

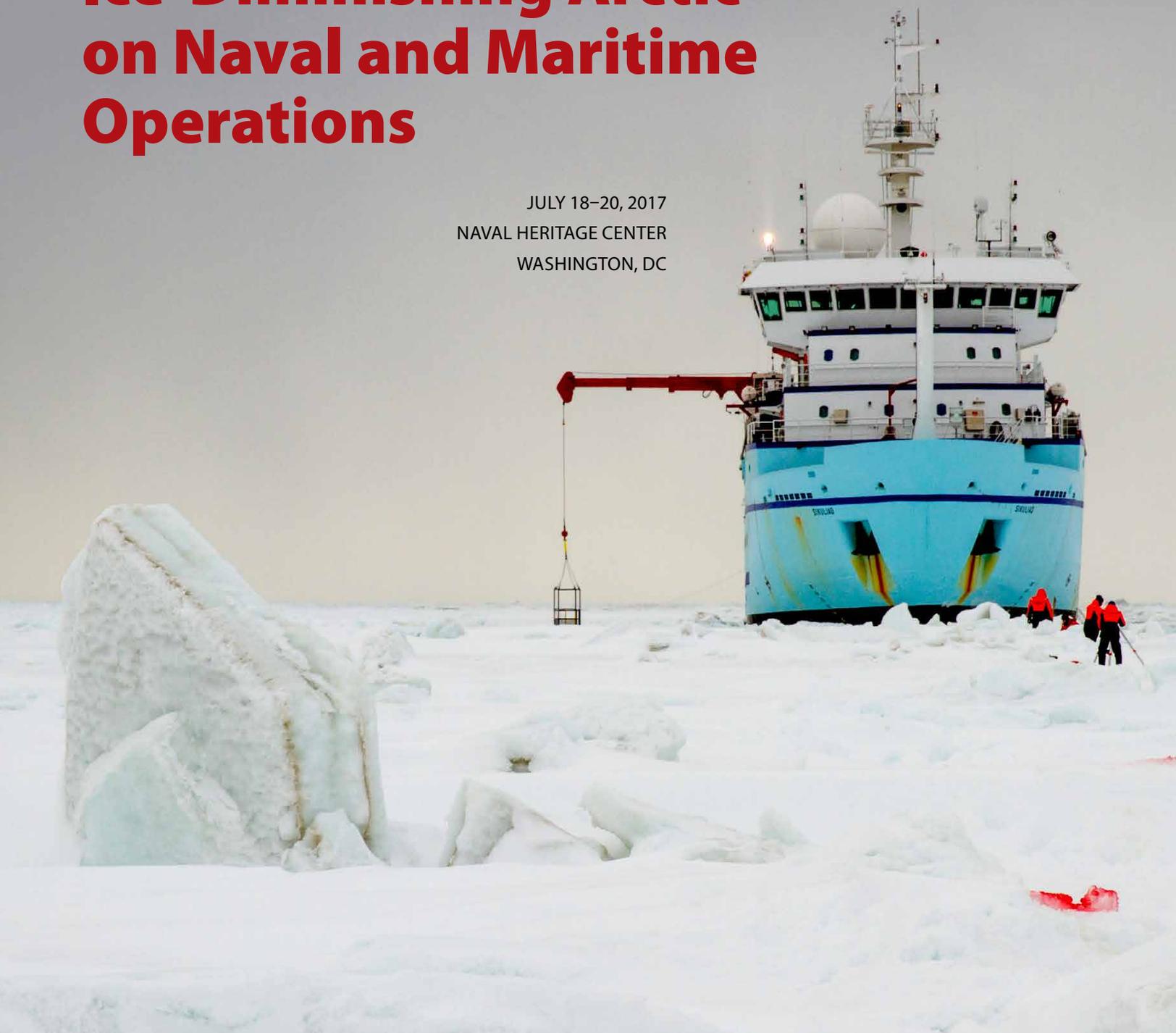


HOSTED AND SPONSORED BY
THE U.S. ARCTIC RESEARCH COMMISSION
AND U.S. NATIONAL ICE CENTER

7th Symposium on

The Impacts of an Ice-Diminishing Arctic on Naval and Maritime Operations

JULY 18–20, 2017
NAVAL HERITAGE CENTER
WASHINGTON, DC



Co-Hosts and Sponsors

U.S. Arctic Research Commission (USARC). The USARC is an independent federal agency created by the Arctic Research and Policy Act of 1984. It is a presidentially appointed advisory body supported by staff in Washington, DC, and in Anchorage, AK. In addition to publishing the biennial *Report on the Goals and Objectives for Arctic Research*, the Commission recommends U.S. Arctic research policy to the President and Congress and builds cooperative links in Arctic research within the federal government, with the State of Alaska, and with international partners. The law also requires the Commission to report to Congress on the progress of the Executive Branch in reaching goals set by the Commission and on their adoption by the Interagency Arctic Research Policy Committee.

U.S. National Ice Center (USNIC). USNIC is a multi-agency center operated by the U.S. Navy, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Coast Guard. We provide the highest quality, timely, accurate, and relevant ice and snow products and related environmental intelligence services to meet the strategic, operational, and tactical requirements of U.S. interests worldwide.

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Acknowledgements

The Co-Hosts acknowledge the generous contributions of time and effort by the Planning Committee and Management Team, the invited speakers and panelists, and numerous other behind-the-scene contributors to the Ice-Diminishing Arctic (IDA) symposium. The U.S. Committee on the Marine Transportation System was a supporting group.

COVER PHOTO. R/V *Sikuliaq* seen from the "headstone" along the line of the performance test. Photo by Roger Topp

Contents

Motivation and Background	1
Agenda.....	2
Symposium Events.....	6
Speakers	7

Motivation and Background

7th Symposium on the Impacts of an Ice-Diminishing Arctic on Naval and Maritime Operations

Motivation

Over the past 40 years, satellite data document a significant trend of decreasing Arctic sea ice extent and thickness that have a direct impact on Arctic operations. This year's symposium program is influenced by a number of recent events and activities, such as implementation of the International Maritime Organization's Polar Code; an active Senate Arctic Caucus (that includes Maine); the release of China's "One Belt One Road" marine initiative, with aspirations for Arctic shipping; a dramatic increase in Arctic marine tourism; a reduction in offshore Arctic oil and gas exploration; the debut of R/V *Sikuliaq*, a fully operational ice-capable global class research vessel operated by the University of Alaska Fairbanks; Russia's continued, and growing, investment in Arctic infrastructure and economic development; U.S. Coast Guard plans to acquire new icebreakers, laying of fiber optic cable across the Arctic that will link Japan to London; and a new, legally binding agreement to enhance international Arctic scientific cooperation, among many others.

Changing Ice Conditions

Satellite records available since late 1978 continue to show an overall downward trend in the extent of Arctic sea ice. This trend has accelerated during the last two decades, with an associated loss of sea ice volume of about 75%. The record sea ice extent minimum occurred in September 2012, and the September extent in 2016 tied with that in 2007 for the second lowest minimum. In January 2017, Arctic sea ice extent averaged 13.38 million square kilometers (5.17 million square miles), the lowest January extent in the 39-year satellite record.

Symposia History

This symposium, held biennially since 2007, provides a review of the ongoing and expected impacts on naval and maritime operations due to rapid changes in the Arctic sea ice cover. The series began with a symposium titled, "Naval Operations in an Ice-Free Arctic," sponsored by the Office of Naval Research, the U.S. National Ice Center, the Oceanographer of the Navy, and the U.S. Arctic Research Commission in April 2001. While that symposium focused on naval operations and national strategic issues, the next symposium, in 2007, expanded the discussion to include impacts on other maritime operations such as commercial transportation, oil and gas exploration and production, fisheries, and oceanographic research. Symposia since then (in 2009, 2011, 2013, and 2015) continued to address the Arctic sea ice and associated environmental conditions vis-a-vis emerging or expected naval, maritime, and other activities in the region.

Agenda

The agenda is also online at <https://www.star.nesdis.noaa.gov/Ice2017/program.php>.

