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Safe Navigation in the U.S. Arctic

Summary of a Conference

October 15–16, 2012
Seattle, Washington

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CONFERENCE PROCEEDINGS ON THE WEB 11

Safe Navigation in the U.S. Arctic

Summary of a Workshop

REVISED JULY 2013

Peter Johnson, *Rapporteur*

October 15–16, 2012
Seattle, Washington

Organized by
TRB Marine Board

Sponsored by
McDevitt Foundation, Lemoyne College
National Oceanic and Atmospheric Administration
State of Alaska
U.S. Arctic Research Commission
Maersk Line Limited

TRANSPORTATION RESEARCH BOARD
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NOTICE: The workshop that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competencies and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to the procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

This workshop was sponsored by the McDevitt Foundation at Lemoyne College; the National Oceanic and Atmospheric Administration; the State of Alaska; the U.S. Arctic Research Commission; and Maersk Line Limited; and was organized by the Transportation Research Board–Marine Board.

The workshop summary was originally posted to the web in April 2013. A revised edition was posted July 2013 with an improved definition of U.S. Arctic boundaries, a revised map depicting U.S. Arctic boundaries (Figure 1, page 2), corrected estimates of annual ship transits through the Bering Strait, and miscellaneous edits.

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Preface

The United States is one of five nations bordering on the Arctic Ocean,[1] along nearly 1,000 miles of coastline in the state of Alaska. With goals and ambitions to develop the region and its resources, the United States also has responsibilities to do so in a safe, orderly, and environmentally sound manner.

High global demand for energy and minerals has led to increasing interest in the exploration and use of Arctic resources. The decreasing ice cover also spurs interest in oil and gas exploration, as well as shipping. There is widespread concern that increased interest will unleash unsafe and high-risk projects that could harm the Arctic environment and habitat. Although global warming and resulting ice pack melt are critical concerns, increased economic activity in the region is all but inevitable, and issues relating to risk management and strategic planning of Arctic operations need to be addressed.

Although the Arctic is a large and somewhat loosely defined region, and international agreements apply varying delimitations of the Arctic waters, the workshop that is the subject of the report focuses on the Arctic Ocean and surrounding seas that are in close proximity to Alaska and where human activities affect and are affected by those waters (see Figure 1, page 2). The total area north of the Arctic Circle encompasses about 6 percent of the Earth's surface with two-thirds of this area being ocean. The North Pole is located under a dynamic floating ice cap and is covered most of the time. In recent years, this cap has shrunk to its smallest area since 1979, when oceanwide satellite measurements began.

Although the United States has not signed the United Nations Convention on the Law of the Sea (UNCLOS), it is worth noting that Part VII, Article 234, "specifically allows coastal nations to adopt and enforce rules for vessels operating in ice-infested waters in their exclusive economic zone (EEZ) or territorial sea…to prevent and protect against marine pollution and similar environmental accidents."[2]

In terms of polluting activities, the Oslo–Paris Convention for the Protection of the Marine Environment of the North-East Atlantic defines Arctic waters (Region I) as covering those north of 60 degrees latitude. The Arctic Council has not established any general geographical delimitation of its mandate, but it is the one international body where Arctic nations can discuss issues of joint concern and develop common proposals for solving problems.

Safe navigation of vessels operating in the Arctic is a concern of all the Arctic nations. Even with reduced ice levels, the Arctic is a harsh and dangerous environment for navigation, with frequent extreme weather and ocean conditions. In the U.S. Arctic, there are little or no critical infrastructure assets to support vessel

[1] The others are Canada, Denmark (Greenland), Norway, and Russia

[2] National Research Council. 2007. *Polar Icebreakers in a Changing World: An Assessment of U.S. Needs*, National Academies Press, Washington, D.C., p. 30.

FIGURE 1 Arctic boundary as defined by the Arctic Research and Policy Act: 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, with the Aleutian Chain boundary demarcated by the contiguous zone limit of 24 nautical miles. (CREDIT: U.S. ARCTIC RESEARCH COMMISSION)

navigation or respond to emergencies. Coastal waters, where most vessels now operate, are poorly charted, lack aids to navigation and ports of refuge, and have limited communications infrastructure.

In response to these concerns, the Marine Board of the National Research Council's (NRC's) Transportation Research Board (TRB), with support from the McDevitt Foundation, the state of Alaska, the U.S. Arctic Research Commission, Maersk Line Limited, and federal agencies that have Arctic safety missions, planned and conducted a workshop on navigation safety in the Arctic. TRB assembled a workshop planning committee, appointed by the NRC, to design and develop the workshop program. Appendix D contains the list of workshop participants. The purpose was to initiate a dialog among private and public stakeholders in the Arctic navigation community with the following goals:

- Identify the risks of navigation in the Arctic,
- Explore partnerships and international cooperation that could lead to implementation of a robust Arctic vessel traffic management system, and
- Explore needs for U.S. Arctic navigation support infrastructure.

The workshop was held in Seattle, Washington, on October 15–16, 2012. This report was prepared by the workshop rapporteur as a factual summary of what occurred at the workshop. The planning committee's role was limited to planning and convening the workshop. The views contained in the report are those of individual workshop participants and do not necessarily represent the views of all workshop participants, the planning committee, TRB, or the NRC. This summary is a compilation of the presentations and other information provided by the workshop participants and a summary of the ensuing discussions. The report has two parts: Part 1 is an overview that provides the context for the topical issues and discussions. Part 2 provides summaries of the presentations and discussions in plenary and breakout sessions. The workshop agenda, with links to the invited presentations and talks that were given during the opening plenary and breakout sessions, can be found in Appendix C. Appendix B contains the breakout session discussion guidelines provided to speakers and participants before the workshop. Other relevant background documents and links that were provided to workshop participants can be found on the TRB workshop website at http://www.cvent.com/events/marine-board-workshop-safe-navigation-in-the-arctic/custom-22-05369f723c514c9aa4addb5b96b707ab.aspx.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise in accordance with procedures approved by the NRC Report Review Committee. The purposes of this independent review are to provide candid and critical comments that will assist the institution in making the final report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the project charge. The review comments and draft manuscript remain confidential to protect the integrity of the process.

TRB thanks the following individuals for their review of this report: James C. Card (retired Vice Admiral, U.S. Coast Guard), Maritime Consultant, Houston, Texas; Stephen M. Carmel, Maersk Line Limited, Norfolk, Virginia; Ed Page, Marine Exchange of Alaska, Juneau; and Fran Ulmer, U.S. Arctic Research Commission, Anchorage, Alaska.

Although the reviewers provided many constructive comments and suggestions, they did not see the final draft of the report before its release. The review of this summary was overseen by Susan Hanson, Professor Emerita, Clark University, Worcester, Massachusetts. Appointed by the NRC, she was responsible for ensuring that an independent examination of this report was conducted in accordance with institutional procedures and that all review comments were carefully considered. Karen S. Febey, TRB Report Review Officer, and Suzanne Schneider, TRB Associate Executive Director, managed the report review process.

The workshop planning committee thanks Peter Johnson for his work in preparing this summary report.

Overview

The workshop focused on the U.S. Arctic and issues affecting U.S. interests in its development and in ensuring safety of navigation. Information from and about other nations was introduced when it might affect the United States or when it might provide useful comparisons or illustrations.

The planning committee selected four topic areas to be addressed in the workshop: vessel traffic management, emergency response capabilities, information and data needs, and resource needs and models. These were used to structure the workshop and shape the agenda. Questions were then developed within each topic area to serve as a framework to guide breakout session discussions. Appendix B contains the breakout session discussion guidelines, which were designed to focus breakout session discussions and provided to session moderators, speakers, and presenters in advance of the workshop.

VESSEL TRAFFIC MANAGEMENT

The first topic selected by the planning committee to be addressed in the workshop was vessel traffic management. The Arctic Ocean is an international body of water and the United States shares responsibility with other nations to manage and ensure its responsible development. This development includes ensuring that maritime operations in the region are safe and environmentally sound. Arctic resources are believed to be significant, and their development is in the early stages. Indicators of the increased pace of resource development include a rise in all types of shipping traffic, research operations, and commercial oil, gas, and mineral exploration. In addition, receding sea ice due to climate change is leading to increased maritime traffic such as certain ice-strengthened cargo ships that can realize cost savings from shorter routes through newly ice-free passages and some cruise ships that offer seasonal new adventures to the High North.

Despite increasing traffic, only a limited number of vessels operate in U.S. Arctic waters, and vessel traffic in the Bering Strait remains manageable for now. Smaller and slower vessels are staying close to shore, and larger, deep-draft vessels are sailing farther offshore but still close enough to avoid ice. Similarly, along the north Alaskan coast, most vessels sail close to shore to avoid ice. The U.S. Coast Guard (USCG) estimates 480 ship transits of the Bering Strait in the summer of 2012. Since traffic in this region was practically nonexistent 10 years ago, these and other data indicate a steady upward trend.

The USCG is the lead federal agency in matters relating to Arctic shipping activity and safe navigation in that it has responsibility for ensuring safe and orderly marine operations in U.S. waters and for working with other nations in international waters. One new technology that aids the USCG in its mission is the automatic identification system (AIS), which has been adopted by international convention. Almost all commercial vessels operating in the U.S. Arctic are equipped with AIS transponders, which continuously transmit information on vessels (e.g., name, characteristics, position, speed, destination). Since 2001, the Marine Exchange of Alaska has operated a joint public–private vessel tracking system, based in Juneau, with federal, state, and industry funding to build and operate it. AIS and satellite communications are used to track vessels operating in Alaska to aid safe and efficient maritime operations. The original purpose of the Alaska Marine Exchange network was to promote ship-to-ship communications to avoid collisions. The system is voluntary, uses available monitoring technology and networks, and supports users with advisories and alerts.

