

NATIONAL SCIENCE FOUNDATION

Advisory Committee for Polar Programs (AC-OPP)

Fall Meeting, October 19-20, 2017

National Science Foundation Headquarters

2415 Eisenhower Avenue

Alexandria VA

MINUTES

Action Items Arising out of the Fall 2017 AC-OPP Meeting

1. Dr. Andrew Backe will contact AC-OPP members via email, to solicit: a) feedback on the timing of the Spring 2018 AC-OPP meeting, b) preferences for aligning with another directorate meeting, and c) possible agenda items. AC-OPP members are asked to reply within one week.
2. Further feedback on agenda items will be solicited from AC-OPP members via email, and the agenda for the next meeting will be finalized relatively quickly.
3. Dr. Backe will provide AC-OPP Strategy Subcommittee members (i.e., Dr. Donal Manahan, Dr. Leigh Stearns, Dr. Patrick Heimbach, Dr. Abigail Viereg, Dr. Mark Flanner, and Dr. Michael DeGrandpre) and Dr. Lyons with links to strategic planning documents the reports discussed during the meeting.
4. The AC-OPP Strategy Subcommittee will draft an outline of an OPP strategy for review at the Spring 2018 AC-OPP Meeting. Dr. Lyons will coordinate the distribution of these materials among subcommittee members.
5. OPP staff will draft a communications plan for the Antarctic Infrastructure Modernization for Science (AIMS) project for review at the Spring 2018 AC-OPP Meeting.

Attendance and Membership

AC-OPP Members present:

- Dr. W. Berry Lyons, Research Scientist, Byrd Polar Research Center, Chair, AC-OPP
- Mr. Raymond V. Arnaudo, Department of State (Ret)
- Dr. Stefanie Brachfeld, College of Science and Mathematics, Montclair State University, Montclair, NJ (via telephone)
- Dr. Michael D. DeGrandpre, Department of Chemistry and Biochemistry, University of Montana, Missoula
- Dr. E. James Dixon, Department of Anthropology, University of New Mexico, Albuquerque
- Dr. Mark Flanner, University of Michigan, Ann Arbor
- Mr. Craig Fleener, Senior Advisory for Arctic Policy, Alaska's Governor's Cabinet (via telephone)
- Dr. Jose D. Fuentes, Pennsylvania State University, University Park
- Dr. Patrick Heimbach, Institute for Computational Engineering and Sciences, The University of Texas at Austin
- Mr. Alex Kosseff, American Mountain Guides Association, Boulder, CO

- Dr. Donal T. Manahan, USC Dornsife College of Letters, Arts & Sciences, University of Southern California, Los Angeles
- Dr. Jo-Ann Mellish, North Pacific Research Board, Anchorage, AK
- Mr. Christopher Mossey, Fermi National Accelerator Laboratory, Batavia, IL (via telephone)
- Dr. Leigh A. Stearns, Department of Geology, University of Kansas, Lawrence (via telephone)
- Dr. Abigail Vieregg, Kavli Institute of Cosmological Physics, Eckhardt Research Centers, University of Chicago, IL
- Dr. Jeffrey M. Welker, University of Alaska, Anchorage (via telephone)

AC-OPP Members absent:

- Dr. John J. Cassano, Department of Atmospheric and Oceanic Sciences, University of Colorado, Boulder
- Dr. Amanda Lynch, Institute at Brown for Environment and Society, Brown University, Providence, RI
- Dr. Thomas Neumann, Cryospheric Sciences Laboratory, NASA Goddard Space Flight Center, Greenbelt, MD
- Dr. Thomas J. Weingartner, College of Fisheries and Ocean Sciences, Institute of Marine Science, Fairbanks, AK

OPP and other NSF staff present:

- Dr. Kelly Falkner, Director, Office of Polar Programs (OPP)
- Ms. Gwendolyn Adams, Safety and Occupational Health Manager, Polar Environment, Safety and Health Section (PESH), OPP
- Dr. Andrew Backe, Management and Program Analyst, OPP
- Mr. Scott Bohnhoff, Section Head, PESH, OPP
- Dr. Scott Borg, Acting Deputy Assistant Director, Directorate for Geosciences (GEO)
- Mr. Robert Cosgrove, Equal Opportunity Program Manager, Office of Diversity and Inclusion (ODI), NSF Office of the Director (OD)
- Ms. Jessie Crain, Antarctic Research Support Manager, Antarctic Infrastructure and Logistics Section (AIL), OPP
- Ms. Renee Crain, Program Manager, Arctic Research Support and Logistics, Arctic Sciences Section (ARC), OPP
- Dr. Paul Cutler, Program Director, Antarctic Glaciology, Antarctic Sciences Section (ANT), OPP
- Dr. Alexandra Isern, Acting Section Head, ANT, OPP
- Dr. Michael Jackson, Program Director, Research Facilities and Special Projects, ANT, OPP
- Ms. Pawnee Maiden, Administrative Officer, OPP
- Dr. Irene M. Qualters, Director, Office of Advanced Cyberinfrastructure (ACI)
- Mr. Ben Roth, Facilities Engineering Project -Manager, AIL, OPP
- Ms. Stephanie Short, Section Head, AIL, OPP
- Mr. Simon Stephenson, Section Head, ARC, OPP
- Dr. Marc Stieglitz, Program Director, Arctic Natural Sciences, ARC, OPP

Thursday, October 19

Welcome and Introductory Remarks

Dr. W. Berry Lyons & Dr. Kelly K. Falkner

Dr. Lyons welcomed all participants to the first AC-OPP meeting convened, after a several-year hiatus. He asked those present at the main table and those joining by phone to introduce themselves, and to provide a brief overview of their background. Dr. Falkner then invited members of the audience to introduce themselves.

Dr. Falkner reviewed the recent history of the AC-OPP, reconstituted as of the current meeting. The Office of Polar Programs had its own Advisory Committee until 2013, when the program was merged into the Geosciences Directorate. Between 2013 and 2016, OPP reported to the Geosciences Directorate, and was advised by a subcommittee of the Advisory Committee for Geosciences (AC-GEO). A three-year review of the GEO-OPP merger resulted in the re-designation of OPP as an Office and the re-establishment of a separate Advisory Committee for Polar Programs.

Dr. Falkner noted that OPP had been asked to consider ways to better liaise with other advisory committees at NSF. Many AC-OPP members have formal roles on other committees, and others will be asked to serve as liaisons from the AC-OPP. Dr. Falkner noted that the AC-OPP is governed by rules for federal advisory committees, which include the need for transparency. Biographies of AC-OPP members are posted online; meeting minutes will also be posted and available to the public. Credentials and contact information for AC-OPP members are made available to the public, so that members of the community can communicate to them.

Dr. Falkner noted that conflicts of interest are taken seriously throughout NSF. She predicted that most AC-OPP discussions should not touch on areas of potential conflict (e.g., discussions in which an AC-OPP member might lobby for something that would direct funding to their institution or provide an advantage to the member or institution). Dr. Falkner directed AC-OPP members to speak up should any discussion move in these directions, so that potential conflicts of interest might be identified and addressed.

The AC-OPP will stand up a Committee of Visitors (COV), comprised of community members convened to review the Office's decision-making process. The COV examines records of application reviews, and assesses the integrity of the OPP merit review process. The COV may also provide suggestions for improving the process. COVs were last completed for the Arctic and Antarctic programs in 2016; they are conducted every 4 years and so are due again in 2019. The AC-OPP will begin to prepare for the COV in 2019.

Dr. Falkner noted the range of expertise represented in the AC-OPP. The OPP has a special relationship with the State of Alaska, and seeks to assure that indigenous communities are represented on the AC-OPP. Dr. Falkner reported that Mr. Fleener, of the Alaska's Governor's Cabinet, would join the discussion via telephone on Friday, October 20. Dr. Falkner noted the geopolitical interests which impact OPP, and the contributions of Mr. Arnaudo's expertise in this area. She remarked that Mr. Mossey, who would also join the discussion in person on October 20, brings large project management expertise to the AC-OPP. Dr.

Falkner noted that OPP has substantial operational responsibilities, and is beginning a large project soon. She also reported that medical review boards and a standing safety board provide advice to OPP in these areas.

Dr. Falkner reviewed the meeting agenda, noting a brief budget discussion scheduled for October 20. She invited AC-OPP members to provide input in developing future meeting agendas. Given the broad diversity of topics to be addressed, it will be necessary to “take turns” with them, across multiple meetings. Dr. Falkner described a focus of the current meeting as identifying strategies for effectively receiving advice from the AC-OPP. The presentations that are scheduled and the materials posted to the website are intended to seed the thinking of AC-OPP members.

Dr. Falkner noted that committee members and staff will provide presentations; she suggested that committee members serve as primary discussants, with staff serving as co-discussants and keeping time. The goals of discussions are to identify actions, advice, and strategies for acting on AC-OPP advice moving forward. Time has been set aside to discussion strategies and topics for future meetings.

Dr. Falkner noted the option to form subcommittees to advance AC-OPP priorities. Subcommittees work independently to conduct tasks assigned by the AC-OPP. When subcommittees report on their work to the Advisory Committee, the content of those reports become part of the AC-OPP’s public record.

Presentation: Policy Concerning Harassment

Dr. Donal Manahan; Dr. Stefanie Brachfeld; Dr. Kelly K. Falkner; Mr. Robert Cosgrove

Dr. Falkner noted that the topic of harassment had been placed on the agenda previous to recent media reports regarding a case of harassment in Antarctica. She suggested the issue is especially important to address at this time as reports are increasingly surfacing. Dr. Manahan encouraged AC-OPP members to read the media reports; he noted the challenge to the community in addressing harassment, given the remoteness of the sites.

Mr. Cosgrove introduced himself to the Advisory Committee. He has worked with NSF since December 2016, and brings 28 years of experience in Title IX and related issues. Mr. Cosgrove reported that NSF learned about the harassment issues in Antarctica about a week after he began at NSF, when a complaint was made to the Office of Diversity and Inclusion (ODI).