DAY 1, TUESDAY, JULY 18

- 0730–0830 **REGISTRATION AND MORNING REFRESHMENTS**
- 0830–0835 **SYMPOSIUM OPENING REMARKS**
CDR Ruth Lane, Commanding Officer, Naval Ice Center, and Director, U.S. National Ice Center
- 0835–0840 **LOGISTICS AND INFORMATION**
Dr. Pablo Clemente-Colón, Advisor, U.S. Arctic Research Commission (USARC)
- 0840–0900 **MAINE AND THE ARCTIC**
Hon. Angus S. King, Jr., United States Senator for Maine
- 0900–0915 **A BRIEF HISTORY OF THIS SYMPOSIUM AND A FEW SUGGESTIONS...**
Hon. Frances Ann (Fran) Ulmer, Chair, USARC
- 0915–0935 **REMARKS FROM THE ALASKAN SENIOR SENATOR**
Hon. Lisa A. Murkowski, United States Senator for Alaska
- 0935–0955 **STATE OF ALASKA ECONOMIC ISSUES**
Mr. Chris W. Hladick, Commissioner, Alaska Department of Commerce, Community, and Economic Development
- 0955–1015 **MORNING BREAK**
- 1015- 1045 **U.S. COAST GUARD (USCG) KEYNOTE ADDRESS**
ADM Paul F. Zukunft, Commandant, USCG
- 1045- 1115 **U.S. NAVY (USN) KEYNOTE ADDRESS**
RADM Stuart B. Munsch, Assistant Deputy Chief of Naval Operations (CNO) for Operations, Plans, and Strategy, USN
- 1115–1145 **NOAA KEYNOTE ADDRESS**
Mr. Craig McLean, Acting Chief Scientist, National Oceanic and Atmospheric Administration (NOAA)
- 1145–1315 **LUNCH BREAK**
- 1200–1315 **SCREENING OF “SEA BLIND” IN PRESIDENTS ROOM**
- 1315–1335 **U.S. NATIONAL ICE CENTER: PROVIDING DOMAIN AWARENESS AT HIGH LATITUDES**
CDR Ruth Lane, Commanding Officer, Naval Ice Center, and Director, U.S. National Ice Center
- 1335–1355 **EMERGING NEEDS FOR TACTICAL SCALE ICE INFORMATION IN THE NORTH**
Mr. David Jackson, Special Project Adviser, Canadian Ice Service
- 1355–1415 **THE INTERNATIONAL ICE PATROL (IIP)**
CDR Gabrielle McGrath, Commander, IIP
- 1415–1435 **COUNCIL ON FOREIGN RELATIONS (CFR) ARCTIC STRATEGY FOR THE U.S.**
ADM Thad Allen, Senior Executive Advisor, Booz Allen Hamilton, USCG (Ret.)
- 1435–1455 **AFTERNOON BREAK**

- 1455–1515 **REMARKS FROM THE ALASKAN JUNIOR SENATOR**
Hon. Daniel (Dan) S. Sullivan, United States Senator for Alaska
- 1515–1535 **OFFICE OF NAVAL RESEARCH (ONR) ARCTIC OPPORTUNITIES**
RADM David J. Hahn, Chief of Naval Research
- 1535–1555 **ARCTIC MARINE TOURISM**
Mr. Aaron Lawton, Director of Operations, One Ocean Expeditions
- 1555–1615 **SIKULIAQ, THE ICE-STRENGTHENED U.S. ACADEMIC ARCTIC RESEARCH VESSEL**
Dr. S. Bradley (Brad) Moran, Dean, College of Fisheries and Ocean Sciences, University of Alaska Fairbanks (UAF)
- 1615–1630 **DAY 1 CLOSING**
Dr. Pablo Clemente-Colón, Advisor, USARC
- 1645–1915 **IDA RECEPTION**
Co-hosted by USARC and the Alaska State Society

DAY 2, WEDNESDAY, JULY 19

- 0800–0840 **REGISTRATION AND MORNING REFRESHMENTS**
- 0840–0845 **LOGISTICS AND INFORMATION**
Dr. Pablo Clemente-Colón, Advisor, USARC
- 0845–0905 **THE INTERAGENCY ARCTIC RESEARCH POLICY COMMITTEE & THE ARCTIC EXECUTIVE STEERING COMMITTEE: MARINE & MARITIME ISSUES**
Dr. Martin Jeffries, Assistant Director-Polar Sciences, Office of Science and Technology Policy, Executive Office of the President
- 0905–0925 **NATIONAL SCIENCE FOUNDATION AND ITS PORTFOLIO OF ARCTIC OCEAN RESEARCH**
Mr. Simon N. Stephenson, Head, Arctic Sciences Section, Office of Polar Programs, National Science Foundation (NSF)
- 0925–0945 **LONG-TERM CHANGES IN THE ICE RETREAT AND OPEN WATER SEASON IN THE ARCTIC: POTENTIAL IMPLICATIONS FOR OPERATIONS IN THE REGION**
Dr. Walt Meier, Senior Research Scientist, National Snow and Ice Data Center
- 0945–1005 **GEOPHYSICAL CONTRADISTINCTION BETWEEN ARCTIC AND ANTARCTIC SEA ICE CHANGE**
Dr. Son Nghiem, National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL)
- 1005–1025 **MORNING BREAK**
- 1025–1045 **THE STATUS OF EXTENDED CONTINENTAL SHELF ACTIVITIES IN THE ARCTIC**
Dr. Larry Mayer, Director, School of Marine Science and Ocean Engineering and The Center for Coastal and Ocean Mapping, University of New Hampshire, and Commissioner, USARC
- 1045–1105 **REFLECTIONS ON ADVANCING SCIENCE AND TECHNOLOGY IN SUPPORT OF THE ARCTIC OPERATOR**
Maj. Gen. Randy “Church” Kee, U.S. Air Force (Ret.), Arctic Domain Awareness Center, Executive Director, University of Alaska
- 1105–1125 **REMARKS FROM THE ALASKAN CONGRESSMAN**
Hon. Don Young, United States Congressman for Alaska
- 1125–1145 **ARCTIC RESEARCH IN RUSSIA**
Prof. Vladimir Pavlenko, Vice-President of the International Arctic Science Consortium (IASC) and Director of the Federal Arctic Research Center of Russian Academy of Sciences, Arkhangelsk, Russia

- 1145–1315 **LUNCH BREAK**
- 1200–1315 **SCREENING OF “SEA BLIND” IN PRESIDENTS ROOM**
- 1315–1335 **ARCTIC BROADBAND INSTALLED ALONG NORTH SLOPE**
Ms. Elizabeth E. Pierce, CEO, Quintillion
- 1335–1355 **U.S. NAVY ARCTIC ROADMAP UPDATE**
CDR Kelly Taylor, Deputy Director, Task Force Climate Change, Office of the Oceanographer of the Navy (OPNAV N2N6E6), USN
- 1355–1415 **DANISH PERSPECTIVES**
RADM Niels Anders Kjær Olsen, Defense Attaché, Embassy of Denmark, Washington
- 1415–1435 **THE NATIONAL ACADEMIES POLAR ICEBREAKER COST ASSESSMENT STUDY**
RADM Richard D. (Dick) West, Former President/CEO, Consortium for Oceanographic Research and Education and Former Oceanographer and Navigator, U.S. Navy (Ret.)
- 1435–1455 **STATUS AND OUTLOOK OF THE USCG HEAVY POLAR ICEBREAKING PROGRAM**
Mr. David Raboy, Budget and Execution Manager, U.S. Coast Guard’s Heavy Polar Icebreaker Acquisition Program
- 1455–1515 **ARCTIC INFORMATION INFRASTRUCTURE: WHAT’S NEW, WHAT’S NEXT**
Mr. David Millar, Vice President, Fugro (USA) Inc.
- 1515–1535 **DIVINING THE FUTURE: HOW ARCTIC SHIPPING PROJECTIONS STACK UP TO REALITY**
Dr. Alyson Azzara, International Trade Specialist, U.S. Maritime Administration
- 1535–1555 **AFTERNOON BREAK**
- 1555–1655 **PANEL I ON ARCTIC MARINE TRANSPORTATION AND Q&A SESSION**
Lead: Dr. Lawson W. Brigham, Fellow, Center for Arctic Study & Policy, U.S. Coast Guard Academy
Panelist 1: CAPT Ed Page, USCG (Ret.), Executive Director, Marine Exchange of Alaska
Panelist 2: Ms. Drue Pearce, Director, Government Affairs, Holland & Hart
Panelist 3: CAPT Benjamin (Ben) Hawkins, Head, Office of Design and Engineering Standards, Commercial Regulations and Standards Directorate, USCG
Panelist 4: Prof. Vladimir Pavlenko, Vice-President, IASC, and Director, Federal Arctic Research Center of Russian Academy of Sciences, Arkhangelsk, Russia
Panelist 5: Ms. Molly McCammon, Director, Alaska Ocean Observing System
- 1655–1700 **DAY 2 CLOSING**
Dr. Pablo Clemente-Colón, Advisor, USARC

DAY 3, THURSDAY, JULY 20

- 0730–0830 **REGISTRATION AND MORNING REFRESHMENTS**
- 0830–0835 **LOGISTICS AND INFORMATION**
Dr. Pablo Clemente-Colón, Advisor, USARC
- 0835–0855 **RESULTS OF THE 2017 ARCTIC COUNCIL MINISTERIAL**
Amb. David A. Balton, Deputy Assistant Secretary for Oceans and Fisheries, Bureau of Oceans and International Environmental and Scientific Affairs, U.S. Department of State
- 0855–0915 **PREVENTING UNREGULATED COMMERCIAL FISHING IN THE CENTRAL ARCTIC OCEAN: AN OVERVIEW**
Dr. Peter Harrison, Professor Emeritus, School of Policy Studies, Queen’s University, Canada

