



# *Witness The* **ARCTIC**

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# Study of Environmental Arctic Change (SEARCH) Update

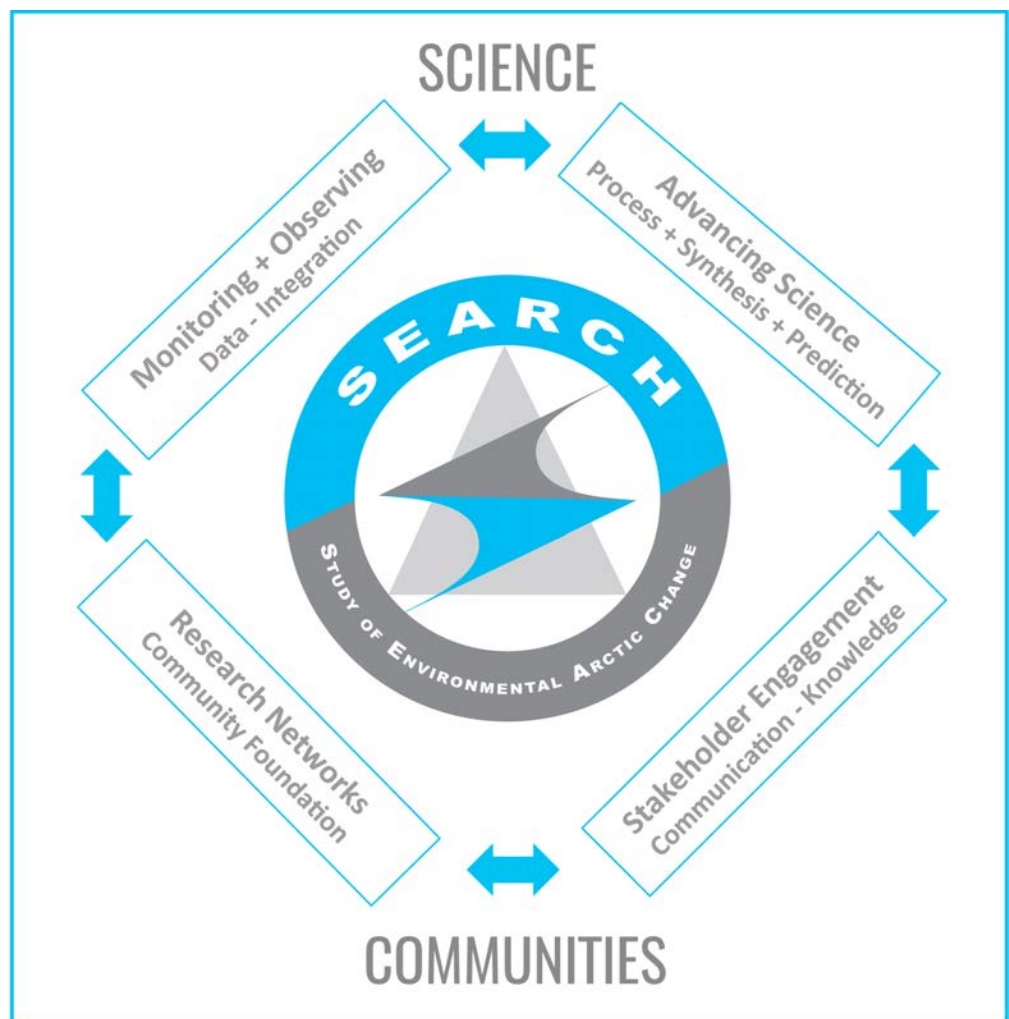
*This update on the Study of Environmental Arctic Change (SEARCH) program includes recent news highlights from each of SEARCH's three Action Teams as well as reports from the Sea Ice Prediction Network and the Arctic Observing Open Science meeting.*

## SEARCH Action Team Highlights

During the [SEARCH annual planning meeting](https://www.arcus.org/search-program/meetings/2015/ssc-november) (<https://www.arcus.org/search-program/meetings/2015/ssc-november>) that convened 19-20 November 2015 following the Arctic Observing Science Meeting, a shared knowledge-to-action framework was developed to encourage greater coordination and integration across each of SEARCH's three action teams (See Figure 1).

The framework emphasizes meaningful exchanges across

disciplines and significant interactions between researchers and stakeholders, and encourages the



*Figure 1. The shared knowledge-to-action framework encourages coordination and integration across the SEARCH action teams. Image courtesy of ARCUS.*

cultivation of new scientific knowledge, understanding, and critical observational capabilities.

Using the framework as a guide, Action Team leaders are now sharing what they have learned after their first year of activities with one another. Together, they are identifying new opportunities to increase each Action Team's overall capacity to address [SEARCH's five-year science goals](https://www.arcus.org/search-program/goals) (<https://www.arcus.org/search-program/goals>) and to provide a stronger foundation for Arctic change science and research.

## The Permafrost Action Team: Document and Understand How Degradation of Near-Surface Permafrost Will Affect Arctic and Global Systems

In its first year, SEARCH's Permafrost Action Team has experienced great success in the areas of research community network building and synthesis science production. This is due, in part, to the fact that the Permafrost Carbon Network ([PCN](http://www.permafrostcarbon.org/)) (<http://www.permafrostcarbon.org/>) was already quite mature when it was absorbed as a project of the SEARCH Permafrost Action Team. Now in its 5th year, the PCN was able to attract over 120 members of the permafrost research community to its annual meeting this December to help explore and advance 11 new synthesis science projects.

A comprehensive report on the Permafrost Carbon Network's activities over the past five years is now available for [download](https://www.arcus.org/files/page/documents/19262/pcn_5_year_synthesis_report.pdf) ([https://www.arcus.org/files/page/documents/19262/pcn\\_5\\_year\\_synthesis\\_report.pdf](https://www.arcus.org/files/page/documents/19262/pcn_5_year_synthesis_report.pdf)). SEARCH's Action Team leaders are looking to the lessons learned by the PCN over this timeframe as they work to expand their own research networks and stimulate new Arctic change science and knowledge production.

## The Sea Ice Action Team: Improve Understanding, Advance Prediction, and Explore Consequences of Changing Arctic Sea Ice

In its first year, the Sea Ice Action Team has led SEARCH's efforts to develop a strategy for sharing scientific knowledge and expertise across the many boundaries that typically constrain scientific disciplines. A good example of this leadership in action was the [Climate Change Communication Workshop](https://www.arcus.org/search-program/sea-ice/activities) (<https://www.arcus.org/search-program/sea-ice/activities>) that the Sea Ice Action Team hosted at the [Fall AGU meeting](https://www.arcus.org/search-program/meetings/2015/agu) (<https://www.arcus.org/search-program/meetings/2015/agu>).

In the year to come, SEARCH's Action Team leads will further leverage the Sea Ice Action Team

strategy to promote new knowledge production and to support scientific collaboration across disciplines. Using a "knowledge pyramid" approach to identify target audiences and content (See Figure 2), the Sea Ice Action Team is working with the research community to compile existing literature and data on important sea ice topics and to synthesize these materials for wider use and consumption. In this way, the Sea Ice Team also hopes to spotlight information gaps requiring additional research.