ODI is the primary NSF office that assures compliance with laws and regulations governing federal-sector equal employment opportunity and civil rights; all those receiving funds from NSF must assure their compliance with laws and regulations that prohibit discrimination in federally assisted programs and activities. Mr. Cosgrove noted that ODI interfaces regularly with OPP on issues of harassment, issues related to remoteness, and strategies to quickly triage troubling situations. Over the past 9 months, ODI has worked with OPP on issues raised related to harassment, and is providing training on how to recognize and mitigate such situations, the laws and regulations that address harassment, and the Code of Conduct.

Mr. Cosgrove described ODI as a backstop for situations that are not resolved on the ice; he assists with investigations of these cases, and provides a report and recommendations to OPP. Mr. Cosgrove noted that the US Antarctic Program (USAP) Code of Conduct prohibits harassment on the ice, and that anyone who goes to USAP locations must attest that they have read, understood, and signed off on the Code of Conduct, and that they are aware of the penalties for violating the Code of Conduct.

The Code of Conduct restates principles and expectations for professional conduct and acceptable behavior by all USAP participants. The list of prohibited behavior is non-exhaustive: any misconduct that could jeopardize the health and safety of an individual in Antarctica is prohibited. The Code applies to facilities, vessels and field locations, and government civilian personnel, official visitors, researchers, support contactors, military personnel, and foreign nationals. Individuals working for institutions that have their own policies related to sexual harassment are also subject to the Code of Conduct; should third parties impose more stringent requirements upon personnel, these remain in effect under the Code of Conduct.

Prohibited acts include conduct that is offensive, indecent, or obscene; physical or verbal abuse and bullying or hazing, whether verbal, physical, electronic, or written; and dishonest conduct, including false accusation or providing false or misleading information to an investigator or other USAP official.

Persons found to have violated the Code of Conduct can be removed from Antarctica as quickly as possible, and may be banned from NSF deployment, lose their grants, and/or be referred to law enforcement authorities for criminal prosecution.

Mr. Cosgrove noted that harassment may not be criminal, and that violations of the USAP Code of Conduct are expected to be reported onsite. When that does not occur, ODI may become involved. Mr. Cosgrove noted that university students may also file a complaint with their university, under Title IX. If the student is not satisfied with the university's response, the student may also come to ODI.

Mr. Cosgrove noted he would not review all the applicable laws and regulations. He reported that NSF has a zero-tolerance policy for sexual harassment. Mr. Cosgrove opened the floor for discussion.

Discussion

Dr. Stearns asked if there was a way someone who had concerns about harassment could discuss these, and the options for reporting, without lodging a formal complaint that would be "escalated up the chain of command." She suggested providing such an option might provide an increased sense of safety at McMurdo.

Dr. Cosgrove replied that "first level mitigation" is an acceptable response to a complaint. If someone brings a complaint to the program manager or human resources at McMurdo and the harassment can be stopped, and the complaining party feels they can continue their work, that level of resolution is acceptable. He noted there is no requirement to bring complaints to the highest level of review.

Dr. Falkner noted that many people on the ice can serve that function, of reviewing options and assisting in stopping the harassment. She noted that the optimal approach is for the person facing harassment to

speak up, name the harassment, and ask that it stop. Dr. Falkner acknowledged that there are times this direct approach does not work, or individuals do not feel empowered to speak up. Dr. Falkner noted that that the Code of Conduct was originally adopted to address issues of safety and professionalism.

Dr. Falkner asked Mr. Cosgrove to speak to the limits of Title IX. Mr. Cosgrove replied that Title IX applies to grantee institutions, and that institutions—rather than individual investigators—are held accountable for Title IX violations. However, removing funding from an institution requires a long process, and Congressional approval. An investigator convicted of a Title IX violation can be restricted from working in Antarctica, through the Code of Conduct, or through cooperation from the university. Allegations of criminal activity must be addressed.

An AC-OPP member asked if OPP knew how pervasive issues of harassment are, or whether measurable progress is being made. Dr. Falkner replied that these data are not available at this time; she noted that individuals are feeling more empowered to report harassment, that the period of “what happens in the field stays in the field” was ending. NSF and OPP are committed to providing a safe environment.

Dr. Falkner noted that Title IX applies to universities, and that the military and contractors often have their own requirements. The expectations of these institutions are often similar; OPP is seeking to assure that the regulatory layers work together. She noted that investigations often move toward employers, with the expectation that these bodies will act. The current discussion is intended to educate AC-OPP members on the challenges in addressing harassment, and the process taken within NSF when complaints are made. OPP seeks to assure that reporting is encouraged, and appropriately followed-up.

Dr. Manahan noted the challenge of harassment or hostility occurring in small group settings. He remarked that principal investigators (PIs) have often spent years setting up a project, and have only a few weeks on the ice to conduct their work. Under this pressure, the PI may feel the need to confront individuals who are not working as hard as expected, and may create an abusive or hostile work environment.

Mr. Cosgrove agreed these interactions may require more attention. He suggested PIs may feel the need to take a strong hand in overseeing a project, and may not appreciate the perspective of undergraduate or graduate students new to the field. Mr. Cosgrove suggested that additional training may help mitigate these situations. Mr. Cosgrove noted that any workplace holds expectations regarding individual behavior; these may be more critical at USAP, where people are together for long periods, with no opportunity to leave.

Dr. Manahan suggested that the points of contact—currently the resident station manager or NSF representative—might be expanded to include additional on-ice assistance. He suggested the position of ombudsman might be created. Mr. Cosgrove agreed this might be valuable in increasing communication and providing a real-time ability to resolve issues. Such a position would communicate the availability of immediate assistance and accountability.

Dr. Brachfeld asked how conflicts between people from different institutions are addressed; she noted that NSF is not structured to serve as an investigating body, but that central reporting of some kind is needed.

Mr. Cosgrove replied that the party seeking to make a complaint can take the complaint to their own university; this is more effective than approaching the other party's institution. The complainant could also approach ODI at NSF. Mr. Cosgrove noted that the Title IX process is not hierarchical, although NSF does not get involved in university-instigated processes until they are completed. If a complainant is not satisfied by the resolution reached at the university(ies), the complaint can be brought to ODI.

Dr. Falkner noted that Ms. Susanne LaFratta-Decker of OPP had worked with a contractor on a policy that encouraged reporting through a number of avenues, and offered the ability to consolidate and address these reports. Dr. Falkner suggested that the provision of advice, counselling and the provision of safe spaces might be of greater concern than providing avenues for reporting, which are in place.

Dr. Falkner noted that contractors provided non-harassment training this year; initial feedback has been favorable. More resources are available now than in the past.

Dr. Falkner questioned whether OPP's commitment to a safe environment is being effectively communicated to investigators and students on-ice. She noted the need for everyone who receives a complaint to know how to move forward with it, and to assure careful investigation and due diligence.

Dr. Scott Borg noted that the situations that have arisen have caught OPP by surprise. He noted a case of intimidation, which may not have been mitigated by having someone to report to on the ice. Dr. Borg noted that Polar programs are not the only remote locations for field work; he asked if universities were addressing harassment in the field in their trainings. NSF staff would take seriously any complaint brought to them, but may suggest that the complaint be taken to university personnel; he asked AC-OPP members to address whether universities were equipped and prepared to receive these complaints.

Dr. Heimbach replied that annual training is mandated by his university; he raised concern about how this training might be offered to students. He noted, however, the "big jump" from a student reviewing and checking off a policy to engaging the reporting structures.

Mr. Cosgrove noted that university Title IX coordinators are consumed with the need to address sexual assault on campus, and may not be able to look beyond those issues at this time. He agreed that Title IX coordinators and others in similar positions could benefit from training on field harassment, but suggested that they are primarily focused on the campus. Mr. Cosgrove suggested that NSF might have a role in informing universities of their responsibility to students engaged in NSF-funded or other field work.

Dr. DeGrandpre asked if persons with concerns could approach Mr. Cosgrove in confidence. Mr. Cosgrove replied that ODI will generally agree to confidentiality, except in cases in which a complainant's name is needed to move forward with an investigation. He also noted that NSF must abide by Freedom of Information Act (FOIA) requirements.

Dr. DeGrandpre asked about a situation in which a supervisor is informed of harassment, but asked to keep the complaint confidential. Mr. Cosgrove noted that increasing numbers of people are being identified as mandatory reporters, who are precluded from keeping such complaints confidential.

Whether a particular person or position is designated as a mandatory reporter depends upon the institution.

Dr. Vieregg suggested that having a position on the ice tasked with receiving complaints would be useful. She also noted the need to focus on preventing harassment, in addition to helping those who have been harassed. She noted the need for those working on the ice to take the issue seriously, and suggested training or telephone discussions asking teams how they intend to address these issues. Another Advisory Committee member added that bullying might also be included in such an approach.

Dr. Heimbach cautioned against expanding the administrative burden on PIs. He reported that the paperwork he is required to complete has expanded significantly since he first worked on the ice, 20-25 years ago. Dr. Heimbach noted, for example, hundreds of pages of compliance documents.

Dr. Flanner reported on a recent conversation with a colleague, who said that his team meets and conducts some role play of challenging situations (e.g., someone refusing to work). He acknowledged that such instruction might not be in NSF's control, but suggested this or other suggested strategies might be including with grant materials.

Dr. Borg noted the expectations that PIs behave appropriately in all settings, not merely on the ice. He underscored the role of universities in establishing and enforcing policies and norms, and suggested, if universities are handling these issues effectively, NSF should not impose another expectation.

Dr. Manahan noted the challenge of engaging multiple institutions, which may be more or less committed to or effective in preventing harassment. He noted that he had personally interacted with 130 different institutions on the ice.

Dr. Borg noted that universities and other institutions have the most direct control over their employees. He also remarked that these issues are not particular to polar work, and that harassment could occur in the mountains or at an observatory. He noted that NSF should not shy away from taking action if a problem arises, but suggested a larger focus on leadership, team dynamics, and culture in general.