- 0915–0935 **NWS ALASKA: STRATEGIC PLANNING TO MEET EMERGING ARCTIC MARITIME OPERATIONAL CHALLENGES**
Mr. Carven Scott, Director, NOAA National Weather Service (NWS) Alaska Region
- 0935–0955 **NOAA ARCTIC RESEARCH OFFICE ACTIVITIES**
Dr. Jeremy Mathis, Arctic Research Office, Climate Program Office, Office of Oceanic and Atmospheric Research, NOAA
- 0955–1015 **MORNING BREAK**
- 1015–1035 **SEA ICE VARIATIONS IN THE NORTHERN ALASKA NAVIGATION CORRIDOR**
Dr. John Walsh, Chief Scientist, International Arctic Research Center, UAF
- 1035–1055 **RESPONSES OF ARCTIC MARINE MAMMALS TO CHANGING SEA ICE CONDITIONS**
Mr. David C. Douglas, Research Wildlife Biologist, Alaska Science Center Biology Office, U.S. Geological Survey (USGS)
- 1055–1125 **ARCTIC ENVIRONMENTAL RESPONSE AND MANAGEMENT**
Dr. Amy Merten, NOAA Office of Response & Restoration and Dr. Alexey Knizhnikov, Head, Oil and Gas Programme at WWF-Russia
- 1125–1145 **ACTIVITIES OF THE RUSSIAN MARINE RESCUE SERVICE IN THE FIELD OF INTERNATIONAL COOPERATION ON ARCTIC ENVIRONMENTAL LEGISLATION, SHIPPING, AND EMERGENCY RESPONSE ISSUES**
Dr. Natalia Kutaeva, Counsellor to the Director, Marine Rescue Service of Rosmorrechflot (MRS)
- 1145–1315 **LUNCH**
- 1315–1335 **LOCAL-SCALE (PEOPLE’S) PERSPECTIVE: LIVING WITH THE CHANGING ICE ON ST. LAWRENCE ISLAND, ALASKA, 2000–2017**
Dr. Igor Krupnik, Curator, Department of Anthropology, Smithsonian Institution
- 1335–1355 **PERSPECTIVES FROM AN ALASKAN NATIVE**
Hon. Marie Greene, Commissioner, USARC
- 1355–1415 **LOCAL/REGIONAL PERSPECTIVE FROM THE NORTH WEST ARCTIC REGION OF ALASKA**
Ms. Shawn Gilman, City Manager, Kotzebue, Alaska
- 1415–1435 **THE 2016 SEARCH FOR THE JEANNETTE**
Dr. Kathy Crane, Visiting Professor, University of Hawaii
- 1435–1455 **NGA ARCTIC WEBSITE AND THE INTERNATIONAL HYDROGRAPHIC ORGANIZATION (IHO) ARCTIC MARITIME SPATIAL DATA INFRASTRUCTURE PROJECT**
Mr. Keith E. Dominic, Chief, Maritime Navigation Division and Arctic Source Lead, National Geospatial-Intelligence Agency (NGA)
- 1455–1515 **CANADIAN ARCTIC SHIPPING RISK ASSESSMENT SYSTEM (CASRAS)**
Ms. Anne Barker, Arctic Program Leader, National Research Council, Canada
- 1515–1535 **AFTERNOON BREAK**
- 1535–1635 **PANEL II ON ARCTIC INFRASTRUCTURE AND Q&A SESSION**
Lead: Ms. Helen A. Brohl, Executive Director, U.S. Committee on the Marine Transportation System
Panelist 1: Ms. Anne Barker, Arctic Program Leader, National Research Council, Canada
Panelist 2: Ms. Kierstin M. Del Valle, Manager, Maritime Policy, Cruise Lines International Association
Panelist 3: Dr. Natalia Kutaeva, Counsellor to the Director, MRS
Panelist 4: Ms. Denise Michels, Director of Transportation, Kawerak, Inc. and former Mayor of Nome, Alaska
Panelist 5: Mr. Matthew (Matt) Bush, Vice President, Global Macro and Investment Research, Guggenheim Partners
- 1635–1645 **SYMPOSIUM CLOSING**
Dr. Pablo Clemente-Colón, Advisor, USARC

Symposium Events

Poster Session

Daily

Naval Heritage Center Lobby

Learn more about maritime science! Science posters will be on display in the lobby of the Naval Heritage Center throughout the conference. A preliminary list of posters includes the following.

The US Navy's New Operational Capability in Global Ice Forecasting

P.G. Posey, et al.

Evolution of the United States National Ice Center

R. Lane and C. Panowicz

GLOBAL ARCHER: The GLOBAL ARctic High-altitude Environmental Research Initiative

J. Intrieri, et al.

Naval Ice Center Ice Stress and Fracture Risk Assessment Tool

C. Panowicz and W. Clark

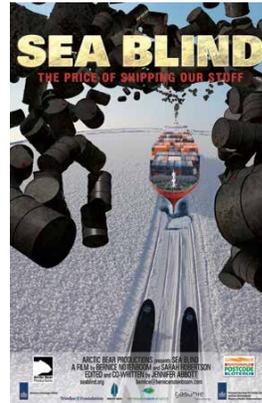
Development of U.S. Navy Coupled Atmosphere-Ocean-Sea Ice Earth System Model for Arctic Predictions

N. Barton, et al.

Overview of National Research Council of Canada Sea Ice and Iceberg Forecasting and Engineering Tools

D. Sudom and A. Barker

Screening of "Sea Blind"



SEA BLIND: THE PRICE OF SHIPPING OUR STUFF. Arctic ice melt allows commercial shipping across Russia's Northern Sea Route to be viable for the first time in history. This Arctic short-cut makes shipping even cheaper and faster than present routes by avoiding passage through the Suez canal. But the savings come at a tremendous price. Shipping is

one of the most polluting and unregulated industries in the world. Colossal ships create health challenges, but worse still, the black carbon the shipping industry is allowed to emit accelerates the Arctic ice melt.

SCREENING 1

Day 1, Tuesday, July 18, 1200–1315

Naval Heritage Center Presidents Room

SCREENING 2

Day 2, Wednesday, July 19, 1200–1315

Naval Heritage Center Presidents Room

Speakers



**Commandant (Ret.)
Thad Allen**

Thad Allen retired from the Coast Guard in 2010 as the 23rd Commandant. He currently serves as Senior Executive Advisor at Booz Allen Hamilton where he supports government and commercial clients in cyber security, energy and the environment, navigation systems, emergency response, and crisis leadership. He is a nationally recognized expert in disaster response and an advisor to government leaders. He was the lead federal official for the responses to Hurricanes Katrina and Rita and the Deepwater Horizon oil spill. Allen also directed U.S. Coast Guard operations in the wake of the 9/11 attacks and the Haitian earthquake. A 1971 graduate of the U.S. Coast Guard Academy, Allen also holds master's degrees from The George Washington University and MIT Sloan School. He is a member in the Council on Foreign Relations and a Fellow in the National Academy of Public Administration. He serves on a number of federal advisory committees.



Ambassador David A. Balton

Ambassador Balton is the Deputy Assistant Secretary for Oceans and Fisheries in the U.S. Department of State. He is responsible for coordinating the development of U.S. foreign policy concerning oceans and fisheries, and overseeing U.S. participation in international organizations dealing with these issues. During the U.S. Chairmanship of the Arctic Council, Ambassador Balton served as the Chair of the Senior Arctic Officials. He also chaired separate meetings on Arctic fisheries, including negotiations that produced the 2015 *Declaration Concerning the Prevention of Unregulated High Seas Fishing in the Central Arctic Ocean*. Balton has appeared as a soloist with the National Symphony Orchestra in Washington, DC (juggling oranges).



Alyson Azzara, PhD

Dr. Azzara is the Arctic and International Trade Specialist for the U.S. Maritime Administration at the Department of Transportation. Her work focuses on Arctic trade issues including vessel safety, navigation, infrastructure, and environmental stewardship. Dr. Azzara provides additional policy expertise on Arctic trade issues impacting the U.S. flag fleet, and she serves as a subject matter expert for various Arctic Council and IMO working groups. She holds a PhD in marine biology from Texas A&M University at Galveston with research focused on bioacoustics and the interaction between large vessels and whales in the Gulf of Mexico.