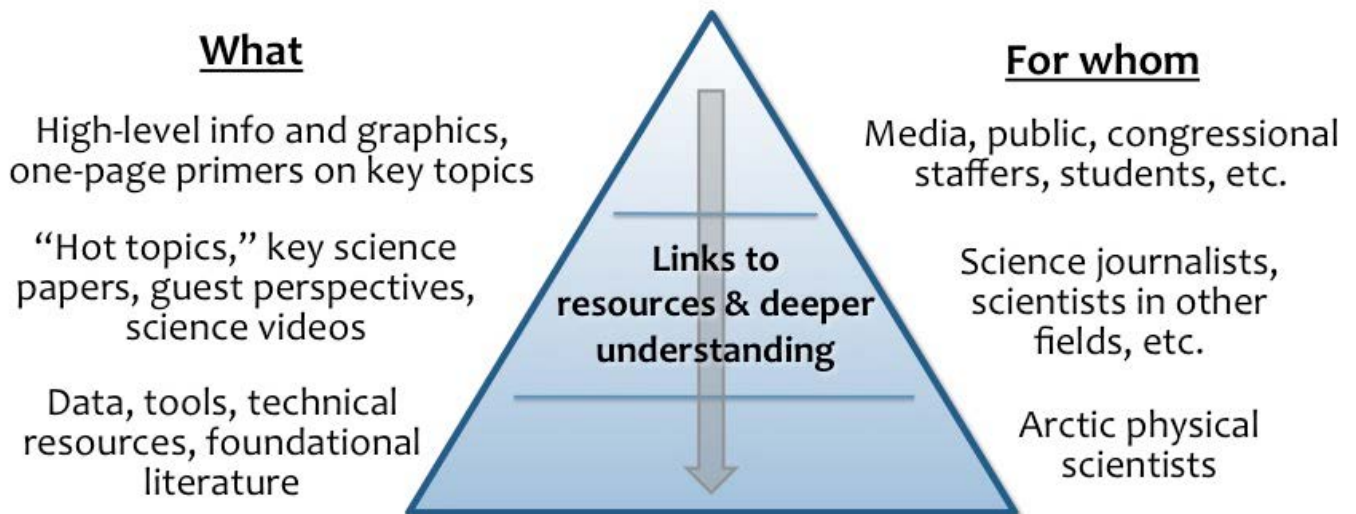


Figure 2. Knowledge pyramid showing tiered science products for communicating across disciplines and with wide audiences. Image courtesy of the SEARCH Sea Ice Action Team.

## The Land Ice Action Team: Improve Predictions of Future Land Ice Loss and Impacts on Sea Level

In the past year, the work of the Land Ice Action Team has advanced SEARCH's efforts to prioritize key Arctic observing needs through the facilitation of a coordinated Greenland Ice Sheet/Ocean Observing System ([GrIOOS](http://web.who.edu/griso/)) (<http://web.who.edu/griso/>) with the international research community.

A GrIOOS development workshop was held 12-13 December 2015 in San Francisco, California. The purpose of the workshop, led by SEARCH Action Team Lead Fiamma Straneo of Woods Hole Oceanographic Institution, was to identify a design and implementation plan for establishing a long-term observatory focused on ice sheet/ocean interactions in Greenland, including the impact of ice sheet changes on the marine environment. The workshop attracted over 50 scientists from 10 countries, covering a wide range of disciplines, and included a large number of early career scientists. Discussion topics included establishing the minimum observations to be collected, existing monitoring networks around Greenland, and identifying a list of prioritized sites. By the conclusion

of the two-day workshop, the group was able to shorten the list of locations to five key areas with a representative set of measurements that varied slightly depending upon site characteristics. The GrIOOS Workshop was productive, cross-disciplinary, and a great step toward setting the Land Ice Action Team in motion.

## Sea Ice Prediction Network: A Contribution to SEARCH

The Sea Ice Prediction Network (SIPN) published the [2015 Sea Ice Outlook post-season report](https://www.arcus.org/sipn/sea-ice-outlook/2015/post-season) (<https://www.arcus.org/sipn/sea-ice-outlook/2015/post-season>) in December 2015. Developed by the 2015 Sea Ice Outlook Action Team, the SIPN Leadership team, and with input from community members, it includes a review of the Arctic summer conditions, a pan-Arctic overview, a summary of local-scale analysis, discussion of the modeling and statistical contributions, and a summary of lessons learned from the 2015 Sea Ice Outlook as well as recommendations for the 2016 Sea Ice Outlook.

SIPN also held an open workshop to discuss data needs for sea ice forecasting on 17 December during the 2015 American Geophysical Union (AGU) fall meetings. This workshop focused on how SIPN and others who provide data observations can best serve the needs of the forecasting community. The goals of the workshop were to help identify data needs for model initialization and verification, which available data products are useful and why, what improvements to existing data products would make for better utilizations (e.g., change in formatting), what additional observations are needed, and how limited spatial scale data (e.g., from ship observations) are being used. Presentations from the workshop are available [here](https://www.arcus.org/sipn/meetings/workshops/december-2015) (<https://www.arcus.org/sipn/meetings/workshops/december-2015>).

Plans for upcoming events include the [2016 Sea Ice Prediction Workshop](https://www.arcus.org/sipn/meetings/workshops/may-2016) (<https://www.arcus.org/sipn/meetings/workshops/may-2016>), which will convene 4-6 May at Lamont-Doherty Earth Observatory in New York. This workshop will focus on sources of polar predictability on the sub-seasonal to inter-annual timescales, sea ice prediction, and operational and research efforts. The meeting will include a series of invited talks as well as contributed presentations and poster sessions. Outcomes of the meeting will include recommendations for the [Sea Ice Outlook](https://www.arcus.org/sipn/sea-ice-outlook) (<https://www.arcus.org/sipn/sea-ice-outlook>) and other activities related to polar prediction.

The 2016 SIPN Webinar series will begin on Tuesday, 22 March with a presentation entitled "Challenges and Best Practices: Sea Ice Thickness Distribution as a Rosetta Stone for Cross-Scale

Communication" by Cathleen Geiger, Sea Ice Geophysicist at the University of Delaware. Registration will be announced via [ArcticInfo](https://www.arcus.org/arctic-info) (<https://www.arcus.org/arctic-info>) and the [SIPN Mailing List](https://www.arcus.org/sipn/mailling-list) (<https://www.arcus.org/sipn/mailling-list>).

## The 2015 Arctic Observing Open Science Meeting (AOOSM)

The Arctic Observing Open Science Meeting ([AOOSM](https://www.arcus.org/search-program/meetings/2015/aosm)) (<https://www.arcus.org/search-program/meetings/2015/aosm>) was held in Seattle, Washington during 17-19 November 2015. More than 200 people attended the meeting. The meeting provided an opportunity for the Arctic science community to present and discuss findings and advances in Arctic observing research. The meeting was organized by the Arctic Research Consortium of the United States (ARCUS) and a 13-member Organizing Committee, and was supported by NSF's Arctic Observing Network program along with other contributors.



