and Boundary Issues**

1. Defining with certainty the area of the Arctic seabed and subsoil in which the United States may exercise its sovereign rights over natural resources such as oil, natural gas, methane hydrates, minerals, and living marine species is critical to our national interests in energy security, resource management, and environmental protection. The most effective way to achieve international recognition and legal certainty for our extended continental shelf is through the procedure available to States Parties to the U.N. Convention on the Law of the Sea.
2. The United States and Canada have an unresolved boundary in the Beaufort Sea. United States policy recognizes a boundary in this area based on equidistance. The United States recognizes that the boundary area may contain oil, natural gas, and other resources.
3. The United States and Russia are abiding by the terms of a maritime boundary treaty concluded in 1990, pending its entry into force. The United States is prepared to enter the agreement into force once ratified by the Russian Federation.
4. Implementation: In carrying out this policy as it relates to extended continental shelf and boundary issues, the Secretary of State, in coordination with heads of other relevant executive departments and agencies, shall:

a. Take all actions necessary to establish the outer limit of the continental shelf appertaining to the United States, in the Arctic and in other regions, to the fullest extent permitted under international law;
b. Consider the conservation and management of natural resources during the process of delimiting the extended continental shelf; and
c. Continue to urge the Russian Federation to ratify the 1990 United States-Russia maritime boundary agreement.

E. **Promoting International Scientific Cooperation**

1. Scientific research is vital for the promotion of United States interests in the Arctic region. Successful conduct of U.S. research in the Arctic region requires access throughout the Arctic Ocean and to terrestrial sites, as well as viable international mechanisms for sharing access to research platforms and timely exchange of samples, data, and analyses. Better coordination with the Russian Federation, facilitating access to its domain, is particularly important.
2. The United States promotes the sharing of Arctic research platforms with other countries in support of collaborative research that advances fundamental understanding of the Arctic region in general and potential Arctic change in particular. This could include collaboration with bodies such as the Nordic Council and the European Polar Consortium, as well as with individual nations.
3. Accurate prediction of future environmental and climate change on a regional basis, and the delivery of near real-time information to end-users, requires obtaining, analyzing, and disseminating accurate data from the entire Arctic region, including both paleoclimatic data and observational data. The United States has made significant investments in the infrastructure needed to collect environmental data in the Arctic region, including the establishment of portions of an Arctic circumpolar observing network through a partnership among United States agencies, academic collaborators, and Arctic residents. The United States promotes active involvement of all Arctic nations in these efforts in order to advance scientific understanding that could provide the basis for assessing future impacts and proposed response strategies.
4. United States platforms capable of supporting forefront research in the Arctic Ocean, including portions expected to be ice-covered for the foreseeable future, as well as seasonally ice-free regions, should work with those of other nations through the establishment of an Arctic circumpolar observing network. All Arctic nations are members of the Group on Earth Observations partnership, which provides a framework for organizing an international approach to environmental observations in the region. In addition, the United States recognizes that academic and research institutions are vital partners in promoting and conducting Arctic research.
5. <u>Implementation</u>: In carrying out this policy as it relates to promoting scientific international cooperation, the Secretaries of State, the Interior, and Commerce and the Director of the National Science Foundation, in coordination with heads of other relevant executive departments and agencies, shall:
   a. Continue to play a leadership role in research throughout the Arctic region;

b. Actively promote full and appropriate access by scientists to Arctic research sites through bilateral and multilateral measures and by other means;
c. Lead the effort to establish an effective Arctic circumpolar observing network with broad partnership from other relevant nations;
d. Promote regular meetings of Arctic science ministers or research council heads to share information concerning scientific research opportunities and to improve coordination of international Arctic research programs;
e. Work with the Interagency Arctic Research Policy Committee (IARPC) to promote research that is strategically linked to U.S. policies articulated in this directive, with input from the Arctic Research Commission; and
f. Strengthen partnerships with academic and research institutions and build upon the relationships these institutions have with their counterparts in other nations.