Anne Barker

Anne Barker is a project engineer within the Ocean, Coastal, and River Engineering portfolio of the National Research Council of Canada (NRC). Joining the NRC in 1998, she has participated in and led projects involving numerical simulations, fieldwork, physical modeling, and data analysis of ice cover behavior and ice-structure interaction. This has included projects covering physical modeling studies of ice loads against offshore wind turbine towers, evaluating the risk of damage to overwintering fuel barges due to ice conditions, feasibility studies for emergency evacuation in the Beaufort Sea, and numerical modeling studies of ice loads and ice pileup on structures. She presently leads the NRC's Arctic Program. In this role, Ms. Barker is responsible for the delivery of relevant outcomes that support the development of engineering technologies to ensure sustainable, low impact development of the Arctic while increasing the quality of life of northerners.



Lawson W. Brigham, PhD

Dr. Lawson Brigham is Distinguished Fellow and Faculty Member at the International Arctic Research Center, University of Alaska Fairbanks (UAF). He is also a Fellow at the U.S. Coast Guard Academy's Center for Arctic Study

and Policy, and Senior Fellow at the Institute of the North. Captain Brigham was a career Coast Guard officer and commanded four cutters, including the icebreaker *Polar Sea* on Arctic and Antarctic expeditions. From 2004 to 2009 he was chair of the Arctic Council's Arctic Marine Shipping Assessment. Brigham has been a research fellow at Woods Hole Oceanographic Institution; a faculty member of the U.S. Coast Guard Academy, Naval Postgraduate School, and the UAF; Alaska Director, USARC; a distinguished graduate of the Naval War College; and holds graduate degrees from Rensselaer Polytechnic Institute (MS), and Cambridge University (MPhil and PhD). His research interests focus on the Russian maritime Arctic, environmental change, polar marine transportation, and polar geopolitics. He is a graduate of the U.S. Coast Guard Academy.



Matt Bush

Mr. Bush is an economist in Guggenheim's global macro and investment research group. He researches economic and policy developments in the United States and has primary coverage for more than 30 countries in sub-

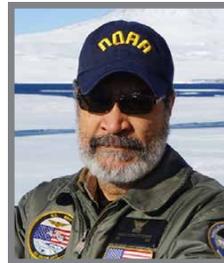
Saharan Africa, Latin America, and Southeast Asia. Mr. Bush also leads Guggenheim's research efforts on sustainable development, focusing on the Arctic region. Prior to joining Guggenheim, Mr. Bush worked for several think tanks researching economic policy and taught at Xiamen University of Technology in China. Mr. Bush graduated from Harvard University with an A.B. in economics. He has earned the right to use the Chartered Financial Analyst® designation and is a member of the CFA Institute.



Helen Brohl

Helen A. Brohl was appointed as the first Executive Director of the U.S. Committee on the Marine Transportation System (CMTS) in July 2006 by U.S. Department of Transportation Secretary Norman Mineta. Maritime transportation

oversight and interest within the U.S. federal government is spread throughout many authorities, departments, and budget line items. As a career Senior Executive, Ms. Brohl manages the CMTS partnership, established under a Presidential Directive in 2004 and authorized in 2012, that joins over 25 federal agencies to address our Nation's waterways, ports, and intermodal connections. Working with senior political, military, and civilian leaders in the federal government, Ms. Brohl directed the development and Cabinet-level approval of the first-ever *National Strategy for the Marine Transportation System* to improve the MTS for capacity, safety and security, environmental stewardship, resiliency, and financing. Ms. Brohl has a coastal geology degree from Florida Atlantic University in Boca Raton, Florida, and a Master of Science degree from The Ohio State University in Columbus, Ohio, in Great Lakes land and water use policy.



Pablo Clemente-Colón, PhD

Dr. Clemente-Colón is an oceanographer retired from the National Oceanic and Atmospheric Administration (NOAA) in 2017 after 38 years of federal service. He also served as Chief Scientist of the National Ice Center, a joint agency

formed by NOAA, Navy, and the U.S. Coast Guard, where he functioned as Senior Scientific Advisor. Dr. Clemente-Colón has participated in icebreaking missions and sea ice field experiments in the Arctic including U.S.–Canada Joint Extended Continental Shelf mapping missions and has supported ice and snow monitoring research and operations globally. He was a contributor to the *Arctic Council Arctic Marine Shipping Assessment 2009 Report* and has been instrumental in the organization of the biennial Symposia on the Impacts of an Ice-Diminishing Arctic on Naval and Maritime Operations since 2007. Dr. Clemente-Colón presently serves as Advisor to the U.S. Arctic Research Commission and actively supports the Executive Boards of the International Arctic Buoy Programme and the International Programme for Antarctic Buoy.



Dr. Kathleen Crane

Dr. Crane was a program manager in the Arctic Research Program of the Climate Program Office of the National Oceanic and Atmospheric Administration. She led the U.S. mission coordination for the Russian-American Long-term

Census of the Arctic and was the co-chair of the Arctic Council's Circumpolar Marine Biodiversity Monitoring Program. She was formerly a Professor of Oceanography at Hunter College, the City University of New York, and a Senior Research Scientist at the Lamont-Doherty Earth Observatory of Columbia University. Dr. Crane received her PhD in 1977 at Scripps Institution of Oceanography, University of California, San Diego, and was a Postdoctoral Fellow at the Woods Hole Oceanographic Institution from 1977 to 1979. She has also been a visiting scientist at the University of California, Santa Barbara; the University of Hawaii; the University of Oslo, Norway; the University of Paris, France under a Fulbright Award in 1985; and the Environmental Defense Fund where she developed their Arctic program.



Keith E. Dominic

Mr. Dominic graduated from U.S. Merchant Marine Academy in 1999 with a Bachelor of Science in Marine Transportation, a USCG Third Mate Unlimited Tonnage License, and a commission in the U.S. Navy Reserve, where he now holds the

rank of Commander. Additionally, Mr. Dominic obtained a Master's in National Security and Strategic Studies from U.S. Naval War College. Mr. Dominic has worked in National Geospatial-Intelligence Agency's Maritime Safety Office for over 17 years. During his tenure, he has held key leadership roles in several divisions, including Nautical Publications, World-Wide Navigational Warning Service, and as Arctic Lead for the Source Directorate. Today, Mr. Dominic is Chief of Maritime Navigation Division-Atlantic. His primary responsibility is for the management and production of Digital Nautical Chart, covering from the east coast of North and South America to the Arctic Ocean, the Mediterranean Sea, Persian Gulf, and the western Indian Ocean.



Kierstin Del Valle

In her position as Manager, Maritime Policy with Cruise Lines International Association (CLIA), Ms. Del Valle develops, coordinates, prepares, and presents CLIA policy to and negotiates industry positions with international, federal,

and state regulatory and rule-making bodies to other industry associations, to foreign governments, in professional seminars and gatherings, and at other venues. Ms. Del Valle graduated from Webb Institute in 2013 and holds a Bachelor of Science in Naval Architecture and Marine Engineering. She is currently in pursuit of her Master of Science in Engineering Management from George Washington University.



David Douglas

Mr. Douglas is a research wildlife biologist with the U.S. Geological Survey Alaska Science Center. He studies how year-to-year variations in the timing of sea ice and snow melt affect the availability and quality of habitats for marine animals

like polar bears and pinnipeds, and for terrestrial animals like caribou and geese. Arctic animals are well adapted to variable weather conditions, but global warming is rapidly changing the Arctic and challenging their resiliency. Since beginning his research career in Alaska in 1986, Mr. Douglas has participated in wide variety of studies where he brings expertise in remote sensing and spatial modeling aimed to quantifying relationships between weather, landscape dynamics, habitat quality, animal movements, and wildlife population dynamics.



Shawn Gilman

Ms. Gilman is the City Manager for Kotzebue, Alaska. Born in Anchorage, she has been fortunate enough to have traveled, lived, and worked in all regions of the state. She is of Aleut descent from the Eyak Village located near Cordova,

located in Prince William Sound. Ms. Gilman was a three-term elected City Councilor where her passion for public service led into her career path as City Administrator. Her appointments have been in the Arctic region of Alaska. She served as City Manager in Fort Yukon, the home of Congressman Don Young, and now in Kotzebue. She is a board member of the Alaska Municipal Management Association and serves on the Ports and Harbors Committee. She studied business and is a business owner.



Rear Admiral David Hahn

RADM Hahn became Chief of Naval Research in November 2016, with concurrent flag responsibilities as Director Of Innovation, Technology Requirements and Test & Evaluation (Opnav N94). A native of Tampa, Florida, RADM Hahn graduated

from the U.S. Naval Academy with distinction in 1985, earning a Bachelor of Science in Mechanical Engineering. He holds a Master of Business Administration from George Mason University and has completed the MIT Seminar XXI program in International Security Affairs. RADM Hahn’s first flag assignment was as the senior technical advisor to the deputy chief of Naval Operations for Information Warfare/ director of Naval Intelligence (OPNAV N2/N6). He has been awarded the Defense Superior Service Medal, Legion of Merit, Defense Meritorious Service Medal, the Meritorious Service Medal, the Navy and Marine Corps Commendation Medal, the Navy and Marine Corps Achievement Medal.