Ms. Gwendolyn Adams of OPP reminded AC-OPP members that harassment also occurs between individuals from different institutions, or between contractors and grantees. She noted that different organizations may have different structures for addressing these concerns, and suggested that the AC-OPP might provide guidance or advice regarding how these situations might be handled, or how decisions regarding institutional responsibility might be made. She also noted the role of alcohol in making people more aggressive and less inhibited than they might otherwise be. She suggested OPP could be resolute in assuring that policies will be enforced and penalties imposed. Dr. Brachfeld added that leadership positions might be taken from those found guilty of harassment.

Dr. Falkner invited Mr. Kosseff to offer his perspective, given his expertise in field risk management. Mr. Kosseff replied that these issues are more common in remote work than within offices and on university campuses. He noted the need to have an effective investigative system in place, and to intervene early to set the right tone. Mr. Kosseff reported that one of the most effective systems he has experienced is a system of remote coaching—someone who can be contacted by phone, who can help to

de-escalate situations or, if necessary, instigate the removal of an individual. He described this as an “intermediate” structure which provides assurance that someone is available. Mr. Kosseff noted that someone remote from the situation can be valuable in different ways than a person on site.

Dr. Falkner stated that she would reconvene with Drs. Brachfeld and Manahan, and that they would provide follow-up to the AC-OPP. In the meantime, she asked AC-OPP members to contact their home institutions and familiarize themselves with applicable policies.

Dr. Falkner reported that support has been made available to host discussions of field harassment; a number of workshops have been held and are planned. The National Academy of Sciences (NAS) is conducting a study of sexual harassment in the academic workforce; this study will be completed in Summer, 2018, perhaps before the Fall 2018 AC-OPP meeting.

Dr. Falkner suggested that that next field season provides an opportunity to identify best practices and areas in need of improvement. She asked AC-OPP members to keep these issues in mind through the season, and seek to identify ideas and strategies to bring back to the group.

Presentation: Polar Data/Cyber Infrastructure

Dr. Patrick Heimbach; Dr. Marc Stieglitz; Dr. Michael Jackson; Dr. Irene Qualters

Dr. Heimbach noted that the presentation would address questions of what cyberinfrastructure is, what NSF currently funds, and what challenges are faced by the foundation and OPP. Dr. Falkner introduced Dr. Irene Qualters, noting her generosity in presenting to the AC-OPP.

Dr. Qualters noted that NSF has an expansive view of cyberinfrastructure, considering it to be not just software, but also networking, people, data, computational resources, and associated skill sets. The NSF is focused not only on the elements of cyberinfrastructure, but also on the research advances that can be enabled by new combinations and approaches. This vision takes into consideration what research is possible, as well as new modes of conducting research.

Dr. Qualters shared a three-layered model of the architecture of cyberinfrastructure, noting that the layers move from increasing interdisciplinary sharing to increasing disciplinary emphasis. Dr. Qualters remarked that neither her office nor the entire foundation provides all elements of this architecture: resources and capabilities also come from campuses, international governmental partners, and the private sector. In considering NSF investments in cyberinfrastructure, there is a goal to ensure cohesion across this architecture, and the ability to access what is needed when it is needed.

As an example, Dr. Qualters noted campus cyberinfrastructure efforts to upgrade the networking capabilities of more than 200 campuses to facilitate national and international research coordination. Dr. Qualters noted that moving large data from telescopes in Chile to the U.S. and on to Europe is not a trivial enterprise.

Dr. Qualters noted that researchers analyzing data from the LIGO detection of gravitational waves are located all over the world. The Arctic Digital Elevation Model (ArcticDEM) project, inspired by OPP,

provides another example of collaboration. Dr. Qualters described the effort to produce these high resolution maps the Arctic as a “mammoth computation problem,” utilizing data from the National Geospatial-Intelligence Agency and computational resources from the University of Minnesota and the University of Illinois, and ESRI/Amazon Web Services to make these results available.

Looking forward, Dr. Qualters noted that facilities are increasingly cyberinfrastructure-intensive, and that research advances are increasingly dependent on robust, reliable, and highly connective cyberinfrastructure. As examples, she noted the large hadron collider, luminosity experiments, and new modes of research. She noted the need to consider how these data will be used by researchers as this architecture is developed.

Dr. Qualters underscored the need for community input, to identify research needs and develop model pathways for cyberinfrastructure. She reported that a Dear Colleague Letter had recently been released by the AC-CISE; these results, which are public, are currently being analyzed.

Dr. Stieglitz described himself, Dr. Cynthia Suchman, Dr. Anjali Bamzai, and Dr. Michael Jackson as de facto Program Officers for cyberinfrastructure within OPP. He reviewed several current polar programs employing cyberinfrastructure. He reiterated Dr. Qualters’ definition of cyberinfrastructure, noting it embraces everything without which it could be difficult or impossible to answer the current complex science questions.

The first two projects Dr. Stieglitz noted, *Cyber-Knowledge Infrastructure for Geospatial Data* (Wenwen Li), and *Earthcube Building Blocks: Polar Data Insights and Search Analytics for the Deep and Scientific Web* (Chris Mattman), focus on improving searches, and utilize web-crawling, data mining and machine learning. Dr. Li’s project searches for data sets, while Dr. Mattman’s looks within these data sets. A project headed by Dr. Heather Lynch, *Earthcube Integration: ICEBERG: Imagery Cyberinfrastructure and Extensible Building-Blocks to Enhance Research in the Geosciences*, provides an entire workflow, from remote sensing through visualization and analysis. This project uses machine learning and high-performance computing (Blue Waters).

A fourth project, *Toward a Tiered Permafrost Modeling Cyberinfrastructure* (Irina Overeem), utilizes high-performance computing to look at thermodynamic problems. A web-portal has been created, at which researchers can input parameters, resolutions, data sets and the type of visualization sought. The work is performed by a Colorado supercomputer. Dr. Stieglitz noted this portal is powerful tool for both research and teaching.

The final project Dr. Stieglitz highlighted, *Scientia Arctica: A Knowledge Archive for Discovery and Reproducible Science in the Arctic* (Matt Jones), is funded through a small supplement and focuses on metadata recovery. The project utilizes machine learning to improve poor metadata sets submitted to the Arctic Data Center.

The OPP operates several data centers in addition to the NSF Arctic Data Center (www.arcticdata.io): The Polar Geospatial Data Center acts as the repository for the ArcticDEM project; social science data is housed at ELOKA. All Antarctic data is housed at the Antarctic Master Directory. The Interdisciplinary

Earth Data Alliance (IEDA) and the Biological and Chemical Oceanography Data Management Office (BCO-DMO) also serve Antarctic needs.

The projects are supported by OPP cyber and core programs grants, contributions from Earthcube and the Office of Advanced Cyberinfrastructure (OAC). These various sources of support provide approximately \$10 million per year in funding.

Dr. Stieglitz noted that OPP does not receive remote data in specific forms and at specific time intervals; the data received are very heterogeneous and require significant coordination with the PIs to receive. The Arctic Data Center works with PIs on metadata and data; the center strictly enforces a policy of only reviewing final reports after the PI has received a digital object identifier (DOI) number. Dr. Stieglitz reported that training is valuable; providing training to graduate students, regarding how to work with and manipulate data has worked well.

Dr. Stieglitz noted the importance of trust between the Arctic Data Center and PIs; PIs are sometimes reluctant to submit their data. Strictly enforcing data policies is critical to building and maintaining PI trust in the system.

Dr. Stieglitz identified several continuing challenges. These include determining how central the NSF Data Centers should be: whether they should serve as a hub for software development, or whether PIs should be supported to develop the software(s) that allow access, analysis, and visualization of data.

Another concern is determining how strategic OPP data centers should be. He noted that cyberinfrastructure grants differ from the typical NSF grant, in that they have specific deliverables for the community—usually software.

Other questions concern how data centers are connected. Two common strategies are to either develop a set of standards and connect those centers that meet these standards, or to develop a layer of translation between centers, which allow for connection without standardization.

The balance between domain experience and cyber expertise among PIs is not clearly known, nor is the role of the cloud in these efforts. Dr. Stieglitz noted that new techniques will be developed, and will have to be balanced against known processes, such as machine learning.

Dr. Heimbach noted that the presentations offered a glimpse of the breadth and challenges involved in these topics; the answers should focus on advancing scientific discovery.

Discussion

Dr. Heimbach began the discussion by asking AC-OPP members to consider whether it would be advisable to support a project that analyzes commonalities among various infrastructures, to determine how interoperability might be increased and streamlined.

Mr. Arnaudo referenced the slide showing the locations of campus infrastructure, and asked if these facilities are only located in the continental U.S. Dr. Qualters explained that NSF's annual investment of

approximately \$200 million is dwarfed by the investments made by universities and other agencies; she also noted that the awarded made to upgrade networking capabilities were competitive: applicants had to demonstrate that advances would be enabled through upgrades, which would not be possible without them. She stated that the current distribution of facilities is, in part, the result of these competitions, although some campuses invested in their own upgrades.

Dr. Manahan reported that he had read a commentary which suggested that rising tuition rates are a result of these investments in infrastructure. He asked OPP staff to describe what they would like to do, given advancing technology. He noted that debates about how and how much to invest had been ongoing since the invention of computing, and that universities are investing on their own, and asked about the role NSF would like to play.

Dr. Qualters noted a number of issues related to the question. She remarked that advances in networking require skill sets, in addition to equipment, and these skill set are often beyond the capacity of any single institution. She noted, as an example, security concerns and the skills to address them.

Networking awards require collaboration, and NSF seeks to pair larger and smaller universities. Dr. Qualters suggested that NSF is investing in community building. She noted a data award to Cornell, the University of Southern California, and the State University of New York-Buffalo; these institutions are seeking to address workload across all three campuses, and burst to the cloud if requirements exceed that capacity.