F. **Maritime Transportation in the Arctic Region**

1. The United States priorities for maritime transportation in the Arctic region are:
   a. To facilitate safe, secure, and reliable navigation;
   b. To protect maritime commerce; and
   c. To protect the environment.
2. Safe, secure, and environmentally sound maritime commerce in the Arctic region depends on infrastructure to support shipping activity, search and rescue capabilities, short- and long-range aids to navigation, high-risk area vessel-traffic management, iceberg warnings and other sea ice information, effective shipping standards, and measures to protect the marine environment. In addition, effective search and rescue in the Arctic will require local, State, Federal, tribal, commercial, volunteer, scientific, and multinational cooperation.
3. Working through the International Maritime Organization (IMO), the United States promotes strengthening existing measures and, as necessary, developing new measures to improve the safety and security of maritime transportation, as well as to protect the marine environment in the Arctic region. These measures may include ship routing and reporting systems, such as traffic separation and vessel traffic management schemes in Arctic chokepoints; updating and strengthening of the Guidelines for Ships Operating in Arctic Ice-Covered Waters; underwater noise standards for commercial shipping; a review of shipping insurance issues; oil and other hazardous material pollution response agreements; and environmental standards.
4. <u>Implementation</u>: In carrying out this policy as it relates to maritime transportation in the Arctic region, the Secretaries of State, Defense, Transportation, Commerce, and Homeland Security, in coordination with heads of other relevant executive departments and agencies, shall:
   a. Develop additional measures, in cooperation with other nations, to address issues that are likely to arise from expected increases in shipping into, out of, and through the Arctic region;
   b. Commensurate with the level of human activity in the region, establish a risk-based capability to address hazards in the Arctic environment. Such efforts shall

advance work on pollution prevention and response standards; determine basing and logistics support requirements, including necessary airlift and icebreaking capabilities; and improve plans and cooperative agreements for search and rescue;

c. Develop Arctic waterways management regimes in accordance with accepted international standards, including vessel traffic-monitoring and routing; safe navigation standards; accurate and standardized charts; and accurate and timely environmental and navigational information; and
d. Evaluate the feasibility of using access through the Arctic for strategic sealift and humanitarian aid and disaster relief.

G. **Economic Issues, Including Energy**

1. Sustainable development in the Arctic region poses particular challenges. Stakeholder input will inform key decisions as the United States seeks to promote economic and energy security. Climate change and other factors are significantly affecting the lives of Arctic inhabitants, particularly indigenous communities. The United States affirms the importance to Arctic communities of adapting to climate change, given their particular vulnerabilities.
2. Energy development in the Arctic region will play an important role in meeting growing global energy demand as the area is thought to contain a substantial portion of the world's undiscovered energy resources. The United States seeks to ensure that energy development throughout the Arctic occurs in an environmentally sound manner, taking into account the interests of indigenous and local communities, as well as open and transparent market principles. The United States seeks to balance access to, and development of, energy and other natural resources with the protection of the Arctic environment by ensuring that continental shelf resources are managed in a responsible manner and by continuing to work closely with other Arctic nations.
3. The United States recognizes the value and effectiveness of existing fora, such as the Arctic Council, the International Regulators Forum, and the International Standards Organization.
4. <u>Implementation</u>: In carrying out this policy as it relates to economic issues, including energy, the Secretaries of State, the Interior, Commerce, and Energy, in coordination with heads of other relevant executive departments and agencies, shall:
   a. Seek to increase efforts, including those in the Arctic Council, to study changing climate conditions, with a view to preserving and enhancing economic opportunity in the Arctic region. Such efforts shall include inventories and assessments of villages, indigenous communities, subsistence opportunities, public facilities, infrastructure, oil and gas development projects, alternative energy development opportunities, forestry, cultural and other sites, living marine resources, and other elements of the Arctic's socioeconomic composition;
   b. Work with other Arctic nations to ensure that hydrocarbon and other development in the Arctic region is carried out in accordance with accepted best

practices and internationally recognized standards and the 2006 Group of Eight (G-8) Global Energy Security Principles;

c. Consult with other Arctic nations to discuss issues related to exploration, production, environmental and socioeconomic impacts, including drilling conduct, facility sharing, the sharing of environmental data, impact assessments, compatible monitoring programs, and reservoir management in areas with potentially shared resources;
d. Protect United States interests with respect to hydrocarbon reservoirs that may overlap boundaries to mitigate adverse environmental and economic consequences related to their development;
e. Identify opportunities for international cooperation on methane hydrate issues, North Slope hydrology, and other matters;
f. Explore whether there is a need for additional fora for informing decisions on hydrocarbon leasing, exploration, development, production, and transportation, as well as shared support activities, including infrastructure projects; and
g. Continue to emphasize cooperative mechanisms with nations operating in the region to address shared concerns, recognizing that most known Arctic oil and gas resources are located outside of United States jurisdiction.

H. **Environmental Protection and Conservation of Natural Resources**

1. The Arctic environment is unique and changing. Increased human activity is expected to bring additional stressors to the Arctic environment, with potentially serious consequences for Arctic communities and ecosystems.
2. Despite a growing body of research, the Arctic environment remains poorly understood. Sea ice and glaciers are in retreat. Permafrost is thawing and coasts are eroding. Pollutants from within and outside the Arctic are contaminating the region. Basic data are lacking in many fields. High levels of uncertainty remain concerning the effects of climate change and increased human activity in the Arctic. Given the need for decisions to be based on sound scientific and socioeconomic information, Arctic environmental research, monitoring, and vulnerability assessments are top priorities. For example, an understanding of the probable consequences of global climate variability and change on Arctic ecosystems is essential to guide the effective long-term management of Arctic natural resources and to address socioeconomic impacts of changing patterns in the use of natural resources.
3. Taking into account the limitations in existing data, United States efforts to protect the Arctic environment and to conserve its natural resources must be risk-based and proceed on the basis of the best available information.
4. The United States supports the application in the Arctic region of the general principles of international fisheries management outlined in the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of December 10, 1982, relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and similar instruments. The United States endorses the protection of vulnerable marine ecosystems in the Arctic

from destructive fishing practices and seeks to ensure an adequate enforcement presence to safeguard Arctic living marine resources.