Kasannaaluk Marie N. Greene

Mrs. Greene was appointed by President Obama in December 2015 to serve as Commissioner on the USARC. After a 20-year career at NANA Regional Corporation, 13 as president and CEO, Greene

contributes a wealth of cultural insight and strong senior level leadership experience to her role on the Commission. During her tenure at NANA, Mrs. Greene achieved a succession of lasting milestones, such as expanding Red Dog Mine, which is one of the world’s largest producers of zinc ore. Greene, originally from Deering, Alaska, the smallest village in NANA’s region, has also served on a number of state and regional organizations, including the Alaska Redistricting Board, the advisory committee for Wells Fargo Bank, and the board of Alaska Federation of Natives. She holds a master’s degree in rural development. Mrs. Greene retired from NANA on January 1, 2015.



Peter Harrison, PhD

Dr. Harrison is Professor Emeritus, School Policy Studies, Queen’s University, Canada. He received his PhD in geography from the University of Washington, Seattle, in 1973. His public service career lasted nearly 30 years, including

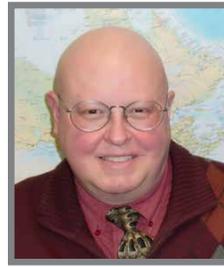
service as Deputy Minister of Natural Resources Canada, the Department of Fisheries and Oceans, the National Research Council of Canada (as Senior Research Fellow, Oceans), and Indian Residential Schools Resolution Canada. Dr. Harrison was also Assistant/Associate Deputy Minister in the Department of Finance, Indian, and Northern Affairs, Revenue Canada, and Human Resources Development Canada. He also served as Secretary to the Priorities and Planning Committee of the federal Cabinet (Privy Council Office), shepherded Canada’s ratification of the United Nations Convention on the Law of the Sea, and the investment of \$150 million in the International Polar Year (IPY). Dr. Harrison chaired the IPY Conference “From Knowledge to Action” in Montreal 2012.



Captain Benjamin Hawkins

Captain Hawkins heads the Office of Design and Engineering Standards in the Commercial Regulations and Standards Directorate at U.S. Coast Guard Headquarters. Together with a diverse, interdisciplinary engineering staff, he is responsible for

the development, promulgation, and implementation of design and construction standards for commercial vessels, offshore structures, and shipboard equipment. Working both nationally and internationally with the goal of enhancing maritime safety and environmental protection through standards development, Hawkins engages stakeholders in International Maritime Organization member states, classification societies, industry associations, and the maritime industry. Captain Hawkins has a master's degree from the University of Michigan in naval architecture and marine engineering as well as a master's degree from the Naval War College in national security and strategic studies. Previous assignments with the U.S. Coast Guard have included tours at the Marine Safety Center and Coast Guard Headquarters while his field assignments have ranged from New York to Alaska, where he served as the commanding officer of Marine Safety Unit Valdez.



David Jackson

Mr. Jackson graduated from the Canadian Coast Guard College in Sydney, Nova Scotia, in 1981 with a diploma in nautical sciences. After 10 years in the Canadian Coast Guard (CCG) Fleet, Dartmouth, Nova Scotia, and earning his Ocean

Navigator 1 (ON 1) certificate of competency, he served in the National HQ, working in the Fleet group to define the navigation equipment suite for the CCG fleet. There, Mr. Jackson was heavily involved at the International Maritime Organization, International Hydrographic Organization, and International Hydrographic Bureau in the development of Electronic Chart Display and Information Systems carriage regulations and S57 data development. After a time as CCG National Oil Spill response officer and project leader for the development of Response Organizations in Canada, he served the Marine Navigation Services group as Navigation and Strategic Advisor to the Director General before assuming the position of National Icebreaking Program Manager for the Coast Guard. Mr. Jackson managed the Icebreaking Program for 10 years before serving with Environment Canada's Meteorological Service as Director of the Canadian Ice Service in 2010.



Honorable Chris Hladick

Mr. Hladick is Commissioner, Department of Commerce, Community, and Economic Development where he oversees six divisions and seven corporate agencies. He serves on the boards of the Alaska Housing

Finance Corporation, Alaska Marine Pilots, Alaska Railroad Corporation, and Alaska Seafood Marketing Institute. Commissioner Hladick also serves on the National Marine Protected Areas Federal Advisory Committee's Arctic Working Group and on the Arctic Council's Arctic Marine Cooperation task force. Earlier, he served as City Manager of Unalaska for 14 years. During his tenure, the city built the Carl E. Moses Boat Harbor, renovated the Spit Dock, built the Coast Guard Dock and a new diesel powerhouse, laid asphalt on previously unpaved streets, and completed the construction of the elementary school. In 2011, Commissioner Hladick was appointed by the legislature to Alaska's Arctic Policy Commission and is an active member of both the Alaska Municipal League and the Southwest Alaska Municipal Conference.



Martin O. Jeffries, PhD

Dr. Jeffries is Assistant Director for Polar Sciences, and Executive Director of the Interagency Arctic Research Policy Committee (IARPC) at the White House Office of Science and Technology Policy (OSTP). He has been on detail at OSTP since

February 2016. His home agency is the Office of Naval Research (ONR), where he is an Arctic Science Advisor and Program Officer for Arctic and Global Prediction. Dr. Jeffries became a career civil servant at ONR in March 2014, when he retired from the University of Alaska Fairbanks after 28 years with the Geophysical Institute, where he investigated sea ice, freshwater ice, and iceberg and ice shelf processes in the Arctic and Antarctica. His research has been reported in many papers in peer-reviewed journals, conference proceedings, and monographs, and he has been the principal editor of the Arctic Report Card and the Arctic chapter in the NOAA State of the Climate report published annually in the *Bulletin of the American Meteorological Society*.



Major General Randy "Church" Kee

Maj. Gen. Kee, United States Air Force (Ret.), is the Executive Director of the Arctic Domain Awareness Center at the University of Alaska, a Department of Homeland Security Center of Excellence. Since January

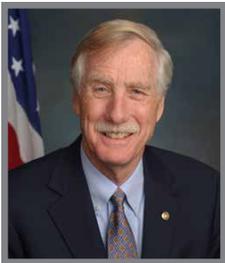
2016, General Kee has led a distributed team in a comprehensive effort of science and technology, research, and development. General Kee has commanded at the Squadron, Group, and Wing levels. He served as the Vice Commander of the U.S. Air Force (USAF) Global Air Mobility Center. General Kee's staff assignments include U.S. Transportation Command, Headquarters USAF, and the U.S. Joint Staff in both Operations and Strategic Plans and Policy Directorates. He has contributed to U.S. Arctic strategy, supported domain awareness technology development, and contributed to Defense Support on Arctic planning initiatives. He culminated his military service as the Director of Strategy, Policy, Planning, and Capabilities for the U.S. European Command in Stuttgart, Germany.



Aleksey Knizhnikov

Mr. Knizhnikov, Head of the Oil and Gas Programme at WWF-Russia, works on strategies to improve environmental performance of the extractive industry in Russia. He is a respected expert on oil and gas and shipping issues in the Russian Arctic,

and a key partner for the WWF-US Arctic Program on bilateral projects aimed at minimizing risks of industrial development in transboundary Arctic regions. Mr. Knizhnikov's work includes building coalitions of Russian nongovernmental organizations, advocating before government regulators, and working with Russian scientists. Before coming to the WWF in 2006, Mr. Knizhnikov worked for more than a decade with ISAR and EcoCenter Zapovedniks to develop public environmental monitoring programs, organize campaigns to reduce environmental impacts of oil and gas projects, and achieve dialogue with the oil and gas and mining industries. Mr. Knizhnikov has a master's degree in geography from Moscow State University.



Senator Angus King

In January 2013, Angus King was sworn in as Maine's first Independent United States Senator. A strong believer in the need for greater bipartisan dialogue and relationship building, he is a member of the Armed Services Committee,

the Select Committee on Intelligence, the Committee on Energy and Natural Resources, the Committee on the Budget, and the Committee on Rules and Administration. Armed Services Committee Chairman John McCain has called him "one of the most serious and hard-working members." During his Senate tenure, Senator King has worked to strengthen America's national security, conducted critical oversight of the nation's Intelligence Community, supported common-sense budget priorities. He also served as the 72nd Governor of Maine. King attended Dartmouth College and the University of Virginia Law School.