AIS is a major advancement for safe vessel traffic because its use helps to promote compliance with safe and environmentally sound practices. As of 2012, the Marine Exchange operates a network of 95 AIS receivers along the Alaskan coast; most of these stations are in the southern half of Alaska, but several are located on the northern coast serving the Chukchi and Beaufort Seas. The system is accessed by many parties, both governmental and commercial. It can be used to monitor vessels and the Marine Exchange maintains a 24-hour watch to notify operators when action is needed. Although the existing vessel tracking system has gaps and areas of noncoverage, it is of value to operators because it supports informed decisions with ongoing knowledge of most vessels in the region. However, although the private sector can use AIS to its advantage by exchanging information when desired, there is no comprehensive monitoring or identification of those areas that need to be tracked for safety reasons. AIS technology has capabilities beyond that in current use and, if desired, a much more robust system of traffic management could be built upon the existing network. Alaskan tug and barge operators who have experience with navigating in the Arctic informed the workshop participants about their concerns regarding risk factors, current gaps in navigation technology, and needed safety improvements. Their needs may indicate areas of traffic management improvement that should be considered.

The USCG has limited capabilities, but wherever it has a presence in the Arctic, it enhances the orderly movement of vessel traffic. Although the USCG has access to all AIS data, it does not actively monitor traffic nor does it specifically utilize the Marine Exchange of Alaska AIS data for safety management. Nonetheless, the presence of USCG vessels reportedly has a positive influence on safety. Many other factors would need to be considered, including a more reliable monitoring system, before an enforcement scheme could be implemented. The

USCG is currently conducting a port access route study to identify appropriate actions to improve the Arctic vessel traffic management and has identified the need for vessel traffic separation schemes in the Bering Strait and other passes such as Unimak Pass in the Aleutians. This study is not yet complete, but among the areas being considered is a voluntary scheme that may help to achieve international agreement.

The report from the vessel traffic management breakout group emphasized the importance of using a risk model for evaluating Bering Strait traffic management measures and identifying short-term actions that could help maintain or improve vessel traffic safety and orderly operations in Arctic waters.

EMERGENCY RESPONSE CAPABILITIES

The second major focus area was the current status and future needs regarding the ability to respond to maritime emergencies in Arctic waters. The scenario of a passenger vessel accident was used to illustrate the current status of such capabilities and lessons learned. It highlighted general issues of preparedness, emergency training, and the unique challenges of response operations in the Arctic. In addition, the current USCG temporary and seasonal deployment of rescue services located on Alaska's North Slope served as evidence of current capabilities and future needs. The Arctic Shield 2012 exercise outlines USCG statutory missions to ensure that the Arctic remains a safe, secure, and environmentally sustainable region and its focus on operations, outreach, and assessment of its capabilities; a summary of Arctic Shield 2012 can be found at http://www.uscg.mil/d17/docs/Arctic%20Trifold%20-%20120614-2.pdf.

In his presentation on these issues, Cees Deelstra, of the Holland America Line, identified the following needs:

- Reliable shore-based communications networks,
- Search and rescue (SAR) assets within reasonable response time frames,
- Emergency towing assets,
- Aviation search and lift assets within 24 hours of large ship operations, and
- Operating partnerships within the cruise industry with similar regional visits.

Deelstra noted that the risk factors for passenger vessels operating in the Arctic include

- Long distances from necessary resources,
- Limited assets and infrastructure, and
- Limited data on hydrography, severe weather, and ice.

In addition, the consequences of a cruise ship accident can be enormous and much more difficult to respond to. Consequently, responsible operators take precautions to minimize the risks, including (*a*) conducting risk assessments; (*b*) having appropriate equipment on board vessels; (*c*) utilizing reliable weather forecasts, ice information, and charts in voyage planning; and (*d*) establishing comprehensive reporting systems. According to Deelstra, such approaches need to be replicated throughout the industry to improve safety.

A presentation by Marshall Borden, of Shell, focused on emergency planning associated with exploratory drilling operations in the Beaufort and Chukchi Seas during the summer of 2012. The drilling operations were planned as ice free, but in the event that ice did appear, Shell positioned two icebreaker class vessels at each site to scout out ice, evaluate potential hazards, issue ice alerts, and manage ice flows. Because of the lack of local resources, Shell brought all needed assets to the sites for the duration of drilling operations.

Based on its Arctic experience in 2012 and from earlier operations, Shell representatives said that the following actions are needed to ensure that emergency response capabilities will be available when needed:

- Establishment of real-time monitoring of vessels in the Arctic region,
- Maintenance of crews dedicated to ice management and transit,
- Provision of continuous ice and weather data and daily ice analysis,
- Establishment of an ice management plan for each vessel, and
- Establishment of cooperative procedures among all operators within a particular area.

With respect to accident response, Borden stated that it is important to have adequate response resources in the right location. It may be useful to have agreements with other nations that identify where to station response vessels. Canada currently has six icebreakers, but this number may soon be reduced to five, whereas it is uncertain if the USCG can maintain one Polar Class icebreaker in its fleet. Other needs include better charts, especially in areas where passenger vessels are likely to operate. There are lessons to be learned from past cruise ship operations, particularly incidents in the Antarctic.

Oil spill response poses a number of unique problems, not the least of which is lack of infrastructure. Agreements among companies and with oil spill response organizations are important. Multinational agreements for a full range of emergency response needs, especially SAR, are also worth considering.[1]

Many participants suggested that the USCG needs to either put more response assets in the Arctic or change where assets are located. Some observed that it

1 The National Research Council study, Responding to Oil Spills in Arctic Marine Environments, is currently under way (http://www8.nationalacademies.org/cp/projectview.aspx?key=49479). On June 22, 2011, the Arctic Council published the international agreement, Search and Rescue in the Arctic.

is questionable whether the USCG has adequate resources to fully meet future challenges of Arctic emergency response, and that a strategy for sharing resources among the Arctic nations merits further investigation. In response to a question about establishing some kind of coordination center for emergency response, it was suggested that perhaps the Arctic Council was an organization to lead such an effort. A final discussion item emphasized the importance of prevention when resource priorities are set.

INFORMATION AND DATA NEEDS

The third focus area addressed the current status of and future needs for information and data by ship operators, regulators, emergency response teams, and others in order to operate safely and effectively in Arctic waters. Currently, the Alaska Ocean Observing System (AOOS) provides a comprehensive ocean data network with more than 3,000 real-time sensors deployed and three major data portals serving users in the Alaska region for a wide variety of purposes. User groups include marine operations with a focus on weather, oceanographic conditions, ice, biological information, coastal hazards identification, and research on ecosystems and climate trends. Input for the data networks comes from multiple sources, including federal and state agencies, research organizations, and industry.

Individual workshop participants identified needs for improving this existing data system:

- Coordinating and integrating Arctic historical data records,
- Clarifying specific maritime user needs, and
- Identifying priority needs for addressing emergency responses, such as a major oil spill from drilling.

Short-term data needs include better ice thickness measurement capabilities and more reliable weather information. Longer-term issues include better collaboration among key federal agencies, including the U.S. Navy (USN).

Also discussed were the lack of accuracy and uniformity in weather observations and forecasting and the need to extend data collection to higher altitudes. On the topic of sea ice, it was suggested that clear identification of specific user needs, the form and resolution of data, and the priorities of sea ice data needs would be most useful.

Although there is recognition that large gaps exist in Arctic data, there appears to be no specific definition of what measurement stations are needed and where to fill those gaps. Since costs are high and new infrastructure is difficult to install, defining specific priorities was noted as important. The modern “Gold Rush” to the Arctic has created a mishmash of information and has highlighted the need

for a standard of data to properly meet requirements for safe and orderly development. A standard for setting data requirements to properly move forward in a collaborative and orderly manner currently does not exist.

The report from the information and data needs breakout group highlighted the following issues cited by many participants as fundamental to safe navigation[1]:

- Timely wind, wave, ice, and weather data;
- Current and accurate charts and water level information;
- Reliable and rapid data delivery to users;
- Improved accuracy and resolution;
- Improved environmental data portals and access;
- Established voyage planning standards and requirements;
- Standardization of data to enhance communications systems; and
- Increased communications capacity by using broadband technology and the Internet.

RESOURCE NEEDS AND MODELS

The fourth major topic area addressed the adequacy of current resources to sustain the infrastructure and operations necessary for safe navigation in the U.S. Arctic and the organizational models that could provide an effective management structure. The issues of funding and implementing systems for traffic management, delivering navigation data, and responding to emergencies are fundamental to this topic.

Participants heard a presentation on collaborative projects in Norway to evaluate and promote safety in maritime operations in the Arctic. These projects bring multiple parties together (national and international), including commercial shipping users, government agencies, and research organizations to identify user needs, demonstrate appropriate technology, and investigate gaps in knowledge and applications. Funding is also a shared endeavor among all the parties.

Discussants considered the issues and lessons learned from these Norwegian efforts, including how to develop useful partnerships and relationships among the affected parties by building trust and credibility over a period of time. Norway as a nation has closer ties to the Arctic and maritime commerce, so broad public interest in and attention to Arctic issues are greater in Norway than in the United States. Nevertheless, Norway's successful process for building collaboration might be applied in the United States also.

John Harrald, from Virginia Polytechnic Institute, introduced the concept of preventive collaboration. He emphasized that successful organizational

1 Workshop participants from each of the other breakout groups also identified information needs.

approaches require collaboration among affected parties and that it is vital to include stakeholders who will have a voice in key decisions.

The breakout group report highlighted the following issues that were cited by many participants as key to the process:

- Maintaining the overall objective of safe navigation and safe operations in the Arctic,
- Adopting workable partnerships as a means to securing adequate resources,
- Applying lessons learned from recent offshore oil operations in the Alaskan Arctic and from the Norwegian efforts in cooperative research and operational planning, and
- Evaluating examples of international marine safety actions by other nations.

It was noted that it is difficult for Arctic issues to receive national attention in the United States because the Arctic is not a high priority on most political agendas. When certain issues need to be resolved on a federal level, such as whether the United States should ratify the Law of the Sea Treaty, they may be supported by maritime interests in the Arctic but have little support elsewhere. In addition, some measures to improve navigation safety in the Arctic may require significant federal resources for which broad political support is needed but is hard to attain. Consequently, some participants suggested that the most feasible approach to securing needed resources is likely to be through partnerships that involve both public and private parties, as well as international collaboration.