Dr. Qualters noted that the landscape of cyberinfrastructure is very complex, and that NSF is not seeking to optimize everything. She noted the value of having science reference cases, to guide investments, and efforts to work closely with all NSF Directorates, to better understand their needs.

Dr. Qualters remarked that data models must assume distributed data, in a hybrid cloud and non-cloud model. She also remarked that “the cloud” does not exist as a single entity. Researchers must be able to traverse all these data environments.

Dr. Lyons remarked that Polar and OPP have examples of the interplay of data management and trust. He noted the success of the Palmer Long-Term Ecological Research Project, through which different types of data were collected over 25 years, with all of it to be made available online within 2 years. This project has been well-managed and accessible. Dr. Lyons suggested that this and other OPP success stories might serve as models moving forward.

Dr. Stephenson asked if communities of polar scientists might apply for the cyberinfrastructure awards. Dr. Heimbach suggested such support might bridge gaps within disciplines and across disciplines. He noted that polar scientists in various disciplines work differently and collect different data, which are submitted to different data archives. He suggested that cyberinfrastructure could be brought to bear in this area, to help, for example, validate models. Dr. Heimbach asserted that polar science provides “showcase” applications and challenges for cyberinfrastructure.

Dr. Qualters replied that each research community has its own experience and strengths. She noted that astronomy perceives new opportunities to combine different types of data from different types of telescopes, as well as the goal of doing so quickly enough to guide a telescope to an area of interest.

Dr. Heimbach also noted the challenge of connecting data to analysis, and understanding the challenges at this stage, as well. He remarked on efforts to organize data in ways that new methods, such as machine learning, might best use them. Dr. Heimbach offered the examples of biology and weather forecasting as areas in which the appropriate equations are not yet known and different approaches are being tried to determine the best ways to use available data.

Dr. Qualters noted issues of workforce development, and preparing the workforce of the future; in this area, too, initial efforts are underway. Dr. Qualters underscored the challenge of using machine learning to conduct analyses for which there is no validation data. She noted very interesting approaches beginning to emerge in biology, and the need for disciplines to begin to learn from one another.

Dr. Stieglitz referenced Dr. Stephenson's question about support for polar scientists. He reported that polar PIs are funding in the areas of machine learning, workflows, and high-performance computing, but that a "critical mass" had not yet developed. Currently, individual grants are being funded; Dr. Stieglitz suggested the next step is to move beyond these, to better engage the cyberinfrastructure communities.

Presentation: Navigating the New Arctic

Dr. Simon Stephenson; Dr. Michael DeGrandpre

Dr. Lyons noted that "Navigating the New Arctic" was one of NSF's 10 Big Ideas, identified in 2016. Dr. Stephenson reported that the Big Ideas were developed by the Directorate leaders during the spring of 2016, and released to the public that summer. The goal was to support new ways of conceptualizing the NSF portfolio to supplement the core programs. Dr. Stephenson referenced a paper released by NSF, which introduced the Big Ideas and laid out the rationale for them.

Dr. Stephenson noted that the Big Ideas are not yet budget items. Last fiscal year (2017), the first funding was made available for convergent research. Big Ideas were invited to participate, and Navigating the New Arctic chose to participate. A number of cross-directorate staff created a Dear Colleague Letter, offering funding for workshops and for research coordination. Three projects in each area were funded for Navigating the New Arctic. Dr. Stephenson shared a slide of the funded projects; he noted that the awards address both transdisciplinary science and issues in the Arctic. He noted an inclination toward socio-environmental research, as well as a few technology projects.

Dr. Stephenson asked the AC-OPP to consider how Navigating the New Arctic might be advanced in the coming year. A few million dollars will be available, to support workshops, networks, and perhaps Early-Concept Grants for Exploratory Research (EAGERS). Dr. Stephenson noted that the Navigating the New Arctic had partnered with Convergence in 2017, and the goal of these efforts is to position the community to be capable of responding to larger opportunities, should they arise through further advancement of the Big Ideas.

Dr. Stephenson remarked that the previous approach might be repeated; a focus on sensors and sensor technologies has also been discussed, perhaps in partnership with Engineering or the CISE Directorate. Partnerships might be forged with other Big Ideas, such as Big Data or Mid-Scale Research Infrastructure. Dr. Stephenson noted that Mid-Scale Infrastructure would be relevant to any efforts to establish observing platforms. He also noted that partnership with Rules of Life might help advanced a focus on the biological components to the New Arctic.

Dr. Stephenson noted the Advisory Committee for Environmental Research and Education (AC-ERE) had suggested that NSF calls for proposals were overly constrained. This AC had suggested a broader invitation, for proposals related to the Arctic future, to allow the community to signal its interests and priorities.

Discussion

Dr. DeGrandpre shared his enthusiasm for the focus on the New Arctic. He noted the use of autonomous sensors in the Arctic environment, and that some technologies are becoming unusable as the Arctic changes, since the life cycle of sensors is shortened by the instability of the ice pack. Dr. Grandpre suggested a workshop or research coordinator network (RCN) focused on the development of new technology in autonomous sensors to operate in the Arctic, or an effort to promote field work with the technology currently available.

Dr. Grandpre noted that the Oceans Ops conference will be held in 2019 and will solicit white papers, which could help to promote and advance these ideas. He also remarked on the Forum for Arctic Modeling and Observational Synthesis (FAMOS), scheduled for October 2017 in Woods Hole, as another venue to advance these opportunities.

Dr. Falkner noted a recent NSF Request for Information on mid-scale infrastructure, which was defined by the National Science Board. These awards can be as large as \$70 million. A recent call asked for ideas regarding what might be done at this scale. Dr. Falkner encouraged submissions from the polar community; the NSF will receive these ideas and shape a program around it. This invitation was distributed through NSF listservs; she asked if there were additional ways to stimulate input from the community before the December 8 deadline.

Dr. Manahan also noted his support for the Big Ideas, and the inclusion of the New Arctic among them. He suggested a review of how science reacted to other big advances, to seek to identify how that science was most effectively advanced. He offered the example of the new focus on DNA, in the mid-20th century.

Dr. Manahan suggested that there might not be sufficient high-end training programs on managing big data for post-doc students, or increased access to advance observational studies. He noted that his institution instigated advanced-level training programs when the ozone hole opened, and these programs are now approaching 30 years of age. Dr. Manahan suggested perhaps a different, more formal training approach to, for example, developing models for arctic melt.

Dr. Heimbach noted that the New Arctic encompasses increasing environmental pressures, and perhaps safety pressures. He asked the extent to which sustained monitoring might become a requirement of

international laws. This might generate requirements for baseline measurements. He noted interest in understanding how the Arctic's complex systems are changing, and the need for a better understanding of the baseline, in order to advance that understanding.

Dr. Fuentes reported on the AC-GEO observation that Navigating the New Arctic requires interaction with Arctic communities, and that many scientists lack understanding about how to do this well. He suggested that funding might support workshops between native communities and scientific communities, noting that both scientists and residents of the Arctic will be needed to successfully implement any large-scale projects that might develop. Dr. Brachfeld reported that the emphasis on social sciences noted in the funded workshops was a result of the recognition of the need to engage communities.

Dr. Walker suggested combining forces with other funding agencies on large scale projects. He noted collaborations with the Academy of Finland and NERC, and the MOSAIC project, as examples.

Dr. Dixon noted the need to develop long-term relationships of trust with indigenous populations, and encouraged other AC members to support collaborations with social scientists who have worked in the Arctic.

Mr. Arnaudo noted the need to consider the international community. He reported that the Arctic Council includes representatives of indigenous communities. Collaboration and coordination among international and indigenous communities should be a component of the Big Ideas.

An AC-OPP member remarked on the very short time provided for a response to the 2017 Dear Colleague Letter, and asked if it might be appropriate to repeat that invitation, providing the community more time to thoughtfully respond. Dr. Stephenson agreed that this might be appropriate. He also noted his support for the consideration of indigenous communities.

In response to a question from Dr. DeGrandpre, Dr. Stephenson reported that the Dear Colleague Letter would have to be released in December or January, with a deadline 3 months later. He also noted that, while additional monies might not be available through the Big Ideas, collaborations across programs are possible.

Dr. Falkner noted opportunities for international collaboration, such as through the North Atlantic Alliance Agreement or the European Commission. She reported that a meeting with business, science, and government representatives, had included discussion of developing a "dating service" to link funding agencies and applicants.

Dr. Welker suggested that the AC-OPP should discuss ice-breakers; Dr. DeGrandpre agreed, noting the absence of this capability, and the need for ice-breakers, if research is to be conducted in the winter.

Dr. Falkner will add a discussion of ice-breaking capabilities to the agenda for the next AC-OPP meeting.

Strategic Planning - Part 1

Dr. Berry Lyons; Dr. Kelly Falkner

Prior to opening the floor for discussion, Drs. Lyons and Falkner reported on several topics impacting the AC-OPP:

AC-OPP liaisons to AC-GEO

Dr. Lyons noted that he and Drs. Fuentes and Dixon had served on the AC-GEO for the past 3 years; the AC-GEO supported a Polar Subcommittee, on which other AC-GEO members served. As the AC-OPP is reconvened as its own body, the question of how the AC-OPP will interact with the AC-GEO and the Geosciences Directorate arises. Four members of the AC-OPP will be appointed to serve on the AC-GEO, to assure these bodies are not working at cross-purposes. Dr. Falkner and other OPP staff will identify those liaisons; Drs. Lyons, Fuentes and Dixon will rotate off the AC-GEO.

Scheduling to advance collaboration with other ACs

Dr. Falkner noted that the current AC-OPP meeting was held adjacent to the AC-GEO meeting. She noted a program goal of scheduling AC-OPP meetings adjacent to the meetings of other committees to facilitate joint discussions.