*Craig Lee University of Washington, Applied Physics Laboratory and Co-chair of Arctic Open Observing Summit Meeting Organizing Committee offers welcoming remarks. Photo courtesy of ARCUS*

The primary goals of AOOSM were to: 1) present and discuss scientific findings and advances resulting from Arctic observing projects; 2) discuss operational and technological achievements of observing science projects and efforts funded through U.S. local, state, and federal agencies, and private and non-profit organizations; 3) explore how well new observational achievements meet major science goals; 4) identify opportunities for collaboration to develop high impact scientific synthesis products and papers; and 5) strengthen the goals, identity, and activities of an integrated Arctic Observing System. The Organizing Committee addressed these goals with a diverse, effective [agenda](https://www.arcus.org/search-program/meetings/2015/aosm/agenda) of plenary presentations, parallel sessions with extended discussion, a poster session, and an agency panel discussion. In total, there were 99 presentations in the parallel sessions and 42 posters.

The agency panel discussion addressed the overarching goal of achieving an interagency Arctic observing system. Eight agency representatives provided brief presentations addressing the unique objectives of their respective organizations, descriptions of current and ongoing observations, and how they envision their agency's role in an interagency Arctic observing network.

Parallel sessions were held during all three days of the meeting, covering 11 different topics. A unique feature of each session was an open discussion period of 45–60 minutes following the presentations, chaired by an organizing committee member.

Post-meeting survey results were overwhelmingly positive and most participants indicated that more regular Arctic observing meetings would be beneficial. Abstracts and presentations from plenary, agency, and parallel session speakers have been made publicly available on the ARCUS [meeting webpage](https://www.arcus.org/search-program/meetings/2015/aosm). Further meeting products including session summaries, a meeting report and possible peer-review publications are also in progress. Any questions or comments regarding AOOSM can be directed to Judy Fahnestock ([judy@arcus.org](mailto:judy@arcus.org)).

AOOSM agenda, organizing committee, and presentations are available [here](https://www.arcus.org/search-program/meetings/2015/aosm/agenda).

# Arctic Horizons —Developing Goals for Arctic Social Sciences in the 21st Century

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[Arctic Horizons](http://arctichorizons.org/) (<http://arctichorizons.org/>) is a new effort funded by the National Science Foundation (NSF) Arctic Social Sciences Program (ASSP) designed to bring together Arctic social science, natural science, engineering, humanities, and indigenous scholars to reassess the goals, potentials, and needs of these diverse communities within the context of a rapidly changing circumpolar North. An Advisory Board and Scientific Steering Committee guide the work.



*Nenets women and children herd reindeer into a temporary corral. These nomadic, pastoral herders have been in western Siberia, Russian, for over a thousand years, but changes such as industrial development, climate change and socio-economic upheaval may threaten their lifestyle. Photo courtesy of Bruce C. Forbes, Arctic Centre, University of Lapland.*

Arctic Horizons has planned a series of five workshops in 2016 that engage a diverse group of approximately 150 western and indigenous scholars to discuss the state-of-the-art in Arctic Social



Sciences. Each workshop is structured around a set of core questions, which will be circulated to attendees in advance. The full schedule of workshops and information on joining is available [here](http://arctichorizons.org/workshops) (<http://arctichorizons.org/workshops>). In addition, the Arctic Horizons Steering Committee will hold town hall meetings at 2016 Arctic Science Summit Week ([ASSW2016](https://assw2016.org/)) (<https://assw2016.org/>), the [Alaskan Anthropological Association 2016 Conference](https://www.alaskaanthropology.org/annual-meeting) (<https://www.alaskaanthropology.org/annual-meeting>), and the [Association of American Geographers 2016 Conference](http://www.aag.org/cs/annualmeeting) (<http://www.aag.org/cs/annualmeeting>) to broaden input from the scientific community.

The first workshop, entitled "Arctic Social Sciences in the 21st Century: Integrating Past, Present, and Future Human Ecodynamics in Arctic Social Science Research," took place in Portland, Oregon on 7-9 February 2016. An agenda and participant list are available online [here](http://arctichorizons.org/workshops) (<http://arctichorizons.org/workshops>), while video, presentation files, and other workshop materials will be made available in the near future.

This series of workshops will culminate in a final synthesis workshop. A primary product will be a document based on the input from workshop participants and online comments and conversations. Additional input from indigenous communities will be solicited throughout 2016 by individual researchers and scholars. It is anticipated that the Arctic Horizon's synthesis will reflect the changing Arctic, advancing social science, and indigenous community needs and help to set intellectual and funding priorities for Arctic social science research in the future.

Public participation by the broader Arctic social sciences community will be solicited through an interactive web platform. The Arctic Horizons [blog](http://arctichorizons.org/blogs) (<http://arctichorizons.org/blogs>) invites comments on overarching discussion questions and on Arctic social science and interdisciplinary research in general. These public comments will be included in the final project report.

For more information, please contact Anna Kerttula ([akerttul@nsf.gov](mailto:akerttul@nsf.gov)).

## 2016-2017 PolarTREC Expeditions

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*By: Jen Danielson and Angela Larson, PolarTREC Program Evaluators, Goldstream Group Inc. and Janet Warburton and Sarah Bartholow, ARCUS*

*PolarTREC* (<https://www.polartrec.com/>) (Teachers and Researchers Exploring and Collaborating), a professional development program that brings K-12 teachers from around the United States together with polar researchers through an innovative teacher

research experience, is one of [ARCUS'](https://www.arcus.org/) (<https://www.arcus.org/>) signature programs. In the last 11 years, ARCUS has placed over 150 teachers with scientists in the Arctic and Antarctic to increase their knowledge about polar science and become better teachers. Working within the research teams, the teachers serve as research technicians, laborers, educators, or observers. They also act as public outreach officers, making contact with the public through web-based presentations, journals, and photos of their experiences. Once home, participants integrate their experiences into classroom instruction and continue public outreach, making the experience a part of their ongoing professional career development. In 2016-2017, 15 teachers will be heading out to the polar regions for their teacher research experiences. More information about their experiences can be found on the [Virtual Base Camp](https://www.polartrec.com/expeditions) (<https://www.polartrec.com/expeditions>).





The 2016-17 PolarTREC teachers gathered in Fairbanks for the week-long program training in preparation for deployment on scientific expeditions to the Arctic and Antarctica. Photo courtesy of Joed Polly.

As part of this program, an external evaluation was conducted by [Goldstream Group Inc.](http://www.goldstreamgroup.com/) (<http://www.goldstreamgroup.com/>) In a recent report to the National Science Foundation, evaluation data shows that PolarTREC teachers and their students increase interest and knowledge about polar science. Researchers who host a teacher benefit as well, both from having a team outreach expert and from a new appreciation of K-12 education. Perhaps the most impressive success of the program is the longevity of its impact. Five, six, and even seven years after the experience, participating teachers report using their PolarTREC experience in current lessons. Designated as "potentially transformative" by NSF, PolarTREC is proving to be an effective model for teacher professional development with the potential to transform the nature of science, technology, engineering, and math (STEM) education.