The key points that define the process for building the necessary collaboration include communication, cooperation, credibility, identification of the optimum path to safety, and development of collaborative networks. Practical actions suggested by individual breakout group participants that might be taken to begin building cooperative structures include encouraging local authorities to take action without national interference and using existing revenue streams to fund infrastructure improvements.

The breakout session report concluded with a list of outstanding issues or considerations for the future identified by individual participants. Foremost, one or more groups could be selected to assume leadership and management responsibility—a number of models exist and could provide the needed structure. Many participants noted that a few basic infrastructure improvements would be key to making any safety system work effectively, including a reliable communications network, workable collaborative systems, workable international partnerships, and identification of adequate resources.

Summary of Session Presentations and Discussions

OPENING PLENARY SESSION

Welcome

The opening plenary session of the workshop was moderated by James C. Card (USCG, retired), chair of the workshop planning committee. Card welcomed the participants and outlined the purposes of the workshop:

- To facilitate an informed dialogue among maritime stakeholders in the responsible and safe development of the Arctic region and its resources,
- To identify key issues affecting safe navigation in the Arctic, and
- To explore actions that could improve safety and enhance orderly marine operations.

Keynote Address

The keynote address was delivered by Thomas Ostebo, USCG 17th District Commander, and followed by a panel of four speakers, who set the stage for subsequent discussions, presentations, and interaction among the attendees. The session ended with an invited talk and welcome to Seattle by Keith Taylor, USCG 13th District Commander, on the role of Puget Sound as gateway to the Arctic.

The session introduced and highlighted the following topics relating to navigation safety in Arctic waters:

- Commercial shipping in the Arctic,
- Emergency response capabilities (using a case study of a passenger ship grounding accident),
- Collection and dissemination of ice data, and
- Collaborative models for safety systems.

The topics illustrate the unique challenges facing Arctic operations today, identify key sectors of the Arctic maritime industry, and describe existing providers of navigation safety services.

In his keynote address (see Appendix A), Ostebo stressed that if the United States is to participate seriously in the international dialogue about Arctic economic development, it must demonstrate its leadership as both a maritime nation and a major Arctic nation. The Arctic Ocean is an international body of water that no one nation owns, but the United States and other Arctic nations can,

with shared interests and capabilities, collectively manage and promote its responsible development. Indicators of the increased pace of development include a rise in all types of shipping traffic, research operations, commercial exploration, and recreational vessels. The USCG estimates 480 ship transits of the Bering Strait in summer 2012, including vessels from the United States, Russia, and China.

The USCG is the lead federal agency in matters relating to Arctic shipping activities and safe navigation, with responsibility for ensuring safe and orderly maritime operations in U.S. waters and for working with other nations in international waters. The USCG also has the mission of responding to maritime incidents, promoting safety of life at sea, and protecting the marine environment. Ostebo observed that this mission is no simple task in the Arctic, given the harsh environment, scarcity of infrastructure, limited resources, and growing level of vessel activity. The USCG faces considerable budget constraints and at the same time recognizes the long lead times needed to introduce new Arctic programs. The challenge is how to allocate resources to current needs and look for ways to leverage partnerships to help meet future needs through public as well as private support.

Ostebo noted the need for vessel traffic separation schemes in the Bering Strait and other passes.[1] He also noted that it is important to ensure that any new regulations will not unduly hinder economic development. The Coast Guard also needs a presence that can adequately respond to emergencies, both onshore and offshore. Helicopter bases are an important part of that response capability. These and other critical missions in the region make it clear that the Arctic is a unique USCG responsibility.

PANEL PRESENTATIONS AND DISCUSSIONS

The discussion that followed the keynote address included the issue of a common vessel traffic system for the entire region, with the suggestion that a voluntary scheme would make it easier to achieve international agreement. On the subject of emergency response, lessons from the summer of 2012 provide some guidance; for example, logistics proved to be of great importance and air support became critical because of the distances involved. It was noted that ships from other countries are working in international Arctic waters close to the United States, but the United States has little knowledge of or control of these operations. It was also suggested that if the United States were to ratify UNCLOS III, it would help promote safety in Arctic operations. Many comments and questions focused on the critical infrastructure needed by the USCG to meet its responsibilities. Priorities have not yet been set, but it is believed that additional bases with basic response equipment are needed.

[1] See TRB Special Report 293 for a discussion of vessel traffic management needs in Unimak Pass in the Aleutians.

Gene Brooks (USCG, retired) of Maersk Line Limited addressed the subject of commercial shipping in the Arctic from the perspective of a major container vessel operator engaged in international trade. (See Appendix C for a link to the presentation.) Brooks noted that vessels calling on Russian ports commonly sail the Northern Sea Route across the northern coast of Russia. Russia requires each operator to conduct a risk assessment of the voyage before approval of the transit. Inspections are also carried out before the voyage to determine whether icebreaker support is needed, ensure that an ice passport[1] is held, and issue warnings about navigation hazards. Despite some advocates who claim the benefits of the Arctic route, container shipping is not yet a commercial reality in the region, he observed. For the major commercial shipping lines, the southern routes still meet their economic needs better than the Northern Sea Route because timeliness and reliability of delivery are important factors. Other than those with destination ports in the Arctic, the class of vessels most likely to transit Arctic routes in the near term are passenger vessels or cruise ships. According to Brooks, this factor is a concern, because if these vessels operate in the U.S. Arctic today, there are no U.S. ice passports, no U.S. infrastructure or special guidance, no ports of refuge, and no readily available response tugs.

When asked what the biggest challenge to commercial shipping in the Arctic is, Brooks replied that there is little or no political interest in the Arctic, which means that there are very few advocates for government attention to provide the needed safety infrastructure or emergency response capability in advance of growing activity and risky operations. With regard to container shipping via Arctic routes, it may occur, but not soon. He noted that Russia will continue to ship oil and other bulk cargo from northern ports and, lacking any challenge, will continue to operate under the Russian set of rules. One useful international initiative that appears to be moving forward is the International Maritime Organization (IMO) Polar Code for the design and operation of ships in Arctic waters. This initiative is getting and deserves U.S. support and attention.

The next speaker was William DuTrizac, from the Transportation Safety Board (TSB) of Canada, a Canadian investigative body charged with determining transportation accident causes and recommending measures to prevent future accidents. He discussed the TSB response to the grounding of the passenger vessel *Clipper Adventurer* in Canadian Arctic waters in August 2010. This grounding illustrates the special risks of passenger vessels operating in these waters and the difficulty of conducting an effective response in the Arctic today. (Appendix C provides a link to the presentation summarizing the accident investigation and results.)

1 An ice passport is a document required by Russia that documents specifications for the ship to navigate safely in ice. The passport specifies a ship's safe allowable movement speed, as well as the safe distance between the icebreaker and the escorted ship while navigating in ice. For more complete information, see http://meeting.helcom.fi/c/document_library/get_file?folderId=76322&name=DLFE-30794.pdf .

Since 1998, the *Clipper Adventurer* has been extensively used in "adventure cruises" and in 2010 was chartered for Canadian Arctic cruises. The ship's master was given responsibility for voyage planning and choice of route and ports of call. The accident report discusses all aspects of the planning and execution of the voyage in August 2010, which resulted in the vessel's grounding and the ultimate rescue of the 128 passengers aboard. Although no loss of life or substantial pollution resulted from this accident, evaluation of the nature of the operation, questionable decisions made, and difficulty of the emergency response provided valuable lessons for improving safety in the future.

According to DuTrizac, some of the most important accident causes were navigating a route without adequate charts and knowledge of local conditions, failure to access available special navigation notices, proceeding at full speed when caution should have been used, inadequate voyage planning outside of recommended practice, and failure to employ safeguards to avoid well-known risks. He also noted that despite the fact that the vessel carried a voyage data recorder, which could have provided valuable information about the accident, the crew failed to collect the relevant data in time to save it.

In conclusion, DuTrizac reported that TSB of Canada made a number of important recommendations for improving safety of these vessels in the future. For example, he noted that this type of shipping activity will continue to grow, along with the risk of accidents. Response capabilities in the Arctic are a challenge because of the lack of infrastructure and accessibility. In the future, ships operating in these waters need much more realistic and robust contingency plans.

The next presenter was Pablo Clemente-Colón, with the USN–National Oceanic and Atmospheric Administration (NOAA)–USCG Joint Ice Center, addressing ice information needs. He described the mission of the National Ice Center and its current activities. (See Appendix C for a link to this presentation.) The National Ice Center is the single most authoritative source of information about ice in the Arctic, including historical data, ice coverage and characteristics, and short- and long-term forecasting and warnings about ice hazards. To collect ice data, the center operates an Arctic buoy program, a satellite sensor system, and airborne sensors. It produces global charts of ice with drift information and other features. It can also tailor specific data packages to meet the needs of mariners with special operational requirements.

Clemente-Colón observed that the recent significant changes in seasonality and thickness of sea ice, along with increased vessel traffic, present new challenges for ice data services, including a need for

- More tactical support, which depends on high-resolution imagery;
- More frequent analyses; and
- Improved forecasting capabilities.

The fact that ice coverage is diminishing does not mean that the risks from ice hazards are reduced; in fact, according to Clemente-Colón, less ice and more traffic increases accident risk and the need for more ice support.

John Harrald, from Virginia Polytechnic Institute, spoke by phone on the role of collaborative modeling for creating and sustaining safety. (See Appendix C for a link to his presentation.) He emphasized that successful organizational approaches require collaboration among affected parties and that building this collaboration is a vital first step. It is therefore important to define the boundaries in any model designed to measure risks and identify risk reduction measures and also to clearly identify all stakeholder participants who will be affected by adverse consequences so that they have a voice in key decisions.

Using examples from past studies, such as the study conducted following the *Exxon Valdez* accident, Harrald showed that selection of the collaborative group requires broad representation and will shape the outcome of the process. Past experience also suggests that often collaboration begins postaccident, making the process more difficult to carry out. A collaborative process, with early involvement of a broad stakeholder base, can be developed in conjunction with an overall risk management strategy at the outset of operations, bringing safety considerations to the forefront when they are most needed.