5. With temperature increases in the Arctic region, contaminants currently locked in the ice and soils will be released into the air, water, and land. This trend, along with increased human activity within and below the Arctic, will result in increased introduction of contaminants into the Arctic, including both persistent pollutants (e.g., persistent organic pollutants and mercury) and airborne pollutants (e.g., soot).
6. Implementation: In carrying out this policy as it relates to environmental protection and conservation of natural resources, the Secretaries of State, the Interior, Commerce, and Homeland Security and the Administrator of the Environmental Protection Agency, in coordination with heads of other relevant executive departments and agencies, shall:
    a. In cooperation with other nations, respond effectively to increased pollutants and other environmental challenges;
    b. Continue to identify ways to conserve, protect, and sustainably manage Arctic species and ensure adequate enforcement presence to safeguard living marine resources, taking account of the changing ranges or distribution of some species in the Arctic. For species whose range includes areas both within and beyond United States jurisdiction, the United States shall continue to collaborate with other governments to ensure effective conservation and management;
    c. Seek to develop ways to address changing and expanding commercial fisheries in the Arctic, including through consideration of international agreements or organizations to govern future Arctic fisheries;
    d. Pursue marine ecosystem-based management in the Arctic; and
    e. Intensify efforts to develop scientific information on the adverse effects of pollutants on human health and the environment and work with other nations to reduce the introduction of key pollutants into the Arctic.

IV. Resources and Assets

A. Implementing a number of the policy elements directed above will require appropriate resources and assets. These elements shall be implemented consistent with applicable law and authorities of agencies, or heads of agencies, vested by law, and subject to the availability of appropriations. The heads of executive departments and agencies with responsibilities relating to the Arctic region shall work to identify future budget, administrative, personnel, or legislative proposal requirements to implement the elements of this directive.

GEORGE W. BUSH
January 9, 2009

Appendix B

Arctic Marine Shipping Assessment 2009 Recommendations
Page 6-7, http://www.arctic.gov/publications/AMSA/exec_summary.pdf

The focus of the *AMSA* is marine safety and marine environmental protection, which is consistent with the Arctic Council's mandates of environmental protection and sustainable development. Based on the findings of the *AMSA*, recommendations were developed to provide a guide for future action by the Arctic Council, Arctic states and many others. The *AMSA* recommendations are presented under three broad, inter-related themes that are fundamental to understanding the *AMSA*: Enhancing Arctic Marine Safety, Protecting Arctic People and the Environment, and Building Arctic Marine Infrastructure. It is recognized that implementation of these recommendations could come from the Arctic states, industry and/or public-private partnerships.

I. Enhancing Arctic Marine Safety

A. *Linking with International Organizations*: That the Arctic states decide to, on a case by case basis, identify areas of common interest and develop unified positions and approaches with respect to international organizations such as: the International Maritime Organization (IMO), the International Hydrographic Organization (IHO), the World Meteorological Organization (WMO) and the International Maritime Satellite Organization (IMSO) to advance the safety of Arctic marine shipping; and encourage meetings, as appropriate, of member state national maritime safety organizations to coordinate, harmonize and enhance the implementation of the Arctic maritime regulatory framework.

B. *IMO Measures for Arctic Shipping*: That the Arctic states, in recognition of the unique environmental and navigational conditions in the Arctic, decide to cooperatively support efforts at the International Maritime Organization to strengthen, harmonize and regularly update international standards for vessels operating in the Arctic. These efforts include:

- Support the updating and the mandatory application of relevant parts of the Guidelines for Ships Operating in Arctic Ice-covered Waters (Arctic Guidelines); and,
- Drawing from IMO instruments, in particular the Arctic Guidelines augment global IMO ship safety and pollution prevention conventions with specific mandatory requirements or other provisions for ship construction, design, equipment, crewing, training and operations, aimed at safety and protection of the Arctic environment.

C. *Uniformity of Arctic Shipping Governance*: That the Arctic states should explore the possible harmonization of Arctic marine shipping regulatory regimes within their own jurisdiction and uniform Arctic safety and environmental protection regulatory regimes, consistent with UNCLOS, that could provide a basis for protection measures in regions of the central Arctic Ocean beyond coastal state jurisdiction for consideration by the IMO.