Updates to *Dynamic Earth*

Dr. Lyons reported that the AC-GEO had produced a document, *Dynamic Earth*, intended to outline a path for addressing issues of scientific interest in the period 2015-2020; they have decided to develop an addendum, updating some of the ideas in the document. Some members of the AC-OPP may be involved in this project; Dr. Lyons encouraged all AC-OPP members to read the *Dynamic Earth* document; those invited to participate will be contacted in the coming months. The project will also include outreach to the scientific community.

Dr. Lyons noted that the AC-OPP had developed similar strategic documents when it was previously convened. Dr. Falkner reported that these documents were made available to the AC-GEO, to inform *Dynamic Earth*. She also suggested that the AC-OPP may want to review and update these documents.

Dr. Falkner noted that the AC-OPP should feed into strategic plans across NSF. As an example, she noted that OPP has had input into the “Windows on the Universe” Big Idea related to astrophysics. Dr. Falkner underscored the need to clearly identify OPP’s priorities and the reasons for them, in order to communicate these to other groups within NSF and to Congress.

Dr. Lyons again encouraged AC-OPP members to review *Dynamic Earth*. He reported that it includes several polar-related topics, included high latitude ecosystems and data issues.

Strategic Planning

Dr. Lyons opened the floor for discussion of strategic planning.

Dr. Manahan suggested that AC-OPP members “blue sky” their hopes for the polar programs, noting uncertainty in many areas, including national support for science. He reported that he had joined the AC to think about polar issues in new ways—he remarked that people ask him less about seeing penguins and more about the collapse of ice sheets these days, and asserted that the AC should be addressing polar issues on a larger scale than before.

Dr. Falkner noted the broad responsibilities of OPP, divergent interests and issues. She also asserted the need to articulate the most important ones in a concise fashion. Dr. Falkner remarked that members of Congress want to be assured that people with expertise have considered and come to agreement about these priorities.

Dr. Manahan noted that several the Big Ideas interact with polar programs, and asked for more information about how they were developed and how they might be implemented. He noted their breadth and the insight behind them.

Dr. Welker agreed on the value of thinking big. He suggested some attention to visualization as a means to share information about the Polar Regions and to help people engage with Polar Regions.

Dr. Flanner noted the importance of international collaboration, particularly for Polar Regions. He remarked on several large ongoing efforts, and a lack of clarity regarding how NSF might engage with them.

Dr. Stieglitz remarked that the ways a sensor network is deployed will determine the questions that can be answered by that data. He suggested attention to questions regarding how to determine where and how to deploy sensors in the next 5-10 years.

Dr. Heimbach reported that the National Academy of Sciences will be releasing a report on sustaining ocean observations. He noted the value of long-term data sources, and providing future generations the ability to understand the impact of decisions being made currently. He asked whether NSF had the ability to take a long view and to consider benefits that may accrue in 20 years, rather than in the current funding cycle.

Dr. Manahan noted his interest in being informed about the interaction among the various agencies in the U.S., and between the U.S. and other nations. Dr. Flanner shared his impression that collaborative arctic research is conducted in a piecemeal approach; he agreed that a “dating service” might be helpful.

Dr. Stephenson reported that the Interagency Arctic Research Policy Committee (IARPC) that addresses arctic issues has become more active, and released its second 5-year plan in December 2016. He noted that the plan does not focus on the full gamut of what agencies do in science, but instead, the places where collaborations occur.

Dr. Stephenson remarked that the plan addresses some areas, such as atmospheric sciences and ocean research well, while other topics, such as collaboration with the Arctic Council and similar groups, are less well addressed. A new section addresses coastal resilience. Dr. Stephenson reported that the NSF Director chairs IARPC, and has advanced education, including STEM education, about the arctic.

Dr. Falkner noted the wide number of topics raised. She raised international and interagency partnerships as an example, and challenged the AC-OPP to consider other ways OPP might spend its partnership capital effectively. She asked the AC-OPP to consider partnerships with the business world, and invited Dr. DeGrandpre to discuss a recent award.

Dr. DeGrandpre reported that he had won a privately-funded ocean pH sensor competition. He noted that the competition itself was expensive—the funders spent nearly \$10 million to hold the competition. He noted that these kinds of opportunities are rare.

Dr. Falkner asked if NSF might play a role in encouraging more competitions like this one. Dr. Heimbach noted that the transportation industry would have interest in the Northwest Passage, as it opens. Data regarding the best route or the best timing would be needed. Another AC-OPP member suggested cruise ships and the tourism industry might have similar interests.

AC-OPP members discussed the need to balance a focus on important science questions with potential industry interest, and explored areas of potential overlap. Dr. Heimbach reiterated that transportation and tourism industries have interest in ice coverage; Dr. Falkner reported that satellite manufacturers in Britain are funded space weather programs. Dr. Manahan remarked on the costs incurred when an oil rig was recently grounded; industry might indeed be interested in funding the science that might prevent these losses.

Dr. Stephenson remarked on a previous comment regarding NSF support for long-term commitments; he noted that biological sciences have undertaken long-term projects; LTER, for example, is intended to continue for 50 years.

Dr. Manahan suggested that observing schemes are always valuable. He noted the importance of long-term monitoring, while acknowledging the need to think carefully about where to monitor.

Dr. Lyons asked if the AC-OPP wanted to review the current documents as a means of thinking about the future. He noted, in addition to the documents previously mentioned, a National Academy of Sciences report on the Antarctic and the Southern Ocean, as well as the Scientific Committee on Antarctic Research's plan.

Dr. Manahan remarked on sea level change, noting the high levels of uncertainty and the lack of predictive ability. He noted that significant work remains regarding modeling and observation. He suggested attention to the feasibility of developing observing systems to improve our understanding of sea level, including in Greenland.

Dr. Lyons noted that AC-OPP members might review the existing documents; he asked what potential next steps might be. Dr. Lyons also noted suggestions to consider links between OPP and the Big Ideas. Dr. Lyons noted that he would like AC-OPP members to have identified “homework” by the end of the meeting, which would be completed before the AC-OPP convenes again.

Dr. Fuentes asked that the reports mentioned be made available to AC-OPP members; Dr. Backe will send links to all the relevant reports.

Preparing for discussion with the NSF Director

Dr. Lyons noted that the NSF Director would be meeting with the AC-OPP the following day; he reported that the AC-GEO generally prepared questions to pose to her, and suggested that the AC-OPP do the same.

Dr. Lyons noted that the Director might have a presentation for the AC-OPP, but would likely take questions, and he invited AC-OPP members to consider what they would like to ask.

AC-OPP members held a preliminary discussion of questions for the Director; they were invited to think further overnight. The questions would be refined and assigned to specific AC-OPP members in the morning.

The meeting adjourned for the day.

Friday, October 20th

Strategic Planning - Part 2

Dr. Berry Lyons; Dr. Kelly Falkner

Dr. Lyons convened the second day of the AC-OPP Fall meeting; he invited Dr. Mossey, who had not attended the previous day, to introduce himself.

Advisory Committee members finalized the questions to pose to the NSF Director, and the individuals assigned to pose each. They then turned to the topic of Strategic Planning.

Dr. Lyons noted that links to two NAS documents had been distributed to all AC-OPP members. He reported that he and Dr. Falkner had agreed that a review of these documents, produced and vetted by the community, might serve as a good first step for strategic planning. He suggested a subcommittee might be convened to produce an outline of the highlights of these documents, and to provide input into any identified gaps. The subcommittee would report to the AC-OPP at the next meeting, with the intent that the AC-OPP would produce a document highlighting the priorities identified.

Dr. Falkner noted that this effort might serve to provide input to the October 25-26, 2018 Arctic ministerial, at which the NSF Director will present U.S. priorities.

Dr. Heimbach asked how broad the review should be; he noted documents produced by Lloyds of London and the U.S. military. Dr. Lyons replied that the subcommittee would determine the breadth of its review. He noted that AC-OPP documents from 2013 would also be made available.

Dr. Falkner remarked that the 2013 AC-OPP documents had been widely vetted, and include input from SCAR and other relevant committees. She suggested the subcommittee might seek to identify AC-OPP priorities for some pre-determined time limit, say for example from the past 5 years.

Dr. Manahan expressed his willingness to participate. He asked about the breadth of the review to be conducted, and suggested that the subcommittee might be comprised of 3-4 AC-OPP members. Dr. Lyons agreed the subcommittee should not be large; he left the definition of its scope to the subcommittee. Dr. Manahan noted the need to assure that several disciplines and both poles are represented.

Subcommittee membership was finalized: Drs. Manahan, Flanner, Stearns, Heimbach, DeGrandpre, and Viereggs.

Dr. Fuentes noted that he had been involved in strategic planning processes at the university level, and that the process at NSF differs from these. He noted the mission of NSF is to support the best ideas identified via research proposals, and asked how that approach was balanced in a strategic planning process.

Dr. Falkner replied that NSF only has a single strategic plan—the overall NSF Strategic Plan. This document is submitted regularly and widely vetted. She noted that the NSF Strategic Plan should be reviewed, to assure that any AC-OPP strategic planning fits within this umbrella. She noted for all bodies within the NSF to “speak with one voice on strategy; anyone speaking with divided voices risks a fall,” she remarked.

Dr. Falkner reported that a number of communities are engaged for advice, particularly regarding funding decisions that need to be made with short notice. She suggested the AC-OPP might help to coordinate a signal to the community, so that they are cued for potential funding opportunities. She also noted the need for the AC-OPP to inform the *Dynamic Earth* document, under revision by AC-GEO.

Presentation: Antarctic Infrastructure Modernization for Science (AIMS)

Dr. Christopher Mossey; Ms. Stephanie Short; Mr. Ben Roth

Ms. Short announced that the Antarctic Infrastructure Modernization for Science (AIMS) project is currently in its final design phase, with construction scheduled to begin in 2019. She described the AIMS project as a significant investment in McMurdo Station, which will touch every part of the station, and noted the need to assure stakeholders have the information they want and need as the project advances.