Questions for Harrald included whether and how to involve other Arctic nations in such a collaborative process. Both the Arctic Council and the IMO were mentioned as appropriate bodies to be involved. The other key question and major issue to be addressed was how to secure adequate resources in the early stages of projects to build collaboration.

The final plenary session speaker was Keith Taylor, USCG 13th District Commander, on the topic "Puget Sound: Gateway to the Arctic." (See Appendix C for a link to his presentation.) Taylor described the large and complex Puget Sound maritime operational region and its longstanding importance as a staging area for Arctic operations. Not only is Puget Sound the home port for USCG icebreakers, but it is also critical to USCG safety missions as the port where marine vessel inspections are carried out and it is ensured that safety standards are met.

Taylor noted that USCG has operated the Puget Sound VTS for the past 40 years. The system was designed as a cooperative effort between the United States and Canada, involving shared responsibilities and authorities under an international agreement. This model may be useful for similar systems in the Arctic, such as in the Bering Strait. Taylor was asked whether the USCG in Puget Sound has the capacity to continue to serve the needs of Arctic operations considering the projected expansion. It appears that in the near term, capabilities may be sufficient, but in the long term they could be problematic.

The opening plenary session concluded with the workshop chair asking the participants to convene in their assigned respective breakout groups and use the guidelines that were prepared for discussions within the each group (see Appendix B). A summary of the presentations and discussions in those breakout sessions is presented in the next section. Following the afternoon breakout session, participants reconvened in a plenary session to hear remarks from the Honorable Mead Treadwell, Lieutenant Governor of Alaska, regarding the state's support for this effort; past, current, and recently initiated efforts relevant to the focus of the workshop; and his appreciation for the input from the participants. Some of the potential needs he identified as important were the adoption of a Bering Strait VTS, improved navigation aids, international cooperation on oil spill research, and improvements in coastal mapping and charting. (See Appendix C for a link to Treadwell's talk points on significant government actions to respond to an accessible Arctic Ocean.)

In the plenary session on the second morning, David Murk, Office of the Secretary of Transportation and chair of the Committee on the Maritime Transportation System (CMTS) Coordinating Board, gave an update on the CMTS U.S. Arctic Marine Transportation Policy response. A link to this presentation can be found in Appendix C.

Breakout Group Presentations and Discussions

Breakout Group 1
VESSEL TRAFFIC MANAGEMENT

The breakout group opened with a presentation by Ed Page (USCG, retired) about the current situation in Alaskan Arctic waters where the Marine Exchange of Alaska has, since 2001, operated a joint public–private vessel tracking system. (See Appendix C for a link to the presentation.) This voluntary system uses available monitoring technology and networks and supports users with advisories and alerts from the 24-hour operations center in Juneau. The widespread use of AIS and satellite communications is key to the system's promotion of safe and efficient maritime operations in the region. The international adoption of AIS is a major advancement for safe vessel operations because its very existence encourages and helps monitor compliance with safe practices. There are now more than 90 AIS stations in Alaska maintained and operated by the Marine Exchange. Although this vessel tracking system has gaps and areas of no coverage, its ability to support informed decisions with ongoing knowledge of most vessels in the region has great value to all operators.

The breakout group discussion expanded to numerous issues under the umbrella topic of vessel tracking systems while focusing on several questions posed by the planning committee (see Appendix B). It was noted that the region covered by current traffic monitoring is limited and the Marine Exchange's operating centers usually pick up on the alerts that are issued. Maritime activity in the Bering Strait is currently limited and the waters are expansive, therefore existing traffic appears to be manageable. Along the north Alaskan coast, most vessels keep close to shore in order to avoid ice. One area noted as being of concern is the uncertainty of Northern Sea Route traffic from the Russian side through the strait because of the lack of vessel tracking information in that region.

Several questions were posed regarding the existing vessel tracking system and how communication with and among vessels works. Currently, all transmitted AIS data are collected and displayed over the Internet via a graphical user interface and accessed only by authorized users. AIS transmissions are received by other AIS-equipped vessels within radio range and the Coast Guard and the state see all information received via AIS. For example, if a company does not want to disclose its vessel locations to the public, that information is not disseminated. Although the USCG always has access to all the data, it currently does not actively monitor traffic. The USCG also receives substantial data from the U.S.

Department of Defense sources and can use these data as needed and appropriate. The AIS technology has capabilities beyond that now in use, and it was noted that it would be possible to build a much more robust system of vessel traffic management from the existing network if it were desired.

The original purpose of the Marine Exchange of Alaska vessel tracking system was not as an enforcement system but rather as a system of information and communications to aid in safe, secure, efficient, and environmentally sound maritime operations. Individual participants noted that many other factors will need to be considered and a more reliable monitoring system will be needed before an enforcement scheme can be implemented. Currently, the exchange relies on (*a*) operators sharing information and identifying anomalies and (*b*) traffic monitoring from AIS and satellite transponder transmissions. The biggest risks to vessel traffic are due to rapid and severe changes in the weather.

Before the workshop, a group of Alaskan tug and barge operators (Arctic Navigation Workgroup) convened a meeting, on July 31, 2012, to discuss their experiences with navigating in the Arctic and impressions about risk factors, current gaps in navigation technology, and needed safety improvements. The workshop participants then considered the following list of critical needs identified by this industry group:

- Improved navigation charts with comprehensive depth contours,
- Updated electronic charts with imbedded navigation aids,
- Increased AIS coverage in Arctic waters,
- Accurate tide and current data,
- Improved ice assessment and forecasting,
- Improved weather data and more accurate local forecasts,
- Implemented traffic management scheme for the Unimak Pass and Bering Strait,
- Established ice operation guidelines,
- Improved satellite and local communications,
- Established safe harbors of refuge,
- Improved emergency response and SAR capabilities, and
- Improved icebreaking capabilities.

Further discussion of these issues and factors affecting navigation safety led the workshop participants to consider how to define the Arctic region and how the multiple uses, seasonal changes, variations in ice coverage, and so on would affect any management scheme that is considered. The group tried to be as consistent as possible within these definitions. Another important consideration was international boundaries and the maritime traffic from one jurisdiction to another. The

discussion then turned to identifying information needs related to traffic management, and the following factors were cited as important by many participants:

- Priority for information should be that which reduces the greatest risks;
- Navigable waters include both coastal routes and rivers;
- Primary challenges are spring thaw, breakout, and river flooding; and
- Reliable communications systems are key to effective information delivery.

The USCG's port access route study is key to providing improved traffic services and defining which routes are recommended and which should be avoided. Many participants noted that in ice-covered waters, more communications will be needed to ensure that vessel traffic stays within fairways.

The group discussed the importance of international standards and training to ensure safe navigation practices. According to some participants, the gradual implementation of the IMO Polar Code is a positive step toward adopting adequate standards and training practices for all vessels operating in the Arctic. One key practice is to have a mariner or pilot who is experienced and trained in vessel operations in ice and Arctic waters on board each vessel. Shell, for example, has ice pilots on its ships; however, there is no provision for licensing for ice pilots in the United States, and some discussion ensued about whether more should be done to ensure adequate training and competency for these crew members. Although some believe that it would be costly, it has been suggested that a tug and barge ice code should also be considered.

On the second day of the workshop, the breakout group continued with discussion of the leadership role of the USCG. Many participants acknowledged that USCG presence is important to providing oversight and order, but expectations of its capabilities are higher than can be delivered. Although the private sector can use AIS to its advantage by exchanging information when desired, the USCG does not comprehensively monitor nor does it identify those areas that need to be tracked for safety reasons. To do so, the USCG would need a stronger mandate and more resources. The USCG is also limited in its capability to engage with the governments of its Arctic neighbors, Canada and Russia.

Many participants indicated that the ports-of-refuge issue also merits attention and could perhaps be combined with designation of traffic lanes. Tools are available to identify suitable ports and designate those with adequate capabilities. It was suggested that collaboration among government authorities and industry could begin the process of selecting ports and disseminating information about how to use them.

Breakout Group 2
EMERGENCY RESPONSE CAPABILITIES

The breakout session opened with two presentations, the first from Cees Deelstra, of Holland America Line, on the subject of cruise ship operations in the Arctic and the second from Marshall Borden, of Shell, on the subject of offshore oil drilling operations in the Arctic. (See Appendix C for links to the presentations.)

Holland America operates major cruise ships worldwide with 14 ships carrying more than 1,000 passengers each. Although their ships sail up to the ice edge, they only navigate in ice-free waters during good weather and take pilots when needed. They have no plans to enter polar regions north of the Bering Strait nor beyond the ice edge west of Norway. However, other operators currently offer or have future plans to offer smaller-vessel cruises in polar waters.

From its experience and knowledge of cruise ship operations in general, Deelstra reported that Holland America sees the critical needs for ensuring adequate emergency response in these waters to be the following:

- Reliable shore-based communications networks,
- SAR assets within reasonable response time frames,
- Emergency towing assets,
- Aviation search-and-lift assets within 24 hours of large-ship operations, and
- Partnerships among cruise vessel operators with similar regional visits.

The Holland America presentation led to discussions of the major risk factors for passenger vessels operating in the Arctic, including

- Distances from response resources,
- Limited assets and infrastructure, and
- Limited data on hydrography, weather, and ice.

The consequences of a cruise ship accident can be enormous and the response to such incidents would be very difficult. Responsible operators take precautionary actions to minimize the risks, including conducting risk assessments and having appropriate equipment onboard. Voyage planning utilizes accurate weather forecasts, ice information and charts, and comprehensive reporting systems. It was noted that these approaches can be replicated throughout the industry. In addition, operators are contributing to the development of the Polar Code and sharing best practices.