Igor Krupnik, PhD

Dr. Krupnik is Curator of Arctic and Northern Ethnology and Head of the Ethnology Division at the National Museum of Natural History, Smithsonian Institution in Washington, DC. His area of expertise includes modern cultures,

ecological knowledge, and cultural heritage of the people of the Arctic, and the impact of modern climate change on Arctic residents, their economies, and cultures. He has written extensively on how the diminishing sea ice in the northern Bering Sea/western Arctic affects local indigenous communities, their subsistence lifestyle, and traditional ecological knowledge. Dr. Krupnik has published and co-edited more than 20 books, collection volumes, catalogs, and community heritage sourcebooks. He has spoken at this symposium in 2007, 2009, 2013, and 2015.



Dr. Natalia Kutaeva

Dr. Kutaeva is Counsellor to the Director of the Maritime Environment Pollution Protection Division, Ministry of Transport in Moscow, Russian Federation, and head of the Russian delegation to the Advisory Group on the

Environmental Safety Aspects of Shipping meetings. In her position, Dr. Kutaeva coordinates the implementation of the national environmental legislation as well as international obligations in the marine environment protection by the maritime transport organizations, and was awarded the Black Sea medal for her contributions.



Aaron Lawton

Mr. Lawton, as Director of Operations at One Ocean Expeditions, brings 20 years of polar expedition cruise operations and logistics experience to the One Ocean Expeditions fleet. He has led expeditions and managed

vessels in the Canadian Arctic, Greenland, Svalbard, and the Antarctic over this timeframe. Mr. Lawton has been a participant and/or planner in a number of Arctic search and rescue (SAR) table-top exercises including the most recent Northwest Passage SARTTX hosted by the Canadian Coast Guard and co-lead by the U.S. Coast Guard in May 2017. He is a contributor to Transport Canada's Arctic Cruise Ship Guidelines working group, helping to develop a comprehensive set of industry standards and best practices for expedition cruise tourism in the Canadian Arctic. Mr. Lawton has supported a number of the initiatives of the Association of Arctic Expedition Cruise Operators in developing and enhancing industry best practices.



Commander Ruth Lane

CDR Lane, who serves as Commanding Officer, Naval Ice Center and Director, National Ice Center, was commissioned in 1998 from the U.S. Naval Academy after earning a B.S. degree in oceanography. She earned her surface

warfare qualification on USS *Whidbey Island* (LSD 41) and completed a tour on USS *Harry S. Truman* (CVN 75) before transferring to the meteorology and oceanography (METOC) community in 2002. CDR Lane's tours include Optimum Track Routing Division Officer, Assistant Operations Officer, and Senior Watch Officer at Naval Atlantic METOC Command; Protocol Officer and Aide to Commander Second Fleet; Oceanographer on USS *Iwo Jima* (LHD 7); Officer in Charge of Naval METOC Professional Development Detachment Atlantic; and Future Exercises Officer and Force Oceanographer to Commander Navy Expeditionary Combat Command. CDR Lane earned a Master of Science degree in physical oceanography from Old Dominion University.



Jeremy T. Mathis, PhD

Dr. Mathis is the director of NOAA's Arctic Research Program (ARP) in the Office of Ocean and Atmospheric Research. Before joining the ARP, Dr. Mathis was the director of the Ocean Environment Research Division at NOAA's Pacific

Marine Environmental Laboratory in Seattle, Washington from 2012 to 2015, and a Professor of Oceanography at the University of Alaska Fairbanks from 2008 to 2012. Dr. Mathis has an extensive background in engineering, oceanography, and climate science. His work focuses on improving understanding of climate change and ocean acidification, particularly in the Arctic. Dr. Mathis has published more than 80 peer-reviewed journal articles and serves on a number of national and international committees.



Dr. Larry Mayer

Dr. Mayer is the founding director of the Center for Coastal and Ocean Mapping at the University of New Hampshire (UNH) and the co-director of the NOAA/UNH Joint Hydrographic Center. His background is in marine geology and

geophysics, and his research interests include sonar imaging, remote characterization of the seafloor, and advanced applications of three-dimensional visualization to ocean mapping. Dr. Mayer has participated in more than 90 scientific research expeditions over the past 40 years. He has been chief or co-chief scientist of numerous expeditions, including seven cruises on USCG Icebreaker *Healy* mapping unexplored regions of the Arctic seafloor in support of a potential U.S. submission for an extended continental shelf under UNCLOS. Dr. Mayer received the Keen Medal for Marine Geology, an Honorary Doctorate from the University of Stockholm, the UNH's Excellence in Research Award, and the Distinguished Alumni Award from the University of Rhode Island's Graduate School of Oceanography.



Commander Gabrielle G. McGrath

Originally from Pittsburgh, Pennsylvania, CDR McGrath graduated with honors from the U.S. Coast Guard Academy in 1996 with a Bachelor of Science degree in marine and environmental

sciences. In 2013, CDR McGrath assumed command of the International Ice Patrol. In this role, she also serves as Co-Director of the North American Ice Service and as the Iceberg Subcommittee Chair of the International Ice Charting Working Group, a consortium of all of the world's ice services. She also served as U.S. Coast Guard Academy Assistant Commandant of Cadets in 2011 and Planning Section Chief at Incident Command Post Mobile to respond to the Deepwater Horizon oil spill in 2010. In 2006, CDR McGrath earned her Master of Science degree in physical oceanography with honors from the University of Rhode Island, Graduate School of Oceanography. After graduate school, she served as the Ice Information Officer and then Deputy Commander of the International Ice Patrol.



Molly McCammon

Ms. McCammon is the executive director of the Alaska Ocean Observing System (AOOS), the Alaska regional component of the national Integrated Ocean Observing System (IOOS) in Anchorage. She is currently trea-

surer of the IOOS Association, a Consortium for Ocean Leadership trustee, and member of the national Ocean Research Advisory Panel. She is a past member of the National Research Council's Polar Research Board, serving on its Committee on Designing an Arctic Observing Network. She also served on the initial Advisory Group for the National Academy of Science's Gulf Research Program. In Alaska, McCammon serves as the Municipality of Anchorage representative to the Cook Inlet Citizens Advisory Council and is a member of the Alaska Sea Grant Advisory Committee and Alaska Center for Climate Assessment and Policy Steering Committee. Prior to her position at AOOS, she served for 10 years as the executive director of the *Exxon Valdez* Oil Spill Trustee Council, managing the restoration program following the 1989 oil spill.



Craig N. McLean

Mr. McLean is Assistant Administrator for NOAA's Oceanic and Atmospheric Research (OAR) office. He is responsible for directing and implementing NOAA's research enterprise. Among numerous formal international engagements

in science and technology, Mr. McLean serves as the U.S. Representative to the Intergovernmental Oceanographic Commission (IOC) and the Co-chair of the U.S. European Union Marine Working Group. Mr. McLean previously served as NOAA's Acting Deputy Assistant Administrator of the National Ocean Service, was founding Director of OAR's Office of Ocean Exploration and Research, and served nearly 25 years in NOAA's Commissioned Corps, making the rank of Captain. Among his achievements and accolades, Mr. McLean led NOAA's planning for the Smithsonian Institution's Sant Ocean Hall and has won the Department of Commerce Silver and Bronze Medals, the NOAA Corps Commendation Medal, and Special Achievement Medal.



Walt Meier, PhD

Dr. Meier is now a senior research scientist at the National Snow and Ice Data Center (NSIDC), University of Colorado, Boulder. His research focuses on passive microwave remote sensing of sea ice to track long-term changes in the ice cover.

Until recently, he was research scientist in the Cryospheric Sciences Lab at the NASA Goddard Space Flight Center. Previous positions include research scientist at NSIDC, adjunct assistant professor at the U.S. Naval Academy, and visiting scientist at the U.S. National Ice Center. He has master's and PhD degrees in aerospace engineering sciences (with a focus in atmospheric and ocean sciences) from the University of Colorado, Boulder, and a bachelor's degree in aerospace engineering from the University of Michigan, Ann Arbor.



Honorable Denise Michels

Ms. Michels is employed by Kawerak Inc., a tribal nonprofit service organization for the Bering Strait region as Director of Transportation. In this position, she is responsible for overseeing the development and implementation

of strategies for intermodal transportation, infrastructure, and Arctic policy. Ms. Michels represents Kawerak Inc. on the Inuit Circumpolar Council – Alaska Board of Directors. She focuses on Arctic issues, public safety, community, and economic and infrastructure development, and promotes bringing together diverse groups. Ms. Michels served as Mayor of the City of Nome, from October 2003 to 2015. Born and raised in Nome, she was the first Alaskan Native to serve in this capacity, and the first woman elected to the post. The mayor is the chief spokesperson for the city, representing community legislative priorities to the Alaska Legislature and the U.S. Congressional delegation. Ms. Michels received her Associate of Applied Science degree from the University of Alaska Fairbanks (UAF) and is currently enrolled in Northern Studies program at UAF.