McMurdo Station was established in 1955, and is the largest of the permanent U.S. stations in the Antarctic, at 164 acres. McMurdo supports research and serves as the logistics hub for work at field sites and South Pole Station. McMurdo station has grown over time, and is now comprised of 85 buildings.

The AIMS Project will improve operations at McMurdo Station by providing greater flexibility and resilience for future research, enhancing safety and improving operational and energy efficiency, and providing facilities and infrastructure that reflect the active and influential presence of the U.S. in Antarctic science.

Mr. Roth provided an overview of the seven major projects within AIMS:

- The central services facility will provide a dining room, kitchen, conference rooms and lecture space.
- A field science support facility will provide space for training, outfitting, and equipping field researchers before they go out in the field. This facility will also provide space for researchers and grantees to calibrate or make minor repairs to their equipment.
- An emergency operations center will include a fire station, medical clinic, and recreation facilities that include a full-sized gym which will also serve as an emergency berth.
- An Industrial Trades Center will include the shops necessary to support the station, maintain station facilities, and support field camp capabilities, including antennae riggers, storage, and

retrieval. The field camp energy equipment and facilities (solar and wind) will also be housed in the Industrial Trades Center.

- The Vehicle Equipment Operations Center will address maintenance and repair needs for all engines on station, including trucks, snow moving equipment, snow mobiles, and generators.
- A new lodging facility will provide 280 rooms, and will include both single and double rooms.
- New utility systems will be installed, to address power, water, fire protection, telecommunications, and waste water. These systems will improve station redundancy and support the new construction.
- Demolition will occur throughout the project. Buildings will not be taken out of service until all their functions are replaced.

Mr. Roth reviewed the AIMS schedule, noting that construction and demolition projects are phased to minimize their impact on science. As a result, the project will extend into 2028. Mr. Roth invited advice from AC-OPP members regarding strategies for sustaining communications with the scientific community throughout the several stages of AIMS.

AIMS stakeholders range from Congress to universities and grantees, including grantees from other agencies. Other external government agencies, including NOAA and the Space and Naval Warfare Systems Command, are also impacted by AIMS.

Mr. Roth reviewed the process for inviting and receiving community input into the project. In 2011, NSF released a community questionnaire, from which more than 200 responses were received. Briefings with other U.S. Antarctic Program Federal Agencies were also held. In 2015, NSF engaged in an 11-month process of town-halls and WebEx gatherings, which engaged more than 450 community members. Four charrettes were held, to develop the initial concepts for AIMS, and updates on the status of AIMS were provided on station and at national conferences. Programming and design documents were developed with tremendous input from the field.

A website, www.futureUSAP.gov, has been established to highlight future U.S. Antarctic Program infrastructure plans and activities.

Mr. Roth noted that AIMS community feedback has been extremely valuable in established field support requirements, clarifying material and process flows, and identifying opportunities for efficiencies. Community input also allowed NSF to better understand the need for increased bandwidth at the station.

AIMS stakeholder involvement will continue throughout the 10-year construction timeline. Updates will be provided on the website, and webcam feeds will provide real-time visuals of the construction process. Briefings will be provided on-ice and at scientific conferences and other venues. Program participants will be provided constructions walkthroughs, to enhance their understanding of the project.

The floor was opened for discussion, with an invitation for AC-OPP members to provide advice and feedback on ways to sustain stakeholder outreach throughout the AIMS project timeline.

Discussion

Dr. Mossey commended the AIL staff on conducting substantial outreach with diverse stakeholders. He asked for further information regarding the messaging that NSF seeks to convey to its various stakeholders—Congress, the Office of Management and Budget (OMB), the scientific community—over the next decade.

Mr. Roth replied that a large number of agencies and programs were engaged in advance, in order to assure the AIMS design was appropriate. He noted that the focus moving forward is on keeping stakeholder informed of project progress. Ms. Short noted that all stakeholders will be impacted in some way by the construction, as it reaches across the entire station. Staff seek to keep these stakeholders apprised of what is happening, when it will happen, and why it is happening. She noted the need for stakeholder assistance in minimizing the impact of construction through advance planning.

Mr. Roth noted that the scope of the AIMS project has been determined, in part by budget constraints. The NSF is aware of additional requirements for the Antarctic Program, and intends development beyond AIMS. They are seeking to develop a communications strategy that will address the phases of the AIMS project, communicate the critical mass of requirements that it addresses, and assure the community of continued development.

Dr. Manahan shared his perspective, as a scientist who has worked at McMurdo Station. He reported that he felt the community understands the need for the project, but remains concerned about the impact of potential budget glitches. He asserted that “there is resilience, but not complete buy-in,” to AIMS among the researchers at McMurdo.

Dr. Mossey asked if there were concerns that NSF is not fully behind AIMS. Dr. Manahan replied that there was a wide-spread understanding that the project was required, and in that sense, the community is fully supportive of it. He also noted confidence within the community that NSF will “get it right,” as they did with South Pole Station.

Dr. Mossey asked if specific engagements with Congress or OMB were needed to maintain confidence and momentum among these stakeholders. Dr. Manahan noted the need to communicate why the science supported by McMurdo is essential.

Dr. Mellish remarked that it was not essential to engage the community “in the minutiae” in order to convey NSF’s commitment to the project. She noted the need for program directors to have accurate, informed, and timely information to share with PIs, in order to help them plan. Dr. Mellish suggested that AIL staff “communicate to the point of overkill” with program managers.

Dr. Lyons added contractors to the list of those who require ongoing updates. He noted that PIs will require the information necessary to make their requests for equipment and supplies, and that contractors will need information to fulfill those requests. Dr. Lyons noted the frustration felt by PIs who arrive on-ice to discover they don’t yet have what they need.

Dr. Mossey noted the third goal of the AIMS project—to establish “facilities and infrastructure that reflects the active and influential presence of the U.S. in Antarctic science.” He suggested that this point might be important to underscore in engaging Congress.

Ms. Short agreed, noting that this goal would also be important to other groups, including OMB. She noted the focus on developing attractive buildings that will serve as entryways to Antarctic research. Mr. Roth described the facilities as “reflecting the stature” of the U.S. and NSF presence, and to convey the importance and professionalism of the U.S. scientific community.

Mr. Arnaudo asked about the provision of wind and solar energy. Mr. Roth replied that smaller scale wind and solar generators are envisioned for use at field camps, to avoid the transport and use of generators. The AIMS project includes the development of the interface necessary to introduce wind or solar generators. These generators themselves are not currently part of the AIMS project.

Dr. Falkner noted that no one present had experienced the South Pole rebuild. She reported that area-based user-groups sponsored by the previous contractor are no longer extant. There are reasons that such groups probably should not be sponsored by the contractor. It is likely some sort of such a group would be beneficial for AIMS. Dr. Falkner suggested the AC-OPP might be involved in developing these groups in the form of a sub-committee to ensure an ongoing community voice as the project advances. She also suggested that persons involved in the South Pole rebuild might be invited to participate and to identify lessons learned.

Dr. Falkner remarked on periodic NSF reviews, which incorporate multiple layers of stakeholder input. OPP will be expected to respond to these.

Dr. Mossey summarized the discussion, noting the importance of assuring that the community understands the station’s capabilities at each stage of the project, as well as the capabilities planned at AIMS completion. He suggested that a strategic communication and engagement plan be developed to identify critical messages to various stakeholder groups, as well as specific moments of opportunity for engagement and communication. He commended the group for thinking about these issues in advance.

Presentation: Community Engagement in Research in Alaska

Mr. Craig Fleener; Ms. Renee Crain

Ms. Crain thanked AC-OPP members for inviting the presentation on community engagement in Alaska. She noted that she is originally from Wyoming and grew up hunting, fishing, and picking berries. She studied Political Science in Florida, then moved to Alaska for graduate school. She began to understand the importance of community engagement while studying adaptations of birds in Alaska. She remarked that, while it is typical in the DC area to introduce oneself with one’s position and place of work, different styles of introduction are appropriate among Alaska native communities, as a means of beginning to build relationships.

Mr. Fleener remarked that this style of introduction is more interesting than his resumé; he noted that he grew up living and learning traditional ways of life in Alaska, and was sent to college by his elders. He had

been conducting research on moose and salmon in the Yukon Flats, and the elders believed his work would have greater impact if he earned a degree. Mr. Fleener noted that his community believes this approach, of combining traditional ways of knowing with college education in scientific methods can be effective. He noted that this dual approach removes the need for translation, because it builds familiarity and skills. He noted the importance of nurturing young people to advance Arctic science.

Ms. Crain referenced documents provided to AC-OPP members. She noted these were divided into three resource categories: community engagement, principles for the conduct of research in the Arctic, and the September 2016 Arctic Science Ministerial report. The principles of conduct have been developed by NSF, and address the expectations of those supported by NSF funds who are working in the Arctic. The community engagement resources were developed by the Arctic Research Consortium of the U.S. (ARCUS), and provide guidance on conducting community engagement.

Ms. Crain shared the ARCUS website in order to highlight the names of indigenous people and organizations who co-produced these resources. She noted the increasing co-production of knowledge by indigenous peoples and scientist, who may or may not be indigenous themselves.

The Interagency Arctic Research Policy Committee (IARPC), created in 1984, brings together all the federal agencies involved in Arctic research. NSF chairs the IARPC, which developed principles and guidance for engaging northern communities. Ms. Crain noted that the current principles were developed some years prior and do not include newer perspectives. Ms. Crain is co-chairing a subcommittee of IARPC which is working to update these principles.

Ms. Crain presented a slide of NSF field locations in one year, followed by a slide of Alaska communities. She noted that all NSF research is conducted close to communities, some quite small, of people who engage in subsistence hunting and gathering.

Ms. Crain noted that informing communities of ongoing research is the lowest level of engagement. Dr. Anna Kerttula de Echave, Program Director, Arctic Social Sciences, in OPP has developed a program to transform research projects and support the co-production of knowledge with indigenous communities. Ms. Crain noted that indigenous communities will be engaged in the revision of the Principles for the Conduct of Research in the Arctic. She also noted "The Power of Multiple Perspectives," a book chapter written by one of Dr. Kerttula's PIs, as an example of the growing body of knowledge about these communities.