The presentation by Marshall Borden, of Shell, focused on exploratory drilling operations that Shell conducted in the Beaufort and Chukchi Seas during the summer of 2012, how Shell prepared for possible emergencies, and what emer-

gency response actions were to be taken. Shell positioned two major drilling vessels in waters north of Alaska to explore leases held in the Beaufort in the east and in the Chukchi in the west. The drilling operations were planned as ice free during this period; however, in the event ice did appear, Shell positioned ice management vessels in each location and planned for such contingencies. Two icebreaker-class vessels were stationed at each site. They conducted ice scouting, evaluated potential hazards, issued ice alerts, and had a plan for managing ice flows by pushing or breaking ice away from drilling vessels. In addition, science and support operations were conducted onboard the vessels.

Because of the lack of local response resources, Shell planned on bringing all needed assets to the sites for the duration of drilling operations. These assets included storage tank vessels to respond to oil spills, back-up helicopters on the route, and vessels and aircraft to move crews. An interesting sidebar was that before the drilling operations started, a bulk carrier had lost power near the Aleutians and Shell was asked by the USCG to assist. According to Borden, the company was able to do so because one of its ice management vessels was in the area and could get to the drifting bulk carrier in time to provide a tow to Dutch Harbor.

From its Arctic experience, both this past year and during earlier operations, Borden stated that Shell has concluded that certain actions are vital for continued assurance that emergency response capabilities will be available when needed:

- Developing VTS-type real-time monitoring of vessels in the Arctic region,
- Maintaining crews trained and experienced in ice management and transit,
- Providing continuous ice and weather data and daily ice analysis,
- Establishing an ice management plan for each vessel, and
- Establishing cooperative procedures among all operators in a particular area.

The 2012 operation is just a beginning for Shell; it is estimated that the company will need about 10 to 12 years before actual oil production is under way. In the future, the company will need more ice-class vessels and will continue to build up their ice management capabilities. Borden observed that Shell believes that other operators will also cooperate and collaborate on these issues.

The group discussion explored questions raised by these presentations and others regarding emergency response measures and their contributions to navigation safety in the Arctic. One question focused on the unique challenges of passenger vessel incidents as compared with oil spills. One difference is the number of people involved and the lack of infrastructure to handle them. It was noted that such challenges require different planning approaches.

The discussion continued on topics such as pairing vessels so they could

offer mutual support and the adoption of the Polar Code by all operators, with special features that would be needed for cruise vessels. Since it could be some time (possibly 3 to 4 years) before a Polar Code is completed and adopted, it was suggested that a key to improved risk management would be to put strategies in place in advance and then deal with scenario assessments.

Many participants noted that for accident response it is important to have adequate response resources in the right location. It may be useful to have agreements with other nations on where to station response vessels. Other obvious needs are better charts for areas where voyages are likely to be planned. Some participants expressed the view that there are lessons to be learned from past cruise ship operations and from incidents in the Antarctic.

The issues regarding oil spill response present some unique problems, including infrastructure limitations. Agreements among companies and coordination with oil spill response organizations were cited as important. It was suggested that multinational agreements are needed for all emergency response efforts, especially SAR, and that the Arctic Council may be a means for promoting cooperative efforts.

Many participants suggested that the USCG either needs to put more response assets in the Arctic or needs to change where assets are located. Some observed that it is questionable whether the USCG has adequate resources to fully meet future challenges of Arctic emergency response and that a strategy for sharing resources among the Arctic nations merits further investigation. In response to a question about establishing a coordination center for emergency response, it was suggested that perhaps the Arctic Council could lead such an effort. A final discussion item emphasized the importance of prevention when resource priorities are set.

The second day of group discussion began with a review of topics still to be covered, including identification of local communities that could participate in emergency response and matching them with traffic patterns, investigation of vessels of opportunity, and evaluation of situations involving both human casualties and pollution. The following critical needs were identified by individual participants and discussed by the group:

- Gathering real-time information of all ships transiting the area;
- Conducting local, regional, and national drills and exercises;
- Preparing an up-to-date inventory of assets;
- Establishing a stockpile and pre-positioning equipment;
- Developing international, national, regional, and local response plans;
- Developing up-to-date charts;
- Enhancing seasonal air support and facilities;

- Raising awareness of Arctic issues and recognition of the United States as an Arctic nation;
- Developing port infrastructure; and
- Completing or implementing the Polar Code and UNCLOS III.

With respect to cruise ship emergency response issues, it was noted that only two cruise ships in the United States currently travel into the Arctic, and the traffic is vastly greater for operations in southeast and south central Alaska. Therefore, the USCG now puts its limited resources where the need appears greatest. Some of the priorities for attention identified by individual participants include completing and implementing the Polar Code, establishing realistic places of refuge and a plan for their use, working with other Arctic nations on SAR capabilities, improving charts and dissemination of chart data, and identifying funding sources for critical needs.

Breakout Group 3
INFORMATION AND DATA NEEDS

Molly McCammon, of AOOS, opened the session with the presentation Planning for the Bering Strait Future: Information Needs and Challenges. (See Appendix C for a link to the presentation.) The AOOS is supported mainly by funding from the National Science Foundation and other federal and state agencies. It provides one of the most comprehensive ocean data networks, with over 3,000 real-time sensors deployed. There are three major data portals serving users in the Alaskan region for a wide variety of purposes from research to commercial fisheries; stakeholders concerned with Arctic navigation safety have ready access to these data.

McCammon reviewed the data types and sources as well as user needs, noting the collaboration with stakeholder groups that provide advice and input to the system. The multiple user groups include marine operations with a focus on weather, oceanographic conditions, ice, and biological information; coastal hazard identification; and research on ecosystems and climate trends. Input for the data networks comes from multiple sources including federal and state agencies, research organizations, and industry. Various methods are available to retrieve and search for these data by using the current portals and networks. For example, the University of Alaska is putting together a social science and economics database of such project topics as housing and food needs for remote villages. In addition, the offshore oil industry and NOAA have signed an information-sharing agreement among government and industry data groups.

According to McCammon, the current system supports vessel traffic monitoring with high-frequency radar located within some remote villages, but it is costly to operate and is still being tested. These high-frequency radar stations also

have capabilities for use in SAR operations. Weather data are disseminated by very-high-frequency radio in remote areas and planning for the use of AIS for this purpose is under way.

McCammon concluded by identifying certain needs for improving the existing data system to better serve users in the Arctic:

- Coordinating and integrating Arctic historical data records,
- Clarifying specific maritime user needs, and
- Identifying priority needs for addressing emergency responses such as that to a major oil spill from drilling.

Short-term data needs McCammon cited include better ice thickness measurement capabilities and more reliable weather information. Longer-term issues include better collaboration among federal agencies, including USN.

The group discussed the short-term data needs, such as improved weather and ice forecasts, as well as issues associated with coordination among various industries collecting and disseminating data unique to each operation. Arctic nautical chart planning is another key concern, and some participants noted that future survey data need to be coordinated with specific regional needs that are served by shallow draft ships or barges. There are also large gaps in data buoy coverage in the Arctic; buoys may be thousands of miles apart and they only collect surface data.

Also discussed was the lack of accuracy and uniformity in weather observations and forecasting, and the need to extend data collection to higher altitudes. On the topic of sea ice, clear identification of specific user needs, the form and resolution of data that would be most useful, and the priorities of sea ice data needs were noted.

Although there is general recognition that large gaps exist in Arctic data, there appears to be no specific definition of what measurement stations are needed and where to fill those gaps. Since costs are high and new infrastructure is difficult to install, many participants noted that it is important to have specific priorities for action. The modern "Gold Rush" to the Arctic has created a mishmash of information and has highlighted the need for standardized data requirements for safe and orderly development.

The group discussion reviewed some aspects of the U.S. Arctic marine transportation system improvement plan, covering key topics of data and information. Regarding aids to navigation, mariners rely on a combination of the Global Positioning System, shoreline landmarks, and local knowledge about waterway conditions. Tracks are captured and shared among mariners. Communications infrastructure is not always reliable in some cases because of limited satellite

coverage in the Arctic. Since icebreakers are often unavailable, a number of tugs and barges only operate during open-water conditions. Industries such as offshore drilling supply their own ice escort vessels. It was noted that SAR planning is always an issue and relies on accurate data availability. Participants observed that the protection of marine mammals from maritime shipping can be supported by good data on locations and predictions of mammal behaviors during various seasons. Data can also support decisions regarding restrictions on areas with high populations.

Breakout Group 4
RESOURCE NEEDS AND MODELS

The breakout session opened with a presentation by Beate Kvamstad, of MARINTEK, about collaborative projects undertaken in Norway to evaluate and promote safety in maritime operations in the Arctic. She provided an overview of projects completed in the past several years and presented case studies of two selected projects: one on Arctic communications, Maritime Communications: Broadband at Sea (MarCom), and the other on maritime safety management in the High North (MarSafe North). (See Appendix C for a link to the presentation.)

MarCom brought multiple national and international parties together, including commercial shipping users, government agencies, and research organizations, to identify user needs, demonstrate appropriate technology, and investigate gaps in knowledge and applications. Funding was also a shared endeavor among all participants.

MarSafe North is a larger project, but similar in concept. According to Kvamstad, its goal is to ensure an acceptable safe level of maritime operations in the High North around the region of Svalbard at about 78 degrees latitude. Partners include the Defense Research Institute, technology companies, and local community user groups. Activities include workshops, meetings, seminars, input to IMO, field testing, and published reports. Progress has been noted for satellite coverage to track ice, identification of places of refuge, and feasibility of wearable antennas. The project highlights future needs for more education and training of Arctic workers and improved communications systems.

The group discussion focused on the issues and lessons learned from these Norwegian efforts. An important lesson cited by many participants is how to develop useful partnerships and relationships among the affected parties by building trust and credibility over a period of time. It was also noted that international collaboration brings important benefits. One concern cited is the fact that the United States has not ratified UNCLOS III, the Law of the Sea Treaty, whereas all other Arctic nations have done so. Norway is a nation with close ties to both the Arctic and maritime commerce, but in the United States there is less public attention and awareness of Arctic and maritime issues. Nevertheless, many

believed that the process for building collaboration that has been successful in Norway could also be applied in the United States. This process includes communication, cooperation, credibility, and the development of inclusive networks of all affected parties that work together over long periods of time.