D. *Strengthening Passenger Ship Safety in Arctic Waters*: That the Arctic states should support the application of the IMO's Enhanced Contingency Planning Guidance for Passenger Ships

Operating in Areas Remote from SAR Facilities, given the extreme challenges associated with rescue operations in the remote and cold Arctic region; and strongly encourage cruise ship operators to develop, implement and share their own best practices for operating in such conditions, including consideration of measures such as timing voyages so that other ships are within rescue distance in case of emergency.

E. *Arctic Search and Rescue (SAR) Instrument*: That the Arctic states decide to support developing and implementing a comprehensive, multi-national Arctic Search and Rescue (SAR) instrument, including aeronautical and maritime SAR, among the eight Arctic nations and, if appropriate, with other interested parties in recognition of the remoteness and limited resources in the region.

II. Protecting Arctic People and the Environment

A. *Survey of Arctic Indigenous Marine Use*: That the Arctic states should consider conducting surveys on Arctic marine use by indigenous communities where gaps are identified to collect information for establishing up-to-date baseline data to assess the impacts from Arctic shipping activities.

B. *Engagement with Arctic Communities*: That the Arctic states decide to determine if effective communication mechanisms exist to ensure engagement of their Arctic coastal communities and, where there are none, to develop their own mechanisms to engage and coordinate with the shipping industry, relevant economic activities and Arctic communities (in particular during the planning phase of a new marine activity) to increase benefits and help reduce the impacts from shipping.

C. *Areas of Heightened Ecological and Cultural Significance*: That the Arctic states should identify areas of heightened ecological and cultural significance in light of changing climate conditions and increasing multiple marine use and, where appropriate, should encourage implementation of measures to protect these areas from the impacts of Arctic marine shipping, in coordination with all stakeholders and consistent with international law.

D. *Specially Designated Arctic Marine Areas*: That the Arctic states should, taking into account the special characteristics of the Arctic marine environment, explore the need for internationally designated areas for the purpose of environmental protection in regions of the Arctic Ocean. This could be done through the use of appropriate tools, such as “Special Areas” or Particularly Sensitive Sea Areas (PSSA) designation through the IMO and consistent with the existing international legal framework in the Arctic.

E. *Protection from Invasive Species:* That the Arctic states should consider ratification of the IMO International Convention for the Control and Management of Ships Ballast Water and Sediments, as soon as practical. Arctic states should also assess the risk of introducing invasive species through ballast water and other means so that adequate prevention measures can be implemented in waters under their jurisdiction.

F. *Oil Spill Prevention*: That the Arctic states decide to enhance the mutual cooperation in the field of oil spill prevention and, in collaboration with industry, support research and technology transfer to prevent release of oil into Arctic waters, since prevention of oil spills is the highest priority in the Arctic for environmental protection.

G. *Addressing Impacts on Marine Mammals*: That the Arctic states decide to engage with relevant international organizations to further assess the effects on marine mammals due to ship noise, disturbance and strikes in Arctic waters; and consider, where needed, to work with the IMO in developing and implementing mitigation strategies.

H. *Reducing Air Emissions*: That the Arctic states decide to support the development of improved practices and innovative technologies for ships in port and at sea to help reduce current and future emissions of greenhouse gases (GHGs), Nitrogen Oxides (NOx), Sulfur Oxides (SOx) and Particulate Matter (PM), taking into account the relevant IMO regulations.

III. Building the Arctic Marine Infrastructure

A. *Addressing the Infrastructure Deficit*: That the Arctic states should recognize that improvements in Arctic marine infrastructure are needed to enhance safety and environmental protection in support of sustainable development. Examples of infrastructure where critical improvements are needed include: ice navigation training; navigational charts; communications systems; port services, including reception facilities for ship-generated waste; accurate and timely ice information (ice centers); places of refuge; and icebreakers to assist in response.

B. *Arctic Marine Traffic System*: That the Arctic states should support continued development of a comprehensive Arctic marine traffic awareness system to improve monitoring and tracking of marine activity, to enhance data sharing in near real-time, and to augment vessel management service in order to reduce the risk of incidents, facilitate response and provide awareness of potential user conflict. The Arctic states should encourage shipping companies to cooperate in the improvement and development of national monitoring systems.

C. *Circumpolar Environmental Response Capacity*: That the Arctic states decide to continue to develop circumpolar environmental pollution response capabilities that are critical to protecting the unique Arctic ecosystem. This can be accomplished, for example, through circumpolar cooperation and agreement(s), as well as regional bilateral capacity agreements.