*"Before my PolarTREC experience I inspired my students to like science by doing fun activities in class and teaching them interesting facts. The problem was that I was teaching them to like science, but I was not inspiring them to be future scientists. Since my PolarTREC experience I have inspired my students by getting them to think like scientists by teaching them to ask questions and be users and collectors of data. My students now not only think of me as being a scientist but they also think of themselves as being scientists."*

*—Feedback from a PolarTREC teacher provided during the anonymous project evaluation process.*

## NOAA's 2015 Arctic Report Card

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*On a clear summer day, a series of interlocking melt pools show as beautiful aquamarine reminiscent of shallow tropical lagoons. Photo courtesy of Dr. Pablo Clemente-Colon, Chief Scientist National Ice Center.*

The National Oceanic and Atmospheric Administration (NOAA) (<http://www.noaa.gov/>) released the [2015 Arctic Report Card](http://www.arctic.noaa.gov/reportcard/index.html)

(<http://www.arctic.noaa.gov/reportcard/index.html>) on 15 December 2015 during a press conference associated with the Fall Meetings of the American Geophysical Union in San Francisco, California. The report was presented by Report Card co-Editors, Martin Jeffries (Office of Naval Research)

(<http://www.onr.navy.mil/>) and Jackie Richter-Menge (U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory) (<http://www.erdc.usace.army.mil/Locations/CRREL.aspx>), along with contributor Kit Kovacs (Norsk Polarinstitutt/Norwegian Polar Institute) (<http://www.npolar.no/en>) and NOAA Chief Scientist Rick Spinrad.

This year's report card is comprised of 12 contributions from 72 scientists in 11 different countries. The 2015 report follows the same format as the previous year, with three sections: *Vital Signs*, *Indicators*, and *Frostbites*. The *Vital Signs* section is for annual updates on air temperature, terrestrial snow cover; the Greenland ice sheet, sea ice, sea surface temperature, ocean primary productivity, and tundra greenness. The *Indicators* section is for recurring topics not included every year. The *Frostbites* section reports on new and newsworthy items, describing emerging issues, and addressing topics that relate to long-term scientific observations in the Arctic.

# Highlights from the 2015 Report Card

- Maximum sea ice extent on 25 February was 15 days earlier than average and the lowest value on record (1979-present). Minimum ice extent in September was the 4th lowest on record. Sea ice continues to be younger and thinner: in February and March 2015 there was twice as much first-year ice as there was 30 years ago.
- Changes in sea ice alone are having profound effects on the marine ecosystem (including fishes, walrus, primary production) and sea surface temperatures.
- **Air temperatures** ([http://www.arctic.noaa.gov/reportcard/air\\_temperature.html](http://www.arctic.noaa.gov/reportcard/air_temperature.html)) in all seasons between October 2014 and September 2015 exceeded 3°C above average over broad areas of the Arctic, while the annual average air temperature (+1.3°C) over land was the highest since 1900.
- The second lowest **June snow cover extent** ([http://www.arctic.noaa.gov/reportcard/snow\\_cover.html](http://www.arctic.noaa.gov/reportcard/snow_cover.html)) on land continued a decrease that dates back to 1979, while **river discharge** ([http://www.arctic.noaa.gov/reportcard/river\\_discharge.html](http://www.arctic.noaa.gov/reportcard/river_discharge.html)) from the great rivers of Eurasia and North America has increased during that time.
- Melting occurred over more than 50% of the **Greenland Ice Sheet** ([http://www.arctic.noaa.gov/reportcard/greenland\\_ice\\_sheet.html](http://www.arctic.noaa.gov/reportcard/greenland_ice_sheet.html)) for the first time since the exceptional melting of 2012, and glaciers terminating in the ocean showed an increase in ice velocity and decrease in area.
- **Walrus** (<http://www.arctic.noaa.gov/reportcard/walrus.html>) are negatively affected by loss of sea ice habitat but positively affected by reduced hunting pressure, while sea ice loss and rising temperatures in the Barents Sea are causing **a poleward shift in fish communities** ([http://www.arctic.noaa.gov/reportcard/boreal\\_fish.html](http://www.arctic.noaa.gov/reportcard/boreal_fish.html)).



*A male walrus seen from aboard the USCGC Healy icebreaker on the Chukchi Sea. Photo by Tim Sullivan, Courtesy of Andrea Skloss (PolarTREC 2013), ARCUS.*

- Widespread positive [sea surface temperature](http://www.arctic.noaa.gov/reportcard/sea_surface_temperature.html) ([http://www.arctic.noaa.gov/reportcard/sea\\_surface\\_temperature.html](http://www.arctic.noaa.gov/reportcard/sea_surface_temperature.html)) and [primary production](http://www.arctic.noaa.gov/reportcard/ocean_primary_productivity.html) ([http://www.arctic.noaa.gov/reportcard/ocean\\_primary\\_productivity.html](http://www.arctic.noaa.gov/reportcard/ocean_primary_productivity.html)) anomalies occurred throughout the Arctic Ocean and adjacent seas corresponding to sea ice retreat in summer 2015.
- [Terrestrial vegetation](http://www.arctic.noaa.gov/reportcard/tundra_greenness.html) ([http://www.arctic.noaa.gov/reportcard/tundra\\_greenness.html](http://www.arctic.noaa.gov/reportcard/tundra_greenness.html)) productivity and above-ground biomass have been decreasing since 2011.

**The Report Card editorial team is:**

Martin Jeffries, Office of Naval Research, Arlington, Virginia;  
James Overland, NOAA Pacific Marine Environmental Laboratory, Seattle, Washington; and  
Jackie Richter-Menge, U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Financial support for the Arctic Report Card is provided by the [Arctic Research Program in the NOAA Climate Program Office](http://cpo.noaa.gov/ClimatePrograms/ClimateObservation/ArcticResearch.aspx) (<http://cpo.noaa.gov/ClimatePrograms/ClimateObservation/ArcticResearch.aspx>), and in-kind support is provided by the [Office of Naval Research](http://www.onr.navy.mil/) (<http://www.onr.navy.mil/>). An independent peer-review of the 2015 Report Card was organized by the Arctic Monitoring and Assessment Programme ([AMAP](http://www.amap.no/)) (<http://www.amap.no/>) of the Arctic Council.

The 2015 Arctic Report Card, a link to a YouTube video, and previous report cards are available on the Report Card [website](http://www.arctic.noaa.gov/reportcard/) (<http://www.arctic.noaa.gov/reportcard/>).

For questions contact Martin Jeffries ([martin.jeffries@navy.mil](mailto:martin.jeffries@navy.mil)) or Jackie Richter-Menge ([Jacqueline.A.Richter-Menge@usace.army.mil](mailto:Jacqueline.A.Richter-Menge@usace.army.mil)).