The group also addressed how navigation safety in the Arctic is part of what might be considered a national Arctic strategy, which many consider a need that has not yet been met. Many participants thought that such a U.S. national strategy could be used to help justify actions ranging from establishing data system networks to managing traffic safety.

On the second day of the breakout session, the group discussed the plenary presentation by David Murk, from the U.S. Department of Transportation, concerning an assessment of Arctic maritime activities that has been prepared by the CMTS and was due to be released in early 2013. It reviews the role of the marine transportation system in the Arctic as well as future trends and points out the need for coordination at all levels of federal, state, and local governments. The study was cochaired by NOAA and USCG, and is considered a federal agency plan for moving forward in the Arctic. The group considered how this effort might be integrated with others to move the process forward.

The breakout group revisited its goal of identifying resource needs and models. Individual participants highlighted the following issues as key to the process:

- Maintaining the overall objective of safe navigation and safe operations in the Arctic,
- Adopting workable partnerships as a means to securing adequate resources,
- Applying lessons learned from recent offshore oil operations in the Alaskan Arctic and from the Norwegian efforts in cooperative research and operational planning, and
- Evaluating examples of international marine safety actions by Russia and Canada such as establishing SAR stations along the Northern Sea Route.

Other examples of beneficial collaborative efforts identified during the discussions included the following:

- An initiative to establish hydrographic commissions with Russia and Canada involving NOAA surveying and charting operations,
- Using the North American Aerospace Defense Command as a venue for U.S.–Canadian collaboration, and
- Enhancing collaboration between the U.S. Northern Command and the USCG on data sharing and communications.

Closing Plenary Session

The closing plenary session included presentation and discussion of the reports from the four breakout groups. The objective was to inform and get feedback from all participants on the critical issues relevant to navigation safety.

Breakout Group 1
VESSEL TRAFFIC MANAGEMENT

The report from the vessel traffic management breakout group emphasized the importance of using a risk model for justifying Bering Strait traffic management and the development of recommended risk reduction measures and highlighted some short-term practical actions identified by individual group participants that could help maintain or improve vessel traffic safety and orderly operations in Arctic (especially congested) waters:

- Accelerating the USCG study on port access routes,
- Establishing safe offshore distances for deep draft ships,
- Establishing safety fairways,
- Providing information for ice avoidance, and
- Minimizing impacts on wildlife and hunters.

Other possible actions cited include (*a*) having a USCG presence (by means of vessels and aircraft), which, it is hoped, will have a positive impact on safety of maritime operations in addition to providing a response capability in the region; (*b*) expanding NOAA survey efforts and weather forecasting efforts and improving communications between marine operations and the USCG in the areas of AIS transmissions, electronic charting, and Notices to Mariners (NTMs); and (*c*) gathering additional data on ice, winds, currents, and other environmental information needs and improving weather forecasting in the region.

Many participants encouraged improved infrastructure for communications between vessels and the USCG regarding such areas as the presence of ice, weather information, location of whalers and whales, areas to be avoided, and hazards. It was suggested that these improvements could be attained via improvements in and expansion of AIS transmissions, electronic charting, NTMs, and an expanded and improved Coast Pilot; however, communications in the Arctic are challenging because of solar flares and other atmospherics, in addition to limited very-high-frequency capability in certain areas.

Traditional traffic regulation schemes such as areas to be avoided, traffic fairways, and regulated navigational areas all exist in concept and are available for application to the Arctic. Information on current marine traffic is also available, and many participants observed that the projections of expanded traffic suggest that there is justification for risk reduction actions to be taken sooner rather than later. Two specific infrastructure improvement measures were discussed: (*a*) an expansion of AIS capabilities to both monitor operations and send safety messages to mariners and (*b*) an expansion of existing communications networks among maritime operators.

Participants' suggestions included the following:

- Actions to improve vessel traffic safety and operations,
- Communications improvements,
- Definition of the role of government agencies key to implementation,
- Identification of risks of inaction,
- Identification and analysis of risk reduction measures,
- Identification of existing and useful traffic regulation schemes,
- Evaluation of the adequacy of existing information on current and projected traffic,
- Promotion of infrastructure improvements, and
- Broad industry input.

Breakout Group 2
EMERGENCY RESPONSE CAPABILITIES

The breakout group on emergency response capabilities explored the current status of and future needs for physical and organizational capabilities to respond to maritime emergencies in the Arctic; the illustrative example of a passenger vessel accident was used, focusing on preparedness and emergency training and identifying promising approaches. General issues of preparedness, emergency training, and the unique challenges of response operations in the Arctic were discussed, and participants attempted to identify promising approaches to securing and maintaining adequate response capabilities for the long term.

Many participants noted that emergency response may be limited by few locally available response assets and infrastructure, long distances, and time and expense involved in pre-positioning assets. Table-top exercises are useful and there may be lessons to be learned from the Antarctic and from other countries. In addition, places of refuge remain to be defined, and agreements with other governments on location of assets are not complete.

The need for effective communication and information is at the core of adequate emergency response. It was noted that communities are often the first

responders and need to be involved in response planning. Work is currently under way to identify communities with locations for such community response (e.g., matched to traffic volumes and routes); mass rescue plans have been developed but have not yet been implemented. It was also noted that large aircraft with heavy medical teams have to land, but potential landing locations are limited. Also, a spill may be a by-product of an accident or incident, and the trajectory of the spill needs to be examined.

The group used a 2009 study by the University of New Hampshire[1] as a guide to identified measures. Participants reviewed the 16 recommendations in the report and discussed which ones they believed were relevant to the Arctic and which of those had already been completed. The discussions resulted in two sets of possible action items: one for the case of cruise ship emergency response and the other for oil spill response. When listed by strategic area categories, the differences in the two cases were not significant and the following potential actions were identified:

- Information and data:
  - Disseminate real-time data for all ships and aircraft, and
  - Provide up-to-date charts;
- Planning and assessments:
  - Provide up-to-date inventory of all assets, and
  - Develop response plans;
- Collaborations and agreements:
  - Recognize Arctic issues,
  - Institute the Polar Code for ships, and
  - Establish mutual aid protocols;
- Training and drills:
  - Conduct periodic, regular drills and exercises; and
  - Provide first-responder training for ships' crews;
- Community capacity and resilience:
  - Establish stockpiles and pre-position equipment,
  - Provide seasonal air support, and
  - Enhance local port infrastructure.

A final discussion item emphasized the importance of prevention when resource priorities are set. The feasibility of establishing some kind of coordination center for emergency response was questioned. The Arctic Council was suggested by some participants as one possible organization to lead such an

1 Coastal Response Research Center. 2009. *Opening the Arctic Seas: Envisioning Disasters and Framing Solutions*. University of New Hampshire, Durham.

effort. However, many participants noted that prevention is key. Once response is required, given weather and distance, the focus shifts to minimizing loss of life and then reducing environmental impact.

Breakout Group 3
INFORMATION AND DATA NEEDS

The third breakout group addressed information needs and the issues related to delivery of sufficient, reliable, accurate data to the mariner to ensure safe navigation. Participants identified a number of critical issues that need to be addressed, including data, funding, political support, information, communications, and AIS infrastructure. For example, it was noted that a standard for setting data requirements to properly move forward in a collaborative manner does not currently exist. A number of data issues were identified by individual participants as critical to safe navigation:

- Wind, wave, ice, and weather data;
- Accurate and current charts and water levels;
- Reliable and rapid delivery of data to users; and
- Improved accuracy and resolution.

Some specific information needs identified by many participants as critical to Arctic navigation safety include

- Improving environmental data portals and access,
- Improving NTMs for the Arctic,
- Improving Coast Pilot specific to the Arctic,
- Establishing voyage planning standards and requirements,
- Expanding the Marine Exchange of Alaska and AIS coverage, and
- Documenting and publishing mariner experiences.

Communications issues identified as critical to disseminating needed data were

- Improvements needed for on-shore infrastructure,
- Standardization of data necessary to enhance communications systems, and
- Increased communications capacity with broadband technology and the Internet.

Breakout Group 4
RESOURCE NEEDS AND MODELS

The resource needs and models breakout group focused on how to provide adequate resources for the major actions needed so that both public and private institutions can accomplish necessary measures for ensuring safe navigation in the Arctic now and in the future. The group's purpose was to supplement and integrate much of the output from the other three breakout groups and to provide a framework for building the needed partnerships and safety systems. The group heard from and considered experience from Norway, where some similar problems were addressed. They also considered lessons from other sources and how they might be adapted for this situation.

The group spent some time defining a context for their discussion. Questions considered by the participants included the following:

- How can needs be determined?
- How can partnerships be built?
- How can the needed resources be obtained?
- How can resilient and sustainable safety systems be established?
- What is the difference between safe operations and safe navigation?
- How can progress be made in the short term? In the long term?

Many participants suggested that bringing attention to Arctic issues in a national context is difficult because the Arctic is not a high priority on most U.S. political agendas. Whereas gaining attention to maritime and Arctic issues is not difficult in Norway, similar understanding is lacking in the United States. When certain issues need to be resolved on a federal level, such as ratification of UNCLOS III, they may be supported by maritime interests in the Arctic but have little support elsewhere. In addition, some measures that could improve navigation safety in the Arctic would require significant federal resources, and in this area, it was noted, broad political support would be needed but is hard to acquire. Consequently, the approach to securing needed resources that appeared most feasible to many participants is through partnerships that involve both public and private parties as well as international collaboration.

The group discussed several key points that define the process for building the necessary collaboration:

- Communication,
- Cooperation,
- Credibility,
- Definition of the optimum path to safety, and
- Development of collaborative networks.

Individual participants also listed some practical actions that might be taken to begin building cooperative structures:

- Encouraging local authorities to take action, and
- Using existing revenue streams such as those from offshore oil and gas leasing to fund infrastructure improvements.

The breakout group report concluded with a list of outstanding issues or considerations for the future. First, many participants believed that it would be necessary to select one or more groups to assume leadership and management responsibility. A number of models exist and could provide the needed structure. Many also noted that a few basic infrastructure improvements will be key to making any safety system work effectively, including a reliable communications backbone, workable collaborative systems, workable international partnerships, and identification of adequate resources.