D. *Investing in Hydrographic, Meteorological and Oceanographic Data:* That the Arctic states should significantly improve, where appropriate, the level of and access to data and information in support of safe navigation and voyage planning in Arctic waters. This would entail increased efforts for: hydrographic surveys to bring Arctic navigation charts up to a level acceptable to support current and future safe navigation; and systems to support real-time

acquisition, analysis and transfer of meteorological, oceanographic, sea ice and iceberg information.

Appendix C

Coast Guard Authorization Act of 2010

SEC. 307. ARCTIC MARINE SHIPPING ASSESSMENT IMPLEMENTATION.

(a) PURPOSE — the purpose of this section is to ensure safe and secure maritime shipping in the Arctic including the availability of aids to navigation, vessel escorts, spill response capability, and maritime search and rescue in the Arctic.

(b) INTERNATIONAL MARITIME ORGANIZATION AGREEMENTS.—To carry out the purpose of this section, the Secretary of the department in which the Coast Guard is operating is encouraged to enter into negotiations through the International Maritime Organization to conclude and execute agreements to promote coordinated action among the United States, Russia, Canada, Iceland, Norway, and Denmark and other seafaring and Arctic nations to ensure, in the Arctic—
(1) placement and maintenance of aids to navigation;
(2) appropriate marine safety, tug, and salvage capabilities;
(3) oil spill prevention and response capability;
(4) maritime domain awareness, including long range vessel tracking; and
(5) search and rescue.

(c) COORDINATION BY COMMITTEE ON THE MARITIME TRANSPORTATION SYSTEM.—The Committee on the Maritime Transportation System established under a directive of the President in the Ocean Action Plan, issued December 17, 2004, shall coordinate the establishment of domestic transportation policies in the Arctic necessary to carry out the purpose of this section.

(d) AGREEMENTS AND CONTRACTS.—The Secretary of the department in which the Coast Guard is operating may, subject to the availability of appropriations, enter into cooperative agreements, contracts, or other agreements with, or make grants to individuals and governments to carry out the purpose of this section or any agreements established under subsection (b).

(e) ICEBREAKING.—The Secretary of the department in which the Coast Guard is operating shall promote safe maritime navigation by means of icebreaking where necessary, feasible, and effective to carry out the purposes of this section.

(h) ARCTIC DEFINITION.—In this section the term ''Arctic'' has the same meaning as in section 112 of the Arctic Research and Policy Act of 1984 (15 U.S.C. 4111).

Appendix D

Federal Agency Mandates

A number of federal agencies have interests, responsibilities and authorities necessary for the development and implementation of various components of an Arctic MTS. Underscored by the high level strategic guidance provided to these agencies through NSPD-66/HSPD-25, what follows is a brief description of each Federal Agency's policies and activities as they relate to the continued development of an Arctic MTS.

Department of Defense (DOD):
U.S. Northern Command and U.S. European Command share responsibility for national defense in the Arctic region. The desired strategic end state for the Arctic is a stable and secure region where U.S. national interests are safeguarded and the U.S. homeland is protected. Key documents for this national security objective are the 2010 *National Security Strategy* and National Security Presidential Directive (NSPD) 66 / Homeland Security Presidential Directive (HSPD) 25, *Arctic Region Policy.* The 2010 *Quadrennial Defense Review (QDR)* report (http://www.defense.gov/qdr/qdr%20as%20of%2029jan10%201600.PDF) provides top-level DOD guidance on the Arctic.

Department of Energy (DOE):
DOE is tasked with addressing the United States energy, environmental and nuclear challenges. It provides directives and manuals for policy as it relates to energy operations. Of particular importance are those directives and manuals that apply to offshore oil and gas operations and potentially renewable energy, should projects of that nature become viable in the Arctic.

Department of Interior (DOI):
The DOI is tasked with protecting America's natural resources and heritage. With regard to the Arctic, there are a number of agencies under the DOI umbrella engaged in providing information, services and capabilities relevant to an Arctic MTS. In addition, the Department of the Interior, through the Bureau of Land Management, U.S. Fish and Wildlife Service, and the National Park Service, manages the majority of the U.S. Arctic coastline.

- Bureau of Ocean Energy Management (BOEM): BOEM is responsible for managing environmentally and economically responsible development of the nation's offshore resources on 1.7 billion acres of the U.S. Outer Continental Shelf (OCS), almost 1 billion of which are on the Alaska OCS. Its functions include offshore leasing, resource evaluation, review and administration of oil and gas exploration and development plans, renewable energy development, National Environmental Policy Act (NEPA) analysis and environmental studies. In Alaska alone, the Bureau has funded more than $350 million in environmental and socioeconomic research, producing more than 400 scientific reports.
- Bureau of Safety and Environmental Enforcement (BSEE): BSEE is responsible for safety and environmental oversight of offshore oil and gas operations, including permitting and inspections of offshore oil and gas operations. Its functions include the development and enforcement of safety and environmental regulations, permitting offshore exploration,

development and production, inspections, offshore regulatory programs, oil spill response and newly formed training and environmental compliance programs. Important Arctic technology and oil spill research is conducted and overseen by the BSEE Technology Research Assessment Program and the Oil Spill Response Research Program.