Amy Merten, PhD

Dr. Merten is the Chief of the Spatial Data Branch, NOAA's Assessment and Restoration Division, Office of Response and Restoration (OR&R) in Seattle, Washington. Dr. Merten developed the original concept for an online mapping/data visualization tool known as "ERMA" (Environmental Response Mapping Application).

She oversees the data management and visualization activities for the Deepwater Horizon natural resource damage assessment case. Dr. Merten was Chair of the Arctic Council's Emergency Prevention, Preparedness and Response (EPPR) Working Group (2015–2017). Dr. Merten received her doctorate (2005) and master's (1999) degrees in marine, estuarine, and environmental sciences with a specialization in environmental chemistry from the University of Maryland.



David Millar

David Millar is the director of Hydrographic Services for Fugro in the Americas, responsible for the company's public-sector coastal and ocean mapping business. With 28 years of marine geophysical and hydrographic survey experi-

ence, Mr. Millar has worked extensively in the Alaskan and Canadian Arctic. He holds bachelor's degrees both in math and physics and in geomatics engineering.



Dr. S. Bradley Moran

Dr. Moran is Dean of the University of Alaska Fairbanks College of Fisheries and Ocean Sciences. Prior to his appointment as Dean, he served as Acting Director of the Obama Administration's National Ocean Council, Assistant

Director for Ocean Sciences in the White House Office of Science and Technology Policy, and Program Director in the Chemical Oceanography Program at the National Science Foundation. In his previous academic position as Professor of Oceanography at the University of Rhode Island Graduate School of Oceanography, he served as Co-Director of the Rhode Island NSF Experimental Program to Stimulate Competitive Research and as Assistant Vice President for Research. Dr. Moran received a bachelor of science degree in chemistry from Concordia University and a PhD in oceanography from Dalhousie University, and he conducted his postdoctoral research at Woods Hole Oceanographic Institution.



Senator Lisa Murkowski

Senator Murkowski is the first Alaska-born Senator and only the sixth United States Senator to serve the state. As the state's senior Senator, she has been a strong advocate for important issues facing the state, including energy,

health care, education, military/veterans' affairs, and infrastructure development. She is the Chairman of the Senate Energy and Natural Resources Committee and also serves on the Senate Appropriations Committee, where she is the Chairman of the Interior and Environment Subcommittee. Senator Murkowski is a member of the Senate Health, Education, Labor, and Pensions Committee and also is a senior member of the Senate Indian Affairs Committee. She earned a B.A. in economics from Georgetown University in 1980 and a law degree from Willamette University in 1985. Prior to her appointment to the United States Senate, Senator Murkowski practiced law in Anchorage and was elected to three terms in the Alaska State House of Representatives.



Rear Admiral Stuart B. Munsch

RADM Munsch serves as Assistant Deputy Chief of Naval Operations, Operations, Plans and Strategy (N3/N5B). A native of North Dakota, he graduated from the U.S. Naval Academy in 1985 with a Bachelor

of Science in Electrical Engineering. At Annapolis, he was brigade commander of his class and an All-American and national champion pistol shooter. Selected for a Rhodes Scholarship, he attended Oxford University and earned a Bachelor of Arts and a Master of Arts in Philosophy, Politics, and Economics. He then was assigned to four consecutive sea duty assignments, serving on USS *Will Rogers* (SSBN 659), USS *Jefferson City* (SSN 759), USS *Kitty Hawk* (CV 63) on the staff of Commander, Cruiser Destroyer Group 5, and USS *Tucson* (SSN 770). In 1999, RADM Munsch reported ashore to U.S. Pacific Command, where he served in the Plans and Policy Directorate (J5) prior to becoming deputy executive assistant to the commander.



S.V. Nghiem, PhD

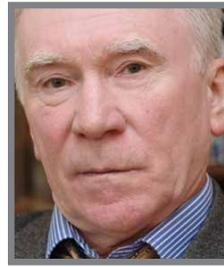
Dr. Nghiem received his PhD from the Massachusetts Institute of Technology. In 1991, he joined the Jet Propulsion Laboratory (JPL), California Institute of Technology (CalTech), where he is currently a Senior Research Scientist, the

Science and Applications Development Lead of the Radar Science and Engineering Section, and the JPL Hydrology Discipline Program Manager of the Hydrology Office in the Earth Science and Technology Directorate. His research encompasses active and passive remote sensing, development of advanced satellite radars and radiometers, electromagnetic scattering and emission modeling, and Earth sciences and applications from the tropics to polar regions. He has published over 100 peer-reviewed articles and over 360 conference articles. Dr. Nghiem has been recognized with the 1999 Lew Allen Award for Excellence, 2006 NASA Exceptional Achievement Medal, 2008 NASA Exceptional Scientific Achievement Medal, 2010 NASA Exceptional Technology Achievement Medal, 2013 Edward Stones Award, and the 2017 Magellan Award.



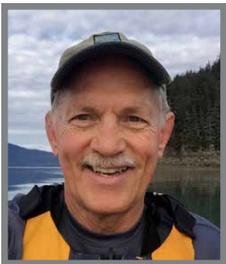
Rear Admiral Niels Olsen

RADM Olsen is Defense, Military, Naval, and Air Attaché to the United States and Canada. RADM Olsen joined the Royal Danish Navy in 1977. He is a Surface Warfare Officer and has served on numerous surface ships of the Fleet, having commanded three. Shore appointments include Head of Department in the Ministry of Defense, DCOS Plans & Policy in Admiral Danish Fleet HQ, Deputy Military Representative to NATO Brussels, Chief of Staff Admiral Danish Fleet, and Vice Chief of Naval Staff.



Vladimir Pavlenko, PhD

Professor Vladimir Pavlenko holds a PhD in economics. He is a member of the Presidium of the Russian Academy of Sciences' Urals Division, Chairman of the Board of the Russian Academy of Sciences' Urals Division Arkhangelsk Scientific Center (2012–2016), Director of the Federal Scientific Center for Integrated Arctic Research (2016–2017), Deputy Chairman of the USSR (Russian) Academy of Sciences' Scientific Council for the Study of the Arctic and Antarctic, member of the European Polar Board, vice president of the International Arctic Science Committee, member of the advisory board on the Arctic at the Federal Council of the Federal Assembly of the Russian Federation, member of the editorial board and editorial staff of the Russian Academy of Sciences' journal *Arktika: Ekologiya i Ekonomika*, member of the expert council at the Arkhangelsk Region governor's office, and professor at the Real Estate Management and Territorial Development Department, Moscow State University of Geodesy and Cartography.



Captain Ed Page

Captain Page, U.S. Coast Guard (Ret.), established the nonprofit Marine Exchange of Alaska in 2001 after serving 29 years as a commissioned officer. There he developed a Vessel Compliance Monitoring and Response System for Alaska to enhance maritime safety and environmental protection that encompasses over 1.5 million square miles of Alaska waters. A 1972 graduate of the U.S. Coast Guard Academy, Captain Page sailed on Coast Guard vessels on Atlantic, Pacific and Alaska waters followed by assignments in marine safety, environmental protection and search and rescue. Later in his Coast Guard career he held positions as Chief of Environmental Protection during the *Exxon Valdez* oil spill response, as Captain of the Port for Los Angeles-Long Beach and Chief of Marine Safety and Environmental Protection for Coast Guard Pacific Area.



Drue Pearce

Ms. Pearce joined Holland & Hart in 2017 as Director of Government Affairs. Ms. Pearce served in the Alaska State Legislature for 17 years, presiding as Senate President for two terms. She left the legislature to serve as Senior Advisor to Secretaries Gale Norton and Dirk Kempthorne at the Department of the Interior. In 2006, she was nominated by President George W. Bush and confirmed by Congress as the first Federal Coordinator in the Office of the Federal Coordinator for Alaska Natural Gas Transportation Projects. Ms. Pearce joined Crowell & Moring LLP as a Senior Policy Advisor when she left federal service in 2010. She serves on the Board of the Marine Exchange Alaska and is the immediate past Chair of the Institute of the North. Ms. Pearce is an Associate Fellow of the Nautical Institute. She was Manager of the Bank of the North's Kotzebue, Alaska, Branch in the early 1980s and has provided contractual services to a variety of Arctic-based private sector business and local governments since 1986. Ms. Pearce is a graduate of Indiana University, the Kennedy School of Government at Harvard University, and The Executive Program at the University of Virginia Darden School of Business.