On September 28, 2016, the White House convened 25 governments to discuss research in the Arctic at the Arctic Science Ministerial. Representatives from Alaska and Arctic indigenous communities were invited to participate. Mr. Fleener promoted a pre-ministerial briefing between Arctic Indigenous Leaders and the U.S. delegation, to inform the U.S. delegation of their priorities and concerns.

Mr. Fleener noted that true engagement of indigenous communities is an ongoing struggle, because of the constant flow of new researchers entering the area, without a full understanding of the principles of engagement. He noted that State and Federal agencies are making good efforts, and remarked on the need to "keep the pressure up," to improve these processes.

Mr. Fleener noted that research has advanced from informing indigenous communities about ongoing research to engaging indigenous communities and finding ways to incorporate their knowledge. Mr. Fleener remarked that more than a paragraph is required to weave thousands of years of information into the scientific knowledge that is developed.

Mr. Fleener remarked on the opportunities provided by the Arctic Science Ministerial. He acknowledged the value of the day allotted to discussions with indigenous people, but noted that the conversation did not go “all the way,” in that it did not document indigenous peoples’ vision of the future of research. Mr. Fleener suggested this exploration might form the second phase of the ministerial, and a companion document to what has already been published.

Dr. Falkner thanked Mr. Fleener and Ms. Crain for their presentation; she noted that the NSF Director would join the AC-OPP after this presentation, and that the AC-OPP intended to discuss community engagement with her. Mr. Fleener suggested that the AC-OPP invite the Director to consider what could be done to seek the next generation of indigenous science researchers. He also noted that each country invited to the ministerial published a 2-page report on their ongoing research and equipment, and their research goals. He suggested an additional 2-page report might be invited from indigenous communities, to address their goals and vision and lay the groundwork for partnerships between indigenous communities and other nations.

Discussion

Dr. Fuentes commended Ms. Crain and Mr. Fleener on the presentation, and noted that he had heard similar comments during his work with communities in and near Barrow, Alaska. He invited the group to discuss the mechanics of forging relationships with indigenous communities, and building links between researchers and communities that could be developed into partnerships. Dr. Fuentes reported that he generally invites children from indigenous communities to visit his sites and touch the balloons; he also generally talks with community teachers, regarding the research that he is conducting. He noted, however, that he does not know how to extend these relationships further.

Dr. Dixon agreed that the problem is difficult; he suggested that developing power-sharing in research may be important to extending community engagement. He noted the need to acknowledge the role of indigenous people in research, beginning with the incorporation of indigenous ideas and concepts in proposal writing.

Dr. Dixon noted the need to build trust and respect over a long period of time, and remarked that this can be difficult for researchers, particularly those who are not familiar with social sciences. Dr. Dixon asserted that a large investment is required from researchers, and that researchers who are not ready to make the investment will not achieve true partnerships. Dr. Dixon noted his own experience in long-term projects, and suggested that the effort required for community engagement has been underestimated.

Ms. Crain agreed, noting conversations within IARPC regarding engaging indigenous representatives in research planning, hiring indigenous people if possible, and visiting indigenous schools. Ms. Crain noted that Alaska is home to more than 230 recognized tribes, which vary in culture and structure. She acknowledged that this can be overwhelming, and noted that the ARCUS website collects and organizes

information for researchers. She commended a video, available on the website, on conducting community engagement. She also noted that indigenous communities are making it easier for researchers to engage.

Ms. Crain remarked that relationships and partnerships are developed over time, and noted the value of indigenous partners. Ms. Crain offered the example of permafrost monitoring, and remarked that indigenous communities are in the perfect position to assure the data are flowing, sensors are operational, etc. Ms. Crain noted that researchers can and should “stretch themselves.”

Dr. Vieregg noted that she has never worked in Alaska, and that she would have no idea where to begin, if she were to propose a project there. She asked if NSF provides support at the proposal-writing stage, for researchers seeking to develop relationships with indigenous communities.

Ms. Crain reported that NSF has an Arctic Research Support contractor who can provide help with ways to engage indigenous communities, and how to hire community representatives, bear guards or liaisons. She noted that researchers are encouraged to include travel funds to conduct outreach before and after research in the field. Ms. Crain remarked on the importance of conducting follow-up with communities, presenting findings in ways that are accessible to these communities. She underscored that NSF is willing to support these kinds of activities. She noted that she believes the scientific community is on the right track, even as more is needed, including developing systematic ways to develop indigenous scientists.

Dr. Mellish remarked that researchers in the Pacific research corridor also deal with the challenges of community engagement. She commended NSF efforts to support community engagement. Dr. Mellish remarked that the North Pacific Research Board requires PIs to propose a plan to work with communities that will be impacted. She noted that engagement can include everything from presentations to indigenous communities to hiring locals on the research team. She noted that indigenous representatives can be invited to join trips as observers. Dr. Mellish acknowledged that this engagement can be difficult, due to distrust between communities and researchers; she also remarked that she has perceived a shift in the intention of PIs to engage communities, and shared her belief that a real change has begun, that the work of NSF and others will pay off in the coming years, as partnerships with indigenous communities become the way in which research is conducted.

Ms. Crain agreed, noting that the international community can also provide guidance, as researchers in Greenland and Canada also seek to partner with indigenous peoples.

Dr. Fuentes noted the challenge of developed long-term, sustained relationships with communities, when NSF funding does not often support long-term research. He asked if the AC-OPP might offer a recommendation to NSF that researchers who work in the Arctic participate in workshops with staff like Ms. Crain, who can guide them to resources and advise their efforts.

Dr. Dixon stated that partnerships, including power-sharing, are more necessary than collaboration. Rather than, for example, sending a copy of a publication to a community, Dr. Dixon said his team flies indigenous representatives to their labs, so they might observe and ask questions about how the work is conducted. He suggested that indigenous students might be funded under internships or fellowships, which might segue into university admissions. He asserted that engagement must extend beyond putting local people into specific roles (e.g., bear watchers), to engaging local communities to become more

involved. He acknowledged that these efforts can be expensive and can be challenged by local politics. Dr. Dixon suggested teaming up with social scientists or native communities which are already involved in these relationships, if a researcher does not have these relationships as they begin.

Dr. Falkner remarked on the Alaska Native Science and Engineering Program (ANSEP), which works with students across the state, beginning in elementary school and through advanced degrees and career placement. She reported that many federal agencies and companies sign up to employ ANSEP students, and suggested that a speaker might be invited to address the AC-OPP regarding how this cadre of students might be connected to OPP PIs, as another pathway for engagement.

Dr. Mellish called ANSEP a “wonderful program,” and noted that entry is competitive. ANSEP is not limited to native students, but does provide them preferential entry. The program begins as early as 5th or 6th grade. Dr. Mellish reported that students in the Anchorage School District are released for 3 weeks to participate in ANSEP. Students are brought to campus to stay, study, and meet and learn from scientists.

Dr. Falkner remarked that Alaskan communities have the highest number of ANSEP students who have gone on to earn doctoral degrees in scholarly areas.

Dr. Manahan supported the need to engage communities, but suggested the focus should not be on the PI. He cautioned again against adding more to the PI’s work load, and instead suggested exploring those programs that are very successful at community engagement, and seeking to learn how they do so. He also suggested that a science and technology center model might be effective. Dr. Manahan noted that 50 percent of students in science and technology drop out of those fields after their sophomore year, and suggested that researchers are approaching the limit of what they can be asked to do.

Ms. Crain suggested that the issue be approached in many ways. She noted that community engagement is a passion for some researchers, who want to spend their time and energy creating partnerships.

Dr. Dixon noted the value of institutional support, noting that archeologists made similar arguments against community engagement 30 years ago. That field changed as NSF and other funding agencies became more receptive to the efforts required to engaging communities, and made more resources available to support those efforts. He noted that indigenous communities in the Arctic have established avenues for researchers to use in connecting with these communities.

Dr. Dixon asserted that PIs need to be sensitive to these requirements, and to think about community engagement from the beginning of their project. He noted that researchers often want to work on native-owned land, or land that has traditional uses; increasingly, community engagement is required for this work to move forward. He also noted increasing willingness to support community engagement efforts, and suggested a hybrid approach was probably most appropriate across all federal agencies.

As the discussion concluded, Ms. Crain reiterated Mr. Fleener’s remarks about developing a follow-up document on the Arctic Ministerial, and taking a pipeline approach to developing indigenous researchers.

Meeting with NSF Director and Chief Operating Officer

Dr. France Córdova, Director; Dr. Joan Ferrini-Mundy, Chief Operating Officer; Mr. Brian Stone, Chief of Staff

Dr. Lyons welcomed Dr. Córdova to the AC-OPP meeting; AC-OPP members in the room and on the telephone introduced themselves. Dr. Córdova introduced Dr. Ferrini-Mundy, who served as the Assistant Director for the Education and Human Resource Directorate prior to becoming Chief Operating Officer.

Dr. Córdova noted that this was the first meeting of the reconvened AC-OPP, and she thanked AC-OPP members for agreeing to serve. She noted that NSF values the expertise members bring to the advisory committee, and remarked that peaceful and productive work in the poles is necessary to assure the best science and for help in keeping the world safe. She noted that she looked forward to getting to know each of the AC-OPP members.

The floor was opened for questions from AC-OPP members.

Support for International Engagement

Dr. Flanner thanked Dr. Córdova for taking time to meet with the AC-OPP; he noted that several members had remarked on the importance of international collaboration in the polar programs, particularly in the Arctic, where an increasing number of research efforts contribute to a “Wild West” feeling. Dr. Flanner suggested that coordination of these efforts could increase the sum of the parts, and asked Dr. Córdova if mechanisms are in place to better foster international collaboration. Dr. Flanner offered the Arctic Science Ministerial as a potential example.