- United States Fish and Wildlife Service (USFWS): USFWS works collaboratively to conserve, protect, and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American People. USFWS is tasked with implementing the Endangered Species Act (ESA) for all land and freshwater organisms. This involves, among other things, placement of a species on the endangered or threatened species list as well as delineating its critical habitat. In addition, USFWS implements the Marine Mammal Protection Act and the ESA for several species of marine mammals, including the polar bear and the pacific walrus.
- United States Geological Survey (USGS): The USGS is the Department of Interior's science Bureau and its mission is to collect, monitor, analyze and provide scientific understanding about natural resource conditions, issues and problems, and how those processes are affected by natural and anthropogenic forces. USGS is actively engaged in the Arctic marine and terrestrial ecosystem research involving long-term inventory and monitoring of physical (hydrology, coastal processes, and ocean chemistry) and biological (fish, water fowl, and marine mammals) phenomena; studies of wildlife-habitat interactions, and associated research on the effects of climate change on Arctic habitats. USGS science activities are often interdisciplinary in nature and often conducted through partnerships with other Federal agencies

Department of State (DOS):

The Department of State has responsibility for the foreign relations of the United States, including activities that relate to the U.S. Arctic MTS. As the amount of Arctic maritime traffic increases, coordination of the U.S. Arctic MTS with other Arctic countries and stakeholders in a manner that is consistent with U.S. foreign policy becomes increasingly important. DOS negotiates and concludes on behalf of the United States international agreements that will impact the Arctic MTS. DOS leads U.S. interagency engagement in the Arctic Council, the primary diplomatic forum dealing exclusively with Arctic issues, including many that relate to economic development, safety of navigation and environmental protection in the Arctic. DOS also plays an important role in U.S. delegations to other international bodies that deal with the Arctic MTS such as the IMO's ongoing work on the Polar Code and other Arctic initiatives.

Maritime Administration (MARAD):

Under the Department of Transportation (DOT) the principal mission of MARAD is to promote efficient, safe, secure and environmentally sound maritime commerce, and to enhance the U.S. merchant marine. MARAD is actively assisting the National Ocean Council, the Committee on the Marine Transportation System (CMTS) and other various working groups. In the Arctic, the sustainable development of resources, protection of safe and secure commerce, and the associated infrastructure will rely heavily on marine transportation services for safe operation and compliance with Federal and International environmental and safety standards.

National Aeronautics and Space Administration (NASA):

NASA develops, designs and maintains satellite capabilities in the Arctic to allow for the collection of various data that facilitates better understanding of changing conditions in the Arctic and maritime domain awareness. The Cryospheric Science Branch investigates Earth's ice cover and its connection to the rest of the climate system. It combines comprehensive surface, aircraft and satellite observations with sophisticated modeling to characterize the behavior of snow and ice and understand the processes at work. NASA's Cryospheric Science Branch provides the scientific expertise to develop instrumentation and satellite missions. It also develops research-quality datasets and works with the broader research community to ensure their effective use. At present, NASA is engaged in "Operation Ice Bridge" to collect various measurements of ice sheets, ice shelves and sea ice to bridge the gap in polar observations between NASA's Ice, Cloud and Land Elevation Satellite (ICESat) – which stopped collecting data in 2009 – and ICESat-2, planned for launch in late 2015.

National Geospatial-Intelligence Agency (NGA):
NGA is a Department of Defense combat support agency and a member of the national intelligence community with the primary mission of collection, analysis and distribution of geospatial intelligence in support of national security. Additionally, NGA operates a worldwide navigational warning system (WWNWS) providing mariners with information on a variety of hazards. Under WWNWS, the globe has been divided into 16 navigational areas (NAVAREA) of which NGA is responsible for tracking hazards, obstacles, naval exercises and other navigation issues for NAVAREA IV and XII along the Pacific and Atlantic coasts. NGA also handles ice patrol messaging during the U.S. Coast Guard's off season.