Elizabeth E. Pierce

Ms. Pierce serves as Chief Executive Officer of Quintillion Networks LLC, and as Vice President of Human Resources and Facilities Services for Alaska Communications Systems Holdings Inc. Ms. Pierce is responsible for overseeing all aspects of

human resources management, including labor relations, organizational development, compensation and benefits management, safety, and risk management. She also oversees all aspects of property management and associated maintenance programs. Ms. Pierce has over 19 years of relevant experience. Ms. Pierce is a graduate of the Program in Advanced Human Resources Management from the University of Toronto. She holds a Senior Professional in Human Resources Certification from the Society for Human Resources Management. Ms. Pierce is an electronics technologist and holds a Journeyman Certification in power generating systems.



Carven Scott

Mr. Scott is the director of the National Weather Service's Alaska Region in Anchorage. The Alaska Region provides weather, water, aviation, and climate services to the nation's largest and most geographically complex area, and includes

three weather forecast offices, the National Tsunami Warning Center, the Alaska Pacific River Forecast Center, the Alaska Aviation Weather Unit, the Center Weather Service Unit, and 12 weather service offices. He also served as Chief of the Environmental and Scientific Services Division at the regional headquarters from 2007 through 2015, successfully recasting and developing the division and enabling Alaska Region to meet current, emerging, and evolving mission requirements. He led the NOAA-Environment and Climate Change Canada Bi-lateral Marine Services Project for more than three years, and served as the chair of the NWS Operational Advisory Team. He earned a bachelor's degree in meteorology and a master's degree in meteorology from Texas A&M University.



David Raboy

Mr. Raboy currently serves as the Budget and Execution Manager for the U.S. Coast Guard's Heavy Polar Icebreaker acquisition program, responsible for the long-term budgeting and near-term execution of acquisition program activities.

In that role, he tracks program funding needs and leads a team that ensures timely delivery of required goods and services. Mr. Raboy has been with the Heavy Polar Icebreaker acquisition program for two and a half years, and in other roles within the Coast Guard's Acquisition Directorate for a total of five years. Through an integrated program office, the Coast Guard is collaborating with the U.S. Navy to acquire three heavy polar icebreakers to support Coast Guard missions in the polar regions.



Simon Stephenson

Mr. Stephenson serves as Head, Arctic Science Section, National Science Foundation. The section funds a broad portfolio of social and natural sciences focused on understanding the Arctic and its role in the Earth system. The section

also supports a logistics program that enables researchers to work throughout the Arctic, including the Arctic Ocean. During his tenure, several initiatives have been started. One is to create an international Arctic Observing Network and another is to provide a robust cyberinfrastructure to serve the Arctic research community. In 2014, Mr. Stephenson was detailed to the Office of Science and Technology Policy to serve as Assistant Director, Polar Sciences. Among his accomplishments there was establishing the new Deputy Secretary-level Arctic Executive Steering Committee chaired by the President's Science Advisor. Mr. Stephenson came to NSF from NASA and the British Antarctic Survey, where his research focused on understanding the mass balance and dynamical behavior the of West Antarctica's large ice streams.



Senator Dan Sullivan

Senator Sullivan became Alaska's eighth U.S. Senator in January 2015. He serves on four Senate committees vital to Alaska: the Commerce, Science, and Transportation Committee; the Armed Services Committee; the Environment

and Public Works Committee; and the Veterans' Affairs Committee. Earlier he served as Alaska's Attorney General where his number one priority was protecting Alaskans, their physical safety, financial well-being, and individual rights. As Commissioner of the Alaska Department of Natural Resources, Mr. Sullivan managed one of the largest portfolios of oil, gas, minerals, renewable energy, timber, land, and water in the world. Senator Sullivan has a distinguished record of military and national security service. He is currently an infantry officer and Lieutenant Colonel in the U.S. Marine Corps Reserves. He earned a bachelor's degree in economics from Harvard University in 1987 and a joint law and Master of Science in Foreign Service from Georgetown University in 1993.



Fran Ulmer

Ms. Ulmer is chair of the U.S. Arctic Research Commission, where she has served since being appointed by President Obama in March 2011. In June 2010, President Obama appointed her to the National Commission on the BP Deepwater

Horizon Oil Spill and Offshore Drilling. From 2007 to 2011, Ms. Ulmer was chancellor of Alaska's largest public university, the University of Alaska Anchorage (UAA). Before that, she was a Distinguished Visiting Professor of Public Policy and Director of the Institute of Social and Economic Research at UAA. She is a member of the Global Board of the Nature Conservancy and on the Board of the National Parks Conservation Association. Ms. Ulmer served as an elected official for 18 years as the mayor of Juneau, a state representative, and as Lieutenant Governor of Alaska. She previously worked as legal counsel to the Alaska Legislature, legislative assistant to Governor Jay Hammond, and Director of Policy Development for the state.



Commander Kelly Taylor

CDR Taylor currently serves as Deputy Director for the U.S. Navy's Task Force Climate Change. A native of Erie, Pennsylvania, she graduated from the U.S. Naval Academy in 1997 with a bachelor's degree in oceanography. In 1998, CDR Taylor

reported to USS *Ashland* (LSD 48), where she served as Machinery Division Officer and Combat Information Center Officer. Following her lateral transfer to the oceanography community, she reported to the Naval Postgraduate School in June 2000, where she earned a master's degree in physical oceanography and atmospheric science. Some of her other assignments include: Operations Officer at the National/Naval Ice Center; Staff Meteorology and Oceanography Officer at Naval Special Warfare Group One; Strike Group Oceanography Team Department Head and Operations office, Fleet Weather Center, San Diego. CDR Taylor's has been awarded the Meritorious Service Medal, Navy Commendation Medal with three gold stars, and the Navy and Marine Corps Achievement Medal with two gold stars.



John Walsh, PhD

Dr. John Walsh is Chief Scientist of the International Research Center and President's Professor of Global Change at the University of Alaska Fairbanks. He is also the Co-Director of the Alaska Center for Climate Assessment and Policy.

Dr. Walsh began his work on Arctic sea ice with the Naval Oceanographic Office in 1969. His more recent research has addressed Arctic climate and weather variability, with an emphasis on the drivers of cryospheric variations over seasonal to multidecadal time scales. Dr. Walsh was a lead author for the 2014 U.S. National Climate Assessment and for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Prior to moving to Alaska in 2003, he spent 30 years on the faculty of the Department of Atmospheric Sciences at the University of Illinois. He has co-authored a textbook, *Severe and Hazardous Weather*.



Rear Admiral Richard D. West

RADM Richard “Dick” D. West (USN, Ret.) served as President and CEO of the Consortium for Oceanographic Research and Education from 2002 to 2008. He was a founding member of the Hydrographic Services Review Panel, a member of a federal

investment in research review team, and past Chairman of the National Sea Grant College Program Advisory Board. He serves on the University of Rhode Island Graduate School of Oceanography Dean’s Advisory Council, and on the University of Connecticut Sea Grant Program. RADM West retired from the U.S. Navy in 2002. As the first Navigator of the Navy, he led the Navy’s transition to electronic navigation. As Oceanographer of the Navy, he was the DOD representative to the U.S. Ocean Commission. RADM West was a career Surface Warfare Officer serving on several ships and senior staffs. He served in Vietnam with the riverine forces and was Commanding Officer of three ships, two during hostilities in the Persian Gulf.



Admiral Paul Zukunft

ADM Zukunft assumed the duties of the 25th Commandant of the U.S. Coast Guard on May 30, 2014. He leads America’s oldest continuous seagoing service and the largest component of the Department of Homeland Security. ADM Zukunft

also served as Commander, Coast Guard Pacific Area, where he was operational commander for all U.S. Coast Guard missions. Other Flag assignments include Commander of the Eleventh Coast Guard District and Director, Joint Interagency Task Force West, where he served as executive agent to United States Pacific Command. In 2010, he served as the Federal On-Scene Coordinator for the Deepwater Horizon Spill. ADM Zukunft graduated from the U.S. Coast Guard Academy in 1977 with a Bachelor of Science degree in government; from Webster University in 1988 with a Master of Arts degree in management; and from the U.S. Naval War College in 1997 with a Master of Arts degree in national security and strategic studies.



Congressman Don Young

Representative Young has served as Alaska’s lone Representative to the U.S. House since 1973. He makes his home in Fort Yukon, Alaska, a small village located seven miles above the Arctic Circle. Before beginning his career in politics, he made a

living as a teacher, gold miner, trapper, and licensed tug-boat and barge operator on the Yukon River. He remains the only licensed mariner in Congress. Congressman Young is a passionate advocate for Arctic issues and priorities, with a particular focus on resource development, maritime transportation, and international collaboration. He is the co-founder and co-chair of the Congressional Arctic Working Group, a bipartisan group launched in 2014 to help Members of Congress better understand the opportunities and challenges in the Arctic region. Congressman Young has served as both the Chairman of the House Natural Resources Committee (1995-2001) and Chairman of the House Transportation and Infrastructure (T&I) Committee (2001–2007).