Dr. Córdova agreed that international engagement and collaboration is extremely important; she noted that one of her first acts as NSF Director was to grant status to the Office of International Science and Engineering, and to hire Dr. Rebecca Spyke Keiser to head that office. Dr. Córdova suggested Dr. Keiser might be invited to speak to the AC-OPP; Dr. Córdova noted that Dr. Keiser is revitalizing policies for international engagement.

Dr. Córdova identified four drivers for international engagement, noting that NSF lacks sufficient bandwidth to work with every country. These four drivers are:

- 1) Mutual benefit for all partners.
- 2) True intellectual collaboration with international partners, founded on strong intellectual foundations in each country.
- 3) Benefits to be realized from expertise, specialty skills, facilities, sites, and/or resources of the international counterparts.
- 4) Active research engagement of students and early career researchers in the U.S.

Dr. Córdova reported that NSF works well with the State Department and the White House on international engagement. She referenced the Arctic Ministerial as an example, and noted that she had also attended a meeting convened by the Office of Science and Technology Policy (OSTP) in September 2016; the next such meeting will be held in Berlin in October 2018—Dr. Córdova will attend as the U.S. representative.

Dr. Córdova remarked that she had co-chaired the science portion of the 2016 meeting with the Russian representative, and that the meeting had included a day devoted to engaging native communities in the Arctic. Dr. Córdova remarked that this gathering was well attended, that the messaging from the native communities were clear and well-received, and that she believes this gathering represented a strong start that will continue in Berlin.

Dr. Córdova noted that she chairs IARPC, which she described as both an important engagement among multiple U.S. agencies, and part of the National Science and Technology Council (NSTC). She reported that the next IARPC meeting will be held at the White House November 16, 2017. Dr. Córdova noted that the meeting will allow for a review of work done previously, and consideration of a strategic plan to guide future work.

Maintaining Leadership in the Scientific World

Dr. Lyons remarked that AC-OPP members had expressed concern about maintaining U.S. leadership in the scientific world, given budgetary restrictions and anti-science attitudes among U.S. citizens; he asked Dr. Córdova to speak to how NSF might maintain that leadership.

Dr. Córdova replied that maintaining such leadership is the collective mission of NSF. She noted the need to strengthen communication to multiple audiences, beginning with the public, and including Congressional representatives, so that the work of NSF and its value to the nation's future is understood, and the next generation is prepared to continue that leadership. Dr. Córdova noted the need to communicate the value of past accomplishments, and remarked that polar programs offer many strong examples. Dr. Córdova reported that the *Green Book* includes some of this discussion, and that she would assure AC-OPP members receive copies. She described the *Green Book* as a small brochure that nonetheless captures current work and the reasons this work will matter to the nation's future.

Dr. Córdova also remarked on the efforts of the Office of Legislative and Public Affairs (OLPA), and recommended OLPA's website to AC-OPP members. She noted video available on the website, discussing how NSF benefits national security, health, and the economy. She remarked that these videos provide helpful illustrations when NSF staff make presentations on the foundation's work.

Dr. Córdova recommended that the AC-OPP invite Amanda Greenwell, Office Head of OLPA, to speak to the group about the resources available for those speaking to Congress. She noted that legislators appreciate examples of developments occurring in their district, as well as visits to institutions where the work is being done. Dr. Córdova described legislative communication as a "contact sport," and noted the need to strengthen relationships with contacts in Congress. She asserted that NSF has strong stories to tell, and needs only to develop the opportunities to tell them.

Community Engagement

Dr. Fuentes noted enthusiasm among AC-OPP members for NSF's Big Ideas, especially Navigating the New Arctic and the attention to community engagement in research. He asked Dr. Córdova to discuss how long-term community engagement might be forged and embedded in the research, interpretation, and dissemination of results, particularly when NSF only provides funding for a few years at a time.

Dr. Córdoba agreed that standard proposals do not fund long-time projects. She noted, however, that the Big Ideas are seen as convergence ideas, and that the foundation understands that time is required to bring different communities or disciplines together. NSF is seeking to identify and structure support for these interchanges, recognizing that it can take a few years for groups to understand one another before they can develop a plan for convergence research. She suggested these efforts might require 7-10 years, or even longer, and stated that the agency is seeking ways to change how research is funded.

Dr. Córdoba reported that a Dear Colleague Letter was released in the Spring, inviting convergence proposals. She noted that convergence differs from interdisciplinary research, in that convergence seeks to identify mutual goals and results. She noted the need for NSF to examine the ways in which it provides funding, in order to assure the funding mechanisms meet the needs of how current research is conducted.

AC-OPP Strategic Planning

Dr. Vieregge reported that the AC-OPP had discussed the Big Ideas, and had also discussed strategic planning. She asked how the AC-OPP should incorporate the Big Ideas in their planning, what role these ideas should play in the AC-OPP process.

Dr. Córdoba replied that the relationship between strategic planning and the Big Ideas was up to the AC-OPP, which is charged with looking at the future of the polar programs. She offered an example from biological sciences, reporting that this advisory council felt the Rule of Life outlined important questions to answer, from the genome to epigenome to phenome. This advisory council broke into small groups, each of which was tasked with considering the problems in different areas of biology, and how they might converge in the Rules of Life. As a result, the entire Directorate has adopted the Rules of Life as a structure.

Dr. Córdoba suggested the AC-OPP look closely at the Big Ideas, and determine what parts of them fit within the polar programs. She noted that some might fit better than others, and some many not apply at all. Dr. Córdoba briefly discussed the ways some of the Big Idea might impact polar programs, concluding that most of them would likely touch the arctic in some way.

Addressing Sexual Harassment

Mr. Kosseff reported that the AC-OPP had received a presentation and held a discussion on sexual harassment. He noted the challenges of the environment, and multiple institutions working in polar programs. He reported on preliminary discussion about prevention or early intervention strategies to address harassment at the sites, and asked about opportunities to benchmark best practices across the disciplines. Mr. Kosseff suggested, for example, an ombudsmen position stationed off-site, who might guide individuals on the ice to mitigate issues before they escalate.

Dr. Córdoba began by asserting that NSF does not tolerate any form of harassment at any sites. She noted the ODI, and suggested that ODI staff might present to the AC-OPP at some point. Dr. Córdoba reported having met with ODI the previous day, and that this is the office that addresses complaints and may have resources regarding the prevention of harassment.

Dr. Córdoba noted that universities are held accountable under Title IX. The NSF Director released a notice to university presidents and vice-provosts about a year ago, notifying them that NSF will withhold

funding from institutions that do not show evidence of compliance with Title IX. Dr. Córdova noted that this letter is available online. Dr. Córdova suggested that institutions must work to develop best practices, and NSF can strengthen its guidance for those going to field sites.

Dr. Córdova acknowledged that the formal processes can be daunting, especially for young people. She noted that Dr. Falkner is working with ODI to explore ways to strengthen NSF presence at sites, and to designate a go-to person, trained and tasked in how to counsel and direct problems, to assure immediate help and support. Dr. Córdova noted her belief that NSF could strengthen its presence and support in this area.

Mr. Kosseff noted that the AC-OPP had discussed the development of a remote resource, removed from the situation on the ice. He noted that the letter distributed to field researchers named several people to whom an individual could report problems, and suggested that an ombudsmen or similar position might help an individual navigate these various options.

Dr. Córdova replied that the advice of the AC-OPP was welcome, and that she appreciated their attention to these issues.

Private Sector Engagement in Navigating the New Arctic

Dr. Manahan reported on the AC-OPP's previous discussion of potentially engaging the private sector in Navigating the New Arctic. He noted the interests of industry and transportation in the arctic, and asked Dr. Córdova to offer her perspective on private sector engagement.

Dr. Córdova remarked that she had met with CISE earlier in the day, and that this Directorate is pursuing several novel and bold partnerships. She remarked that partnerships are an emerging theme across NSF, and that partnerships can provide a way to leverage existing resources.

Dr. Córdova also reported that she had attended a conference on biological sciences and philanthropy with Dr. James Olds, the Assistant Director of the Biological Sciences Directorate. The New Arctic was discussed at this conference; Dr. Córdova remarked that private entities were identified, with whom new partnerships may be announced. She noted the need to share ideas with a wide audience, in order to develop these connections.

Dr. Córdova noted several potential partnerships, including, for example, partnering with engineering companies on the deployment of autonomous vehicles, or the development of 3-D printed sensors. She suggested that the community needs to be “unleashed” to explore partnerships and report on their own big ideas regarding how to engage the new arctic. She suggested that the arctic provides a “dramatic showcase” for new technologies that could be deployed through partnerships.

Communicating with AIMS stakeholders

Dr. Mossey noted the morning's presentation on the AIMS project, and staff concerns regarding how to engage various stakeholders as the project moves from design to implementation. He asked if Dr. Córdova had any advice to offer.

Dr. Córdova referred the question to Dr. Ferrini-Mundy, who noted her appreciation for the question, and for the AC-OPP's attention to the AIMS project. She underscored the importance of continued communication, and suggested that lessons learned, and best practices might be gleaned from the experience of AC-OPP members with South Pole Station and other projects. Dr. Ferrini-Mundy suggested a strategic communications plan might be developed jointly with NSF and OLPA, and she encouraged the AC-OPP to maintain a clear pathway for multiple stakeholder communication through the project and into operations.

Dr. Ferrini-Mundy suggested that the AC-OPP could be helpful in identifying communication gaps. She asserted her interest in working closely with AC-OPP on a strategic communications plan to reach the research community, the research support community, Congress, international partners, and other agencies.

Final thoughts

Dr. Falkner shared Mr. Fleener's suggestion that the next Arctic Ministerial invite indigenous communities to present on their activities and interests, in the same way that the represented nations did. Dr. Fuentes noted Mr. Fleener's concern that the priorities of indigenous communities be included in the discussion.

Dr. Ferrini-Mundy noted NSF's support for public participation in science, and for engaging local communities in science. She noted the Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (INCLUDES) project, and suggested the AC-