National Oceanic Atmospheric Administration (NOAA):
NOAA's support for the Arctic MTS includes sea ice forecasts, marine weather, navigation services (nautical charts, tides and currents, positioning), oil spill response, and satellite search and rescue (SARSAT). Severe ocean storm conditions in the Bering Sea and Arctic waters can pose very complex weather and oceanographic hazards that threaten ships offshore and Alaskan communities onshore. At sea, NOAA's marine weather forecast and warning capabilities are a "life line" for mariners, especially commercial fishers. Sea ice forecasts are a particularly great need; as the Arctic Council's Arctic Marine Shipping Assessment (AMSA) report states, "Operators need to know where the ice is and isn't; where it's going to be, how closely packed it is and how thick and strong it is; generally, how difficult it will be to go around or, when necessary, go through. These parameters [are] needed on a variety of space and time scales… to ensure safe marine practices." NOAA operates an ice forecast desk in Anchorage, which produces graphical analyses of sea surface temperatures and sea ice as well as a seasonal five-day sea ice projection. NOAA also produces offshore and high-seas forecasts and snow and ice products for the Arctic and sub-Arctic regions. Observations and data are gathered via satellite, radar, airborne, floating, and ground instrumentation. NOAA satellites serve double duty as the communication link for SARSAT. Military (USN, USCG) and commercial interests, including the cruise and eco-tourism industry; oil, gas, and mining industries; shipping; and fishing, represent the primary drivers for NOAA navigation services in U.S. Arctic waters as Arctic transits and access to resources grow more feasible. NOAA is mandated to provide the Nation with nautical charts and oceanographic information for marine transportation, accurate

positioning infrastructure, real-time and forecast models for navigation and oil spill response, and satellite search and rescue services for the entire 3.4 million square nautical miles of the U.S. Exclusive Economic Zone; the U.S. Arctic is part of this responsibility. In the event of an oil spill or other hazardous material release, NOAA provides scientific support to first responders and post-incident natural resource damage assessment expertise to conserve and restore ecosystems. This spill response work includes trajectory modeling, environmental sensitivity analyses, oil in ice studies, contingency planning, and other scientific research geared toward environmental protection. NOAA fisheries scientists and law enforcement officers work in the Bering Sea to ensure that commercial fisheries maintain sustainable harvests there; if interest in commercial fish species moves north into the Chukchi and Beaufort Seas, NOAA will work with the fishing industry to develop fishing operations in a manner that protects habitat and sustainable resources for Arctic communities. NOAA Fisheries also works to protect marine mammals throughout the Arctic from various anthropogenic activities beyond fisheries, including oil and gas exploration and development.

National Science Foundation (NSF):
NSF promotes the progress of science to advance national health, prosperity, welfare and national defense. The Division of Arctic Sciences in the Office of Polar Programs supports scientific research in the Arctic, related research, and operational support. Science programs include disciplinary, multidisciplinary, and broad interdisciplinary investigations directed toward both the Arctic as a region of special scientific interest and as a region important to global systems. Disciplinary interests encompass the atmospheric, biological, physical, earth, ocean, and social sciences. The Arctic System Science Program provides opportunities for interdisciplinary investigations of the Arctic as a system. NSF is chair of the Interagency Arctic Research Policy Committee which, in coordination with the Arctic Research Commission, develops and establishes integrated Arctic research policy as mandated by the Arctic Research and Policy Act of 1984. NSF operates two ice-capable vessels for research purposes, *Lawrence M. Gould* and the *Nathanial B. Palmer*, both of which are capable of operating in the Arctic. NSF and the University of Alaska-Fairbanks are currently collaborating on the construction of a third ice-strengthened research vessel, the *Sikuliaq*.

United States Army Corps of Engineers (USACE):
USACE has regulatory oversight for dredging and disposal operations in U.S. waters, construction of offshore islands and jetties on the outer continental shelf and transport of dredged material for disposal in ocean waters. Other responsibilities include the maintenance of structures (shore protection, jetties, groins, etc.) that benefit navigation, reporting discrepancies in navigation charts discovered in the course of dredging or maintenance operations to the USCG and maintaining access to harbors. USACE also provides strategic, as well as project planning, design, construction, research and development, and environmental support. It publishes an “Engineering and Design – Ice Engineering” manual detailing policy with regard to building practices applicable in the Arctic. USACE also maintains a Deep Draft Port and Small Boat Harbor Centers of Expertise as well as a Cold Regions Research and Engineering Laboratory (CRREL). Currently, USACE and the State of Alaska are collaborating with other Federal agencies, local governments, industry, federally recognized tribes and non-

government organizations to develop a comprehensive plan to meet future navigation improvement needs in the Arctic.

United States Coast Guard (USCG):
The U.S. Coast Guard's Arctic Strategic Approach recognized USCG as the Nation's lead agency for ensuring maritime safety, security and stewardship. It also recognizes USCG as both the leader for our Nation's maritime engagement in the Arctic as well as in advancing U.S. national interests in the Arctic maritime domain. The Coast Guard performs its 11 statutory missions under Title 14 of the U.S. Code in all waters and with respect to any vessels subject to United States jurisdiction – including U.S. Arctic waters and vessels operating there. In support of its missions in the Arctic, USCG participates in Operation Arctic Crossroads, a community outreach program spanning northern Alaska that combines local knowledge with military expertise to meet the challenges of operating in the Arctic. USCG also provides a scientific research platform, the USCG *Healy*, for Arctic science missions by other agencies and organizations.