# IARPC Releases Biennial Report and Plans for Next 5-year Research Plan

*By: Tamara Dickinson, Ph.D. Principal Assistant Director for Environment and Energy Office of Science and Technology Policy Executive Office of the President; Mike Kuperberg, Ph.D. Executive Director, U.S. Global Change Research Program Office of Science and Technology Policy Executive Office of the President; Sandy Starkweather, Implementation Scientist, IARPC*

In December 2015, the National Science and Technology Council (NSTC) (<https://www.whitehouse.gov/administration/eop/ostp/nstc>) Committee on Environment, Natural Resources, and Sustainability released the [Biennial Report](https://www.whitehouse.gov/sites/default/files/microsites/ostp/NSTC/iarpc-biennial-final-2015-low.pdf) (<https://www.whitehouse.gov/sites/default/files/microsites/ostp/NSTC/iarpc-biennial-final-2015-low.pdf>) of the Interagency Arctic Research Policy Committee (IARPC) (<http://www.iarpccollaborations.org/index.html>). The report covers Arctic research activities carried out by 16 Federal agencies under the IARPC [5-Year Arctic Research Plan](https://www.whitehouse.gov/sites/default/files/microsites/ostp/2013_arctic_research_plan.pdf) ([https://www.whitehouse.gov/sites/default/files/microsites/ostp/2013\\_arctic\\_research\\_plan.pdf](https://www.whitehouse.gov/sites/default/files/microsites/ostp/2013_arctic_research_plan.pdf)) issued by the White House in February 2013. An excerpt

from a [White House blog post](https://www.whitehouse.gov/blog/2015/12/14/new-report-describes-progress-and-promise-interagency-approach-arctic-research) (<https://www.whitehouse.gov/blog/2015/12/14/new-report-describes-progress-and-promise-interagency-approach-arctic-research>) written by Tamara Dickinson and Mike Kuperberg at the time of the Biennial Report's release is provided below, followed by information about the process by which IARPC will update the current 5-Year plan.



*IARPC releases biennial report and plans for next 5-year research plan.*

# IARPC Biennial Report

The Biennial Report, produced by IARPC, describes key interagency activities and accomplishments carried out over a two-year period following the release of the research plan. These efforts focused on leveraging research funding and scientific talent to accelerate our understanding of, and ability to predict, environmental changes in the Arctic. The report details how IARPC enhanced cooperation among the agencies and encouraged participation from other entities, including the State of Alaska, indigenous communities, universities, local organizations, and international research agencies.

In developing its report, IARPC focused on topics considered both important to national policy and likely to benefit from interagency collaboration; these include, regional climate models, human health studies, and adaptation tools for communities.

The report describes how IARPC-enabled activities have addressed research ranging from coordinated field deployments to sharing and interoperability of data. These activities generate knowledge that will inform key national priorities such as homeland security; energy, water, and food security; maintenance of transportation infrastructure; and protection of natural resources.

For example, IARPC agencies and external partners developed a framework for studying the ecosystem in the Beaufort and Chukchi seas north of Alaska, and then, through a competitive process, selected research projects to target critical knowledge gaps. One of the most biologically diverse and productive regions in the world, this vast area is important to tribal, Alaskan, U.S., and international interests—and it is undergoing rapid change. IARPC-led efforts in this region will help leaders, decision makers, and stakeholders anticipate and effectively respond to these changes.

This and other research described in the report supports IARPC's vision of a prosperous, sustainable, and healthy Arctic understood through innovative and collaborative research coordinated among Federal agencies and domestic and international partners. It further reflects an emerging connectivity across the vast network of activities and individuals with a stake in Arctic research—a network that includes citizens of the United States, as well as many around the world.



# IARPC's Update Process

The Biennial Report is a key input towards producing IARPC's next 5-year plan for Arctic research—a plan that will cover Federal activities that will benefit from interagency coordination for fiscal years 2018-2021. The plan "update" process is already well underway, guided by a subgroup of IARPC staff. Additional inputs to the new plan include agency specific plans for Arctic research, key documents describing the research needs of the State of Alaska, as well as community-produced reports on research recommendations. The next plan will build on the successes of IARPC's current implementation structure, create stronger opportunities to understand the Arctic as a system, and include even broader collaboration across Federal agencies and with non-Federal partners on important Arctic research.

A series of opportunities to solicit public input are already underway. The first was a workshop hosted in Washington D.C. on 1-2 December 2015 to clarify the high level policy drivers for the next Plan as well as to identify research themes. Regular dialog with the community about the "update" process is being sustained through IARPC Collaborations and its 12 Collaboration Teams. IARPC Collaborations membership is open to anyone who can contribute to our efforts to accelerate Arctic research, request an account at [the IARPC Collaborations website](http://www.iarpccollaborations.org/index.html) (<http://www.iarpccollaborations.org/index.html>). In addition, several listening sessions on the plan scope are being conducted throughout the spring. The first will be a session in Fairbanks, Alaska on 13 March 2016 as part of Arctic Science Summit Week ([ASSW2016](https://assw2016.org/)) (<https://assw2016.org/>). IARPC expects that the updated plan will be ready for public comment through the Federal Register process in summer of 2016. Watch for updates on the draft release through the IARPC Collaborations [website](http://www.iarpccollaborations.org/index.html) (<http://www.iarpccollaborations.org/index.html>).

# Polar Research Board's Arctic Matters Day

*By: Lauren Everett, Program Officer at the National Academies of Sciences, Engineering, and Medicine*

The Polar Research Board's "Arctic Matters" initiative is a multifaceted public engagement effort timed to coincide with the U.S. chairmanship of the Arctic Council (April 2015-April 2017). The initiative aims to increase public understanding of changes affecting the Arctic region and the many potential impacts of such changes on people and places around the world.

As part of that initiative, the Polar Research Board (PRB) (<http://dels.nas.edu/prb>) held a free public event, "Arctic Matters Day," on 14 January in Washington, D.C. The program included six keynote presentations, a variety of panel discussions, and a set of ten interactive exhibits. Throughout the day, the focus was on layman-friendly demonstrations and discussions about how we all affect and are affected by the dramatic environmental changes happening in the Arctic region.

This event attracted a diverse, enthusiastic crowd of approximately 500 people. Attendees included university and high school students and teachers; congressional staff; embassy representatives; federal, state, and local government agency representatives, people from think tanks, NGOs, and private sector organizations; and individual concerned citizens—many of whom had never before attended an Arctic-themed event.

[Presentation videos](http://nas-sites.org/arctic/2015/12/01/arctic-matters-day-agenda) (<http://nas-sites.org/arctic/2015/12/01/arctic-matters-day-agenda>) and a [photo gallery](http://nas-sites.org/arctic/2016/02/08/arctic-matters-day-gallery) (<http://nas-sites.org/arctic/2016/02/08/arctic-matters-day-gallery>) are available along with further information on the [Arctic Matters website](http://nas-sites.org/arctic/) (<http://nas-sites.org/arctic/>). The Polar Research Board has produced a suite of educational resources, including a [booklet](http://nas-sites.org/arctic/2015/06/04/arctic-matters-booklet) (<http://nas-sites.org/arctic/2015/06/04/arctic-matters-booklet>), [website](http://nas-sites.org/arctic-interactive) (<http://nas-sites.org/arctic-interactive>), and [classroom poster](http://nas-sites.org/arctic/2015/08/20/arctic-matters-poster) (<http://nas-sites.org/arctic/2015/08/20/arctic-matters-poster>) all available free online.