APPENDIX A

Keynote Address

Thomas Ostebo, *17th District Commander, U.S. Coast Guard*

The United States is the greatest maritime nation on the planet. We are one of only three nations that has extensive shoreline on the Atlantic, Pacific, and Arctic Oceans. We are the only nation capable of ensuring that freedom of navigation is not impeded around the world. We are the only nation fully capable of projecting power anywhere anytime worldwide. We are a maritime nation whose economic prowess and existence depend on the free and safe maritime trade, with some 80 percent of our gross domestic product tied to maritime trade.

So before I get started, this nation and you all deserve a big hand for all that you do to keep this country great and to keep the world from slipping into isolation and darkness.

I will begin with some broad comments, some provocative assertions, and some alarming data to get a dialogue going.

Therefore in keeping with the theme of what makes this country great and what makes America exceptional and unique, I want to talk about the Arctic. And while there has been a great deal of talk and discussion and research and pontificating and bloviating on the subject of the Arctic over the last few years, on a whole host of subjects, I want to talk about what I consider the inevitable surprise and the unstoppable force: Arctic economic development.

This is to say inevitable, possibly chaotic and perhaps out-of-control Arctic maritime development. At least out of U.S. control. Because the United States is only one of many players and is in a way late to the Arctic game.

Also, although blindingly obvious, but yet to be acknowledged, is the fact that the Arctic is water and nobody owns it.

It is not a country; it is not a continent. It is a huge body of water that connects Europe, Asia, and North America by the shortest most direct route. What was once frozen and inaccessible is now presenting the world with tremendous opportunities and challenges, that we can either face and manage and shape or we can react and suffer from.

So here is what is going to happen, whether we like it or not. Maritime trade, commerce, activity, development is going to happen in the Arctic and it is going to happen by every nation in the world who has an interest is this region. And I would submit this is at least 25 countries.

So considering there are only five nations that boarder the Arctic Ocean and eight nations in the Arctic Council, this leaves 17 other nations with maritime interests, history and capability that are effecting the transformation of the Arctic from frozen and inaccessible to busy and perhaps endangered.

So here is my point number one and cause for action.

Stuff is happening and we (the United States) are not in control. Stuff is happening and it cannot be stopped. So if you believe what I said about America's special place and importance in the world-wide maritime regime, and if you take into account that we are an Arctic nation and that we have a boarder in the Arctic, you will understand that today, that is today, not some time in the future the United States has a choice to make. We are either going to jump in and lead this unprecedented geospatial, geopolitical transformation or we are not. This is in fact a choice. We can sit back and let things develop and watch with all the consequences associated with that approach or we can roll up our sleeves and lead in the safe, orderly, legally sufficient and environmentally prudent development of the Arctic.

In a lot of ways the changes in the Arctic are just a continuation of all the historic reasons and drivers for maritime commerce, which are to find and exploit faster, safer trade routes and greater access to resources. The difference today is having the benefit of 600 years of worldwide maritime expansion and exploitation to reflect upon and learn from as we stand on the threshold of an open Arctic Ocean.

Will we do better? Can we take advantage of all the opportunities presented today in a safe and environmentally responsible way? Can we do it in a way that maximizes the benefits to all?

So that is the strategic question. We have an entire ocean opening up, we have a new coastline longer than the entire Eastern Seaboard now accessible and under development, we have access to unimaginable amounts of oil, gas, and minerals and we have international interest at a level not seen in a hundred years. And all of this is above my pay grade.

So now back down to earth and my world, and what the Coast Guard and specifically the 17th District Command (D-17) is doing about all this? Well I would begin by saying that this development and this entire space is a U.S. Coast Guard issue. First it is maritime, second it is commerce, third it is life at sea, fourth it is environmental protection, and finally it is security and defense. And while other agencies and departments may have equities in one or some of these genres, none, other than your U.S. Coast Guard, has lead or complementary responsibilities in all.

Since, as I mentioned earlier, this is a today problem—it is my problem.

This past summer, the Bering Strait experienced approximately 480 transits of vessels carrying all types of cargo destined for ports around the world flagged and

crewed by dozens of nationalities. Some 35 different research vessels plied the waters off our coast. Shell began its historic oil exploration work, the Russians have renewed their Arctic Research Station, the Chinese circumnavigated the Arctic in their newest icebreaker. Also Nome has had a 50 percent increase in port calls, Barrow is at 20 percent increase, and all the North Slope communities will see a doubling of maritime activity in the next 2 years.

All of this means Coast Guard business in the Arctic is brisk. Search-and-rescues are up, inspections are up, and illicit traffic is up, marine environmental protection cases are way up. Most of you may not know but I testified at a Senate hearing last week and reminded Chairman Mark Begich that although this summer's oil exploration was not as productive as industry had hoped and while we all have spent much time worrying about the hole in the ground, we still had four near misses with major pollution potential that had nothing, zero, to do with oil exploration. Two lost barges in the Bering Strait, a cracked hull on a 2-million-gallon lightering barge in Barrow, and a close call on an Aleutian grounding.

So what is D-17 doing about it? Money is tight and operational resources overall are scarce or spoken for. Lead times for infrastructure and assets are very long. So I got no money and I got no time. Perfect.

What we did and what we are doing is methodical, pragmatic planning and allocation of the revenue we do have, to the highest risk and most urgent need. We are leveraging partnerships being creative and totally transparent.

This year we planned and flawlessly executed Operation Arctic Shield 2012 and we are in the lessons-learned analysis phase and in the Arctic Shield 2013 planning phase. I could talk all day about the specifics of this operation and am happy to answer any questions you may have on it later but at this point I wanted to pass on some obvious discoveries and some no-brainer issues that involve both monetary and regulatory solutions.

First, we have to get some traffic rules: Bering Strait, Unimak Pass, and Dixon Entrance. This is the number one preventive measure in my area of responsibility.

Second, we need to get some simple regulation that entices economically rational preventive behaviors. Such as oil spill removal organizations, tug prepositioning, and commercial emergency response capability for the responsible party.

Third, the U.S. government needs a presence, both physical and virtual, leveraging technology over bricks and mortar. But with the ability to respond in a sufficient manner to ensure the public's interests and national interests are being promoted and protected. This is both offshore, onshore, and cyber.

Fourth, no one agency or department can do it alone. This will take the

combined efforts of national government, state, local, and, particularly important, tribal cooperation and honest and creative discourse.

So here is the situation in summary before we go to questions and answers. The Arctic is the biggest maritime event since the Panama Canal, it is literally a Gold Rush with returns on investments in the trillions of dollars, it is 100 percent maritime, and it is uniquely Coast Guard. I believe the future of this nation can be altered for the better if we take this opportunity and do what America has always done: lead from the front and turn loose our collective adventurous spirit and our entrepreneurial minds and our unmatched national technological prowess. The prize is economic wealth, quality of life, energy independence, and more efficient globalized maritime trade, especially to and from the United States.

APPENDIX B

Guidance for Discussions in Plenary and Breakout Sessions

After the welcome and keynote address, there will be a plenary session with four speakers who will set the stage for subsequent discussions, presentations, and participation and input by all attendees. The plenary speakers will introduce and highlight the topics vital to the provision of adequate navigation safety in Arctic waters. The four overarching topics for the subsequent breakout sessions are

- Vessel traffic management,
- Emergency response capabilities,
- Information and data needs, and
- Research needs and models.

The plenary speakers will set the stage and introduce these topics with presentations that feature unique challenges facing Arctic operations today and examples of these within elected sectors of the maritime industry and providers of navigation safety services. Following the plenary session, the participants will be assigned to one of the four topic area breakout groups. Each breakout group will begin with a topic-specific presentation, and facilitated discussions will follow from the plenary and focused talks.

Guidance for each breakout group discussion is provided, along with key questions that are intended to help focus the discussion. Each group is encouraged to summarize main points raised and report these at the final workshop plenary session.

Breakout Group 1
VESSEL TRAFFIC MANAGEMENT

Discussions in Breakout Group 1 will address current status of and future needs for various schemes to regulate or manage vessel traffic in Arctic waters.[1] The presenters will discuss the general levels of shipping activity in key regions (e.g., Aleutian Islands, Bering Strait) in the recent past as well as the likely short- and long-range trends. They will also give examples of traffic systems now in place and whether they appear adequate to ensure safe operations now and in the future,

1 The group should note the status of current USCG proposals for Arctic traffic regulations.

taking into consideration such factors as quality of charts, aids to navigation, remote sensing, and communications. The group will be asked to focus its discussion on identifying practices or systems to ensure safe navigation to meet the needs of growing shipping activity. The following questions can be used to guide the discussion and solicit input from various perspectives represented by those participating in the breakout group:

General

- What practical actions are most important to take in the short term to improve and maintain vessel traffic safety and orderly operations in Arctic waters, especially in congested areas?
- What government agencies or other responsible parties must be engaged to implement these actions and when is international action necessary?
- Are the risks of inaction clearly stated and what risk assessment techniques might be used to evaluate cost and benefits?

Specific

- Are the existing, traditional traffic regulation schemes available to the USCG sufficient for the special circumstances in the Arctic or are new approaches needed?
- Is there sufficient information about current and projected traffic conditions to recommend implementation of specific traffic regulations in specific locations or is further study needed?
- Are specific infrastructure improvements (including communications and vessel tracking) needed in order to make traffic regulations feasible and practical?
- What industry input is needed in order to evaluate and make informed decisions about the implementation of vessel traffic regulations?

Breakout Group 2
EMERGENCY RESPONSE CAPABILITIES

Discussions will address current status of and future needs for physical and organizational capabilities to respond to maritime emergencies in Arctic waters. The presenters will use the example of a passenger vessel accident to illustrate the current status of such capabilities as well as to document some lessons learned from recent incidents. They will also discuss the general issues of preparedness and emergency training, and the unique challenges of response operations in the Arctic by using the example of current USCG temporary and seasonal deployment of rescue services located on Alaska's North Slope. The group will focus on identifying approaches to securing and maintaining adequate response capabilities for the long term. The following questions are to guide the discussion and solicit input from various perspectives.