Appendix E

Alaska Northern Waters Task Force (ANWTF)

The ANWTF was created by Alaska State Legislature HCR 22 during the 2010 legislative session, with specific direction to:

- Create a state and federal commission responsible for overseeing development
- Facilitate regional coordination, cooperation, and outreach in creating a commission to keep local stakeholders informed and able to engage
- Identify and coordinate efforts of mutual concern for federal, state, local and international agencies
- Conduct hearings in the northern region of the state to fulfill the above purposes

The ANWTF focused on the following key areas:

- Oil, Gas and Mineral Development
- Arctic Fisheries
- Marine Transportation
- Arctic Research
- Arctic Infrastructure

The ANWTF conducted 12 meetings in Juneau, Anchorage, Barrow, Wainwright, Kotzebue, Nome, Wales, Bethel, and Unalaska; toured Red Dog Mine, Bering Strait Choke Point, potential future port sites, Nome port and gold dredging, Barrow Arctic Science Consortium, and the communities of Wales and Wainwright; received testimony from 65 experts from universities, U.S. military, non-governmental organizations and dozens of state and federal agencies; heard public testimony from local communities and residents, and; studied vast quantity of scientific, social, and economic research. In Findings and Recommendations published on January 30, 2012, the ANWTF included the following recommendations (top three listed first):

http://housemajority.org/coms/anw/pdfs/27/NWTF_Full_Report_Color.pdf

- The ANWTF recommends that the State of Alaska and the federal government provide Alaskans with meaningful opportunities to participate in Arctic policy and Outer Continental Shelf development decisions, particularly with those Alaskans likely to be most impacted by changing conditions.
- The ANWTF recommends that the Alaska State Legislature create a commission to develop a comprehensive state strategy for the Arctic.
- The ANWTF recommends that the Alaska State Legislature and the State of Alaska continue to urge the United States Senate to ratify the United Nations Convention on the Law of the Sea.
- The ANWTF supports the development and implementation of a comprehensive U.S. Arctic strategy.

- The ANWTF recommends that the State of Alaska and the U.S. participate in the adoption of international agreements for shipping, fisheries, oil and gas development, and other trans-boundary issues.
- The ANWTF recommends that the State of Alaska and the Alaska State Legislature support greater international cooperation and engagement with the Arctic Council and ICC.

Oil, Gas and Mineral Development

- The ANWTF recommends that the State of Alaska and the U.S. develop a framework for the identification, acquisition and sharing of data to support leasing, permitting, and other agency decisions.
- The ANWTF recommends that the State of Alaska and the U.S. support continued improvements in the ability of industry and the government to prevent, contain, control, and remediate spills in the Arctic.
- The ANWTF recommends that the University of Alaska establish an oil spill research center.

Arctic Fisheries

- The ANWTF recommends increasing fisheries research and monitoring in the region.
- The ANWTF encourages the State of Alaska and the U.S. Government to continue actively negotiating fisheries accords with other nations.
- The ANWTF recommends that the State of Alaska and federal authorities prepare strategies to maximize the degree to which local communities and resident Alaskans can benefit from the development of commercial fisheries in waters north of the Bering Strait.

Marine Transportation

- The ANWTF recommends that the United States, the State of Alaska, and the international community work to finalize the Polar Code.
- The ANWTF recommends that the United States and the State of Alaska and the international community examine whether to establish an offshore vessel routing scheme for circumpolar marine traffic, including through the Aleutians.
- The ANWTF supports increasing short and long range navigational aids in the North American Arctic and extending Automatic Identification System (AIS) vessel tracking across the North Slope waters to Tuktoyaktuk.
- The ANWTF endorses completing the Aleutian Island Risks Assessment and recommends that the State of Alaska continue to support and participate in the USCG Port Access Route Study.

Arctic Infrastructure

- The ANWTF recommends the State of Alaska continue to urge the federal government to forward base the USCG in the Arctic and to fund construction of additional ice breakers and ice capable vessels.
- The ANWTF recommends that the State of Alaska and the federal government continue efforts to develop deep draft ports and additional safe harbors in northern waters.
- The ANWTF supports increased funding to expedite NOAA's Hydrographic Arctic mapping and updated mapping of coastal navigation and village entrance routes.

Research

- The ANWTF recommends that the State of Alaska and the federal government identify priorities for Arctic research. By ranking priorities funding can be targeted more effectively and research can be better coordinated.
- The ANWTF recommends improving the exchange of research information and integration of data management.
- The ANWTF recommends increased long-term monitoring of the Arctic, including routine surveys of key chemical, physical, and biological parameters of the Beaufort and Chukchi Seas.

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