*Fran Ulmer, U.S. Arctic Research Commission Chair, welcomes the public to the keynote presentations during Arctic Matters Day. Photo courtesy of National Academies, Arctic Matters.*



The PRB is a unit within the National Academies responsible for studies related to the Arctic, Antarctic, and cold regions in general. More information about the PRB and other related activities can be found [here](http://dels.nas.edu/prb/) (<http://dels.nas.edu/prb/>).

*Max Holmes, Woods Hole Research Center, talks about amplifying forces in climate change. Photo courtesy of National Academies, Arctic Matters.*



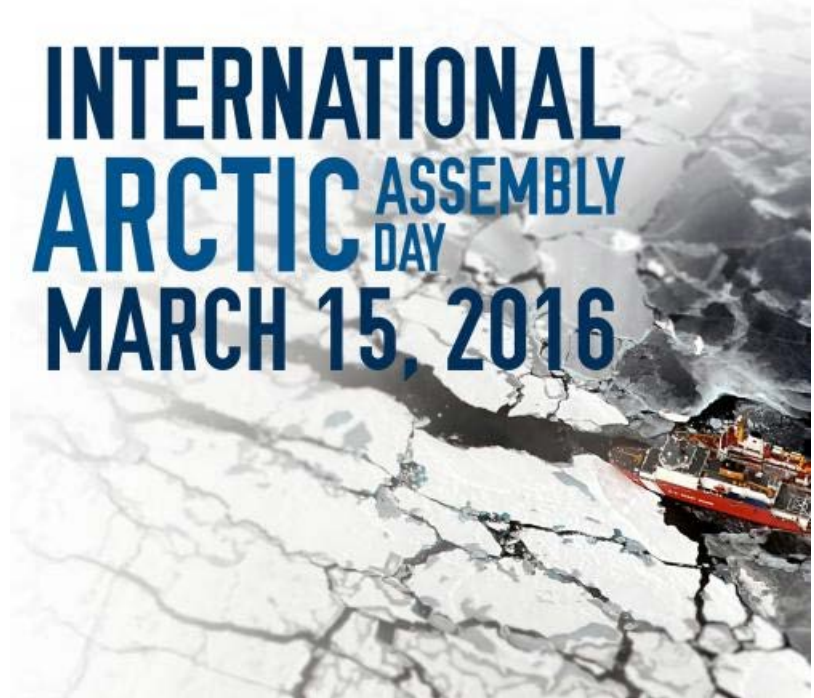
*Members of the public attending Arctic Matters Day enjoyed interactive displays and conversations with presenters. Photo courtesy of National Academies, Arctic Matters.*

# University of Alaska Fairbanks to Host First International Arctic Assembly

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*By: Kristin Timm, International Arctic Research Center, University of Alaska Fairbanks*

Scientists, indigenous people, government officials and other people interested in the Arctic are invited to participate in the first [International Arctic Assembly](https://assw2016.org/about/assembly) (<https://assw2016.org/about/assembly>) at the University of Alaska Fairbanks ([UAF](https://www.uaf.edu/)) (<https://www.uaf.edu/>) on Tuesday, 15 March 2016. The one-day event will be held at the UAF Davis Concert Hall and streamed online. It will harness the expertise of high-level officials attending the [Arctic Science Summit Week](https://assw2016.org/) (<https://assw2016.org/>), [Arctic Observing Summit](http://www.arcticobservingsummit.org/) (<http://www.arcticobservingsummit.org/>), and the [Arctic Council's Senior Arctic Officials Meeting](https://assw2016.org/about/sao) (<https://assw2016.org/about/sao>) to examine how the research community, the people of the Arctic, and the policy community can work together to better respond to a rapidly changing Arctic.



*Image courtesy of the Arctic Science Summit Week Team.*

"It will be a wonderful opportunity to hear the visionary perspectives of those who are helping to guide our nations in addressing the challenges of a rapidly changing Arctic," said [Larry Hinzman](http://www.alaska.edu/orgcharts/uaf-chancellor/vc-research/) (<http://www.alaska.edu/orgcharts/uaf-chancellor/vc-research/>), UAF Vice Chancellor for Research and International Arctic Assembly coordinator. The meeting comes at a time when increased tourism, shipping, resource extraction, and other commercial and military activities in the Arctic are creating opportunities and challenges for state, national, and international governing bodies. Information to make policy decisions is often in demand in these situations, but the connection between research

and policy is far from a straight line and often includes significant obstacles.

Beginning at 8:15 a.m. (Alaska Daylight Time), the program for the day includes several short presentations, moderated panels, and opportunities for questions and discussions with in-person and remote audiences.

The morning session will be moderated by [Byron Mallott](http://ltgov.alaska.gov/) (<http://ltgov.alaska.gov/>), Lieutenant Governor of Alaska, and will open with four keynote speakers who will broadly examine the intersection of science and policy from different perspectives:

- [Ambassador David Balton](http://www.state.gov/r/pa/ei/biog/bureau/125942.htm) (<http://www.state.gov/r/pa/ei/biog/bureau/125942.htm>) (Deputy Assistant Secretary for Oceans and Fisheries in the Bureau of Oceans and International Environmental and Scientific Affairs, U.S. Department of State), who coordinates the development of U.S. foreign policy concerning oceans, fisheries, and the polar regions;
- [Inuuteq Holm Olsen](http://www.iceland.is/iceland-abroad/us/nyc/files/media/us_nyc/inuuteqholmolsen-.pdf) ([http://www.iceland.is/iceland-abroad/us/nyc/files/media/us\\_nyc/inuuteqholmolsen-.pdf](http://www.iceland.is/iceland-abroad/us/nyc/files/media/us_nyc/inuuteqholmolsen-.pdf)) (Minister Plenipotentiary at the Greenland Representation at the Danish Embassy in Washington, D.C.), who manages Greenland's foreign affairs related to Arctic and Nordic policies;
- [David M. Kennedy](http://search.noaa.gov/search?utf8=%E2%9C%93&affiliate=noaa.gov&query=David+M.+Kennedy&commit=) (<http://search.noaa.gov/search?utf8=%E2%9C%93&affiliate=noaa.gov&query=David+M.+Kennedy&commit=>) (Deputy Under Secretary for Operations at the National Oceanic and Atmospheric Administration (NOAA)), who provides day-to-day management of NOAA's national and international research operations, and has led the federal scientific response to the *Exxon Valdez* oil spill and other incidents; and
- [Marcus Carson](http://sei.academia.edu/MarcusCarson) (<http://sei.academia.edu/MarcusCarson>) (senior research fellow at the Stockholm Environment Institute), who studies social change processes with an emphasis on the social and political drivers and obstacles involved in developing policy responses to climate change in the U.S. and the European Union.