General

- What practical actions are most important to take in the short term to improve or maintain needed emergency response capabilities in Arctic waters?
- What government agencies or other responsible parties must be engaged to implement these actions and when is international action necessary? Have the appropriate levels of international interaction and support needed, including the organizational pathways and specific groups and individuals to be involved, been identified?
- Are the risks of inaction clearly stated and what risk assessment techniques might be used to evaluate cost and benefits?

Specific

- Is there sufficient information about risks of accidents to recommend implementation of specific infrastructure for emergency response in specific locations or is further study needed?
- What unique challenges are presented in responding to a passenger vessel (tourism) incident as compared with an oil spill response and what challenges are similar?
- How can "vessels of opportunity" best be identified and organized for emergency response?
- How can emergency response exercises such as table-top drills be used most effectively to determine response capability needs and improve readiness?
- What are the most urgent actions for responsible authorities to implement both within the United States and internationally in order to have adequate emergency response capabilities in Arctic waters?

Breakout Group 3
INFORMATION AND DATA NEEDS

Discussions will address the current status of and future needs for information and data by ship operators, regulators, emergency response teams, and others in order to operate safely and effectively in Arctic waters. The presenters will provide an overview of existing, available data and information sources and highlight important gaps that appear to adversely affect current operations. They will also discuss the general issues of who provides these data, how they are delivered, how existing systems are funded, and what unique challenges exist in the Arctic. The group will be asked to identify approaches to securing and maintaining adequate data and information networks. The following questions are to guide the discussion and solicit input from various perspectives.

General

- What practical actions are most important to take in the short term to improve and maintain needed data and information networks in Arctic waters?
- What government agencies or other responsible parties must be engaged to implement these actions and when is international action necessary?
- Are there research needs that, when filled, would provide necessary or added safety margins to Arctic maritime operations?
- Are the risks of inaction clearly understood and would risk assessment techniques be useful to evaluate costs and benefits?

Specific

- Is there sufficient information about what current data and research results are available and about the data needs of Arctic operators to recommend specific actions to maintain and enhance networks and support systems to deliver data or is further study or information needed?
- What unique challenges are presented in the Arctic in designing and implementing data collection and delivery systems that will ensure safe and effective operations?
- What are the most urgent data needs for vessel operations in Arctic waters to ensure safety and which needs are best met by either government (public) providers or private industry?
- What data systems require international cooperation to ensure adequate coverage and reliability?

Breakout Group 4
RESOURCE MODELS

Discussions will address the needs for adequate resources to sustain or further develop the infrastructure and operations necessary for safe navigation in the U.S. Arctic and will explore organizational models that could provide an effective management structure. The session presenters will explore public–private partnership examples that may have merit and use examples of related maritime traffic and safety systems used elsewhere in the United States and other nations. They will also discuss the general issues of funding and implementing systems for traffic management, delivering navigation data and responding to emergencies, as well as the special challenges presented in the Arctic. The group will be asked to focus its discussion on identifying practical, near-term solutions for providing needed resources. The following questions can be used to guide the discussion and solicit input from various perspectives.

General

- What practical actions are most important to take in the short term to establish an organizational structure that can provide and maintain adequate resources?
- What models of government agencies and public–private partnerships offer the best opportunities for ensuring navigation safety in the Arctic and sustaining (or further developing) the needed infrastructure?
- What level of international cooperation is necessary to ensure the success of new models?

Specific

- Is there sufficient information about current and projected resource needs to design and implement an adequate navigation safety system?
- What unique challenges are presented in Arctic waters that could have major impacts on resource needs and the design of an organizational structure?
- What lessons might be applicable from similar experience in other nations (such as Norway)?
- What lessons might be applied from experience with VTS using public–private partnerships for shipping in some major U.S. ports in the recent past?

APPENDIX C

Workshop Agenda and Links to Presentations

Conference website:
www.TRB.org/Conferences/ArcticNav2012.aspx

Links to presentations are shown in the Workshop Agenda at the following site:
http://onlinepubs.trb.org/onlinepubs/mb/Arctic-Agenda.pdf

Agenda

Presentations, Handouts, and Breakout Proceedings are in **red bold.**

8:00 a.m. – 9:00 a.m., *Outside of Grand Ballroom*
Continental Breakfast

9:00 a.m. – 9:45 a.m., *Grand Ballroom*
Opening Session
Welcome
VADM James Card (U.S. Coast Guard, ret.), Chair, Organizing Committee
Keynote Address
RADM Thomas Ostebo, U.S. Coast Guard 17th District Commander
On behalf of VADM Peter Neffenger, U.S. Coast Guard, Deputy Commandant for Operations

9:45 a.m. – 10:45 p.m., *Grand Ballroom*
Plenary/Panel Session
VADM James Card (U.S. Coast Guard, ret.), Chair, *presiding*
Commercial Shipping in the Arctic
RADM Gene Brooks (U.S. Coast Guard, ret.), Maersk Line Limited
TSB Response to the Clipper Adventure Grounding
W.C. (Bill) DuTrizac, Transportation Safety Board (TSB) of Canada

10:45 a.m. – 11:15 a.m., *Outside of Grand Ballroom*
Morning Break

11:15 a.m. – 12:15 p.m., *Grand Ballroom*
Plenary/Panel Session *(continued)*
VADM James Card (U.S. Coast Guard, ret.), Chair, *presiding*
Ice Sensing Technologies for Safe Arctic Navigation
Pablo Clemente-Colón, Navy/NOAA/U.S. Coast Guard Joint Ice Center
The Role of Collaborative Modeling in Creating and Sustaining Resilient Safety Systems
Jack Harrald, Professor, Center for Technology, Security, and Policy; Virginia Polytechnic Institute and State University *(**handout**)*

12:15 p.m. – 1:00 p.m., *Grand Ballroom*
Plenary Session
Puget Sound: Gateway to the Arctic
RADM Keith Taylor, U.S. Coast Guard 13th District Commander
Discussion of Goals
VADM James Card (U.S. Coast Guard, ret.), Chair

1:00 p.m., *Outside of Grand Ballroom*
Working Lunch
Pick up box lunch outside Ballroom and take to breakout rooms

1:15 p.m. – 3:00 p.m.
Breakout Sessions

Breakout Group 1, *Chancellor*
Shipping Operations / Traffic Regulation Schemes
Stephen Carmel and Steven Scalzo, Committee Members, *presiding*
Major Vessel Traffic Monitoring & Management Options for Reducing Risk of Arctic Maritime Operations
Ed Page, Marine Exchange of Alaska
Breakout Group 2, *College*
Emergency Response Capabilities
John Holmes and Mary Brooks, Committee Members, *presiding*
Major Cruise Line Perspective: Emergency Response in the Arctic
Cees Deelstra, Holland America Line
Arctic Navigation during Shell's Alaska Operations and Emergency Response to a Freighter
Marshall Borden, Master AHTS Vessels, Shell International Exploration and Production, Inc.
Breakout Group 3, *Grand Ballroom*
Information Needs
George Newton and Steve Barnum, Committee Members, *presiding*
Planning for the Bering Strait Future: information Needs and Challenges
Molly McCammon, Alaska Ocean Observing System
Breakout Group 4, *Regent*
Models for Determining Needs and Resources
VADM James Card and Martha Grabowski, Committee Members, *presiding*
Safety of Maritime Operations in the Barents Sea
Beate Kvamstad, MARINTEK

3:00 p.m. – 3:30p.m., *Outside of Grand Ballroom*
Afternoon Break

3:30 p.m. – 5:30 p.m.
Breakout Sessions *(continued)*

5:30p.m. – 7:00 p.m., *Governors*
Reception
Guest Speaker: **Lt. Governor Mead Treadwell**, State of Alaska

Tuesday, October 16, 2012

8:00 a.m. – 4:30 p.m., *Outside of Grand Ballroom*
Registration

8:00 a.m. – 9:00 a.m., *Outside of Grand Ballroom*
Continental Breakfast

9:00 a.m. – 10:00 a.m., *Grand Ballroom*
Plenary Session
VADM James Card (U.S. Coast Guard, ret.), Chair, Organizing Committee
Update on CMTS U.S. Arctic Marine Transportation Policy Response Document
David Murk, Office of the Secretary of Transportation; and Chair, CMTS Coordinating Board

10:00 a.m. – 10:45 a.m.
Breakout Sessions

Breakout Group 1, *Chancellor*
Shipping Operations / Traffic Regulation Schemes
Breakout Group 2, *College*
Emergency Response Capabilities
Breakout Group 3, *Grand Ballroom*
Information Needs
Breakout Group 4, *Regent*
Models for Determining Needs and Resources

10:45 a.m. – 11:15 a.m., *Outside of Grand Ballroom*
Morning Break

11:15 a.m. – 12:30 p.m.
Breakout Sessions *(continued)*

Breakout Group 1, *Chancellor*
Shipping Operations / Traffic Regulation Schemes
Breakout Group 2, *College*
Emergency Response Capabilities
Breakout Group 3, *Grand Ballroom*
Information Needs
Breakout Group 4, *Regent*
Models for Determining Needs and Resources

12:30 p.m. – 1:30 p.m., *Outside of Grand Ballroom*
Working Lunch

1:30 p.m. – 2:30 p.m.
Plenary Session
Summary of key issues and follow-up items for each breakout topic
VADM James Card (U.S. Coast Guard, ret.), Chair, *presiding*

2:30 p.m. – 3:00p.m., *Outside of Grand Ballroom*
Afternoon Break

3:00 p.m. – 4:30 p.m.
Plenary Session *(continued)*
Summary of key issues and follow-up items for each breakout topic
VADM James Card (U.S. Coast Guard, ret.), Chair, *presiding*

4:30 p.m. – 5:00 p.m., *Grand Ballroom*
Closing Session
Final thoughts and Follow-up
VADM James Card (U.S. Coast Guard, ret.), Chair, *presiding*

APPENDIX D

List of Participants

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