The keynote speakers will be followed by select international research program directors and [Arctic Council Working Group](http://www.arctic-council.org/index.php/en/about-us/working-groups) (<http://www.arctic-council.org/index.php/en/about-us/working-groups>) and Task Force leaders who will discuss current collaborative structures and recent scientific contributions used to address some recent Arctic challenges and opportunities. Distinguished speakers include [Julia Gourley](http://www.arctic-council.org/images/PDF_attachments/US_team_bios/US_Bio_Julie.pdf) ([http://www.arctic-council.org/images/PDF\\_attachments/US\\_team\\_bios/US\\_Bio\\_Julie.pdf](http://www.arctic-council.org/images/PDF_attachments/US_team_bios/US_Bio_Julie.pdf)), U.S. Senior Arctic Official; Ulrik Westman, Chair of the [Swedish Environmental Protection Agency](http://www.swedishepa.se/) (<http://www.swedishepa.se/>); and [Tara Sweeney](#)

(<http://arcticeconomiccouncil.com/about-us/executive-committee/>), Chair of the Arctic Economic Council.

The International Arctic Assembly will conclude with a dialog about the future role of scientific research in decision-making, policy, industry, security, and environmental stewardship in the Arctic. Speakers, panelists, and conference participants will be challenged to find innovative approaches to collaboratively respond to opportunities and challenges that emerge from a rapidly changing Arctic. [Ambassador Mark Brzezinski](https://www.whitehouse.gov/blog/2015/08/13/ambassador-mark-brzezinski-appointed-executive-officer-arctic-executive-steering/) ([https://www.whitehouse.gov/blog/2015/08/13/ambassador-mark-brzezinski-appointed-executive-officer-arctic-executive-steering](https://www.whitehouse.gov/blog/2015/08/13/ambassador-mark-brzezinski-appointed-executive-officer-arctic-executive-steering/)), Executive Director of the U.S. Arctic Executive Steering Committee, will provide the closing remarks.

Broad participation is encouraged for the International Arctic Assembly, and a one-day registration option is available for anyone who would like to attend. The International Arctic Assembly is included with registration for the [Arctic Observing Summit](http://www.arcticobservingsummit.org/aos-2016-themes-and-important-announcements) (<http://www.arcticobservingsummit.org/aos-2016-themes-and-important-announcements>) and the [Arctic Science Summit Week](https://assw2016.org/) (<https://assw2016.org/>). Registration includes the conference program, lunch, breaks, and an unprecedented opportunity to network with international Arctic leaders in science and policy. Online [registration](https://assw2016.org/register) (<https://assw2016.org/register>) is available through Tuesday, 1 March. On-site registration will be available at the University of Alaska Fairbanks Wood Center beginning at 7:00 a.m. (Alaska Standard Time) on Saturday, 12 March 2016 or on the morning of the event.

The day will conclude with a banquet at the [Carlson Center](http://www.carlson-center.com/) (<http://www.carlson-center.com/>) in Fairbanks to celebrate the Arctic and international cooperation through cultural performances, remarks from Arctic leaders, and a meal featuring many Alaskan foods. Banquet tickets can be purchased online [here](https://assw2016.org/register) (<https://assw2016.org/register>) or at the door, while supplies last.

The International Arctic Assembly Day will be live-streamed from the Arctic Science Summit [website](https://assw2016.org/) (<https://assw2016.org/>). Discussion and questions will be encouraged from online participants and via twitter using the hash tag #ASSW2016.

The full agenda for the International Arctic Assembly is available online [here](https://assw2016.org/about/assembly) (<https://assw2016.org/about/assembly>).

# Arctic Observing Summit Aims to Fulfill Long-standing Potential Between Arctic Governance and Research

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*By: Nate Bauer and Kristin Timm, International Arctic Research Center, University of Alaska Fairbanks*

In March, the third biennial Arctic Observing Summit ([AOS 2016](http://www.arcticobservingsummit.org/aos-2016-themes-and-important-announcements)) (<http://www.arcticobservingsummit.org/aos-2016-themes-and-important-announcements>) will be held at the University of Alaska Fairbanks ([UAF](https://www.uaf.edu/)) (<https://www.uaf.edu/>), in conjunction with the Arctic Science Summit Week ([ASSW](https://assw2016.org/)) (<https://assw2016.org/>) and the [Arctic Council's Senior Arctic Officials Meeting](https://assw2016.org/about/sao) (<https://assw2016.org/about/sao>). Collectively, these events are being convened in hopes of advancing a cohesive agenda for the national and international Arctic research and policy communities. The Arctic Observing Summit is being convened to provide community-driven, science-based guidance for the design, implementation, coordination, and sustained long-term (decades) operation of an international network of Arctic observing systems.



"The rapidity and breadth of Arctic change is challenging existing, established response tools and mechanisms," explains [Hajo Eicken](http://www.iarc.uaf.edu/people/heicken) (<http://www.iarc.uaf.edu/people/heicken>), co-chair of the summit and Director of UAF's International Arctic Research Center. "The type of information needed at this point by those living in the Arctic and other decision-makers has to at least in part come from networks of sustained observations."

In a world of change, there are several roles for science in international policy and governance. Data and information are delivered from observations to serve as indicators of change and major transitions. Science also provides information about linkages across systems and regions, and data to shape adaptation actions and policy responses to rapid change.

Despite the value of this information, to date there has been a patchwork response to observing the

Arctic. For example, in U.S. Arctic waters, sustained observations have been distributed across a diverse set of entities including academia, federal and state agencies, the private sector, local government, and foreign nations. In fact, a full third of sustained observations in the U.S. exclusive economic zone (EEZ) (<http://oceanservice.noaa.gov/facts/eez.html>)—the zone over which the nation has special rights regarding the exploration and use of marine resources—have been conducted by foreign countries and through international collaboration. Data availability has been inconsistent. The National Science Foundation's Arctic Observing Network (NSF-AON) ([https://www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=109687](https://www.nsf.gov/news/news_summ.jsp?cntn_id=109687)) data has been the most accessible, building on the data policy established by the Study of Environmental Arctic Change (SEARCH) (<https://www.arcus.org/search-program>). However, a significant portion of the data is effectively unavailable or challenging to access.

Our Arctic research communities have also dealt with limited coordination of data acquisition and program design. Problem definition and information products have been forced to rely on data and information bottlenecks between stakeholders and researchers.

"In order for these observations to be meaningful and effective, we will need to build new partnerships between indigenous peoples, Arctic communities, the private sector, universities, government agencies, and many others," explains Eicken. "This is the path the Arctic Observing Summit is helping to pave."

There is clear and realistic potential for much greater breadth and collaboration across these stakeholder and research communities, based on their individual capabilities and histories of organization and innovation. Such efforts tie into broader international agreements supportive of collaborative research and exchange, such as the United Nations Convention on the Law of the Sea (UNCLOS; 1982) ([http://www.un.org/depts/los/convention\\_agreements/convention\\_overview\\_convention.htm](http://www.un.org/depts/los/convention_agreements/convention_overview_convention.htm)), or efforts sustained by Arctic Council Working Groups (<https://www.arctic-council.org/index.php/en/about-us/working-groups>) and motivated by Arctic Council Agreements (<http://www.arctic-council.org/index.php/en/our-work/agreements>) (e.g., Search and Rescue; Spill Response); official international agreements, including participation from the private sector (e.g., the International Maritime Organization (<http://www.imo.org/en/Pages/Default.aspx>), the International Organization for Standardization (<http://www.iso.org/iso/home.html>)); and formal and informal co-management of living marine resources.

Collaboration between different national and international entities under the auspices of international



agreements can help advance coordinated responses to the challenges of rapid Arctic change. Open access, co-production, and co-management of data helps ensure benefits for Arctic communities, stakeholders, and all humankind and can help break down traditional boundaries between operational networks and scientific research. To advance these goals requires engagement between science, government, and policy at a number of levels. For one, existing and functional groups, such as international scientific organizations or treaty systems as well as the [Arctic Council](http://www.arctic-council.org/index.php/en/) (<http://www.arctic-council.org/index.php/en/>) and its Working Groups, must maintain stated and detailed collaboration agreements. Further, best-practice standards across these communities, together with their approaches to data co-management and collaboration, must come from the bottom up and develop according to conditions faced on the front lines of interaction.

"The Arctic Observing Summit provides us the opportunity to make progress in better leveraging existing observing efforts, jointly planning new ones, and making sure that those who need the information have access to it," said Eicken.

The Arctic Observing Summit presents a unique opportunity for new advancements and innovation. Based on recommendations from previous [Summits](http://www.arcticobservingsummit.org/) (<http://www.arcticobservingsummit.org/>), AOS 2016 will focus on six themes: 1) international and national strategies for sustained support of long-term Arctic observing; 2) technology and innovation for sustained Arctic observations; 3) contributions from the private sector and industry to sustained Arctic observations; 4) actor and stakeholder engagement and needs in sustained Arctic observations; 5) Arctic observations in the context of global observing initiatives; and 6) interfacing indigenous knowledge, community-based monitoring, and scientific methods for sustained Arctic observations.

In preparation for the Arctic Observing Summit, community input was invited in the form of white papers and short statements, poster presentations, and through town halls and other meetings. Over 100 articles have been submitted for public review and discussion in preparation for AOS. The thematic working groups have been preparing synthesis documents to report on the state of Arctic observing under each theme; to identify linkages among themes, remaining gaps, needs, and priorities; and to generate discussion around solutions, implementation, community engagement, and international cooperation.

AOS provides a platform from which to address urgent and broadly recognized needs for Arctic observing across all features of the Arctic system, including the human component. This meeting will foster international communication and the widespread coordination of long-term observations,

aimed at improving understanding and responding to system-scale Arctic change. AOS also serves as an international forum for optimizing resource allocation, through coordination and exchange between those focused on long-term observing activities, while minimizing duplication and gaps.

The Arctic Observing Summit will take place from 15-18 March 2016 in Fairbanks, Alaska. The agenda and more information about the themes, white papers, and posters are available [here](http://www.arcticobservingsummit.org/aos-2016-themes-and-important-announcements) (<http://www.arcticobservingsummit.org/aos-2016-themes-and-important-announcements>).

Online registration is available through Tuesday, 1 March via the ASSW [website](https://assw2016.org/register) (<https://assw2016.org/register>), and there are special rates for students and early career scientists. On-site registration will be available at the University of Alaska Fairbanks Wood Center beginning at 7:00 a.m. (Alaska Standard Time) on Saturday, 12 March 2016 or on the morning of the event.

The plenary sessions will be live-streamed from the Arctic Science Summit Week [website](https://assw2016.org/) (<https://assw2016.org/>). Discussion and questions will be encouraged from online participants and via Twitter using the hash tag #ASSW2016 or #AOS2016.

# Connecting Arctic Research – A Note from the ARCUS Executive Director

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Greetings from ARCUS headquarters in snow-covered Fairbanks!

The Arctic Research Consortium of the United States (ARCUS) is dedicated to connecting Arctic research across boundaries, and has been for more than 25 years. We work to support communication, coordination, and collaboration between researchers, among institutions, spanning disciplines, bridging sectors, and connecting nations. *Witness the Arctic* is one of many offerings we provide.



Since I last wrote, ARCUS has been very busy. We convened the [Arctic Observing Open Science Meeting](https://www.arcus.org/search-program/meetings/2015/aosm) (https://www.arcus.org/search-program/meetings/2015/aosm) in November that brought a wide range of researchers and funders to Seattle. We kicked off the eleventh year of [PolarTREC](https://www.polartrec.com/) (https://www.polartrec.com/), enabling teachers from around the country to become a part of an Arctic or Antarctic research expedition and inspire their teaching and that of their colleagues. We inaugurated the [Arctic Research D.C. Seminar/Webinar Series](https://www.arcus.org/research-seminar-series) (https://www.arcus.org/research-seminar-series), which allows some of the leading Arctic researchers to meet with Washington policymakers and others to discuss the latest discoveries.

We continued management of our widely acclaimed [ArcticInfo listserv](https://www.arcus.org/arctic-info) (https://www.arcus.org/arctic-info), hosted numerous meetings in our [Arctic space](https://www.arcus.org/communitymeetings) (https://www.arcus.org/communitymeetings) at the American Geophysical Union Fall Meeting, and facilitated a good half dozen workshops on topics ranging from permafrost to sea ice to the Greenland ice sheet.

ARCUS is a member-focused organization and we invite you to join us. We expanded access to [ARCUS membership](https://www.arcus.org/arcus/member-information) (https://www.arcus.org/arcus/member-information) to all types of [organizations](https://www.arcus.org/arcus/application) (https://www.arcus.org/arcus/application) and to [individuals](https://members.arcus.org/individual-application) (https://members.arcus.org/individual-application) interested in championing the study of this important region. This includes academic institutions, government agencies, corporations, indigenous organizations, and not-for-profits. Dues

are not high, as we seek to represent and engage all those working toward better understanding of the Arctic and the application of that knowledge to decision-making. For more information on ARCUS and how to get involved, please view our new ARCUS video [here](https://www.arcus.org/) (<https://www.arcus.org/>).

I hope that you find value in this special federal programs issue of Witness the Arctic. Feel free to contact me with any ideas that you have for future content, or any other suggestions that ARCUS could pursue to better help you connect across boundaries. I'd love to hear from you at [bob@arcus.org](mailto:bob@arcus.org).

Thank you for everything that you do in support of Arctic research.

*Robert H. Rich, Ph.D., CAE*

Published by the Arctic Research Consortium of the United States • 3535 College Road - Suite 101 • Fairbanks, AK 99709 • [info@arcus.org](mailto:info@arcus.org)

**Editors:** Betsy Turner-Bogren, Kristina Creek, Lisa Sheffield-Guy, and Helen Wiggins

**Contributors:** S. Bartholow, N. Bauer, J. Danielson, T. Dickinson, L. Everett, M. Jeffries, A. Kerttula, M. Kuperberg, A. Larson, B. Myers, J. Overland, R. Rich, J. Richter-Menge, L. Sheffield-Guy, S. Starkweather, K. Timm, B. Turner-Bogren, J. Warburton, H. Wiggins

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Arctic Research Consortium of the  
United States  
3535 College Road  
Suite 101  
Fairbanks, AK 99709 USA  
Phone: 907-474-1600  
Fax: 907-474-1604  
[info@arcus.org](mailto:info@arcus.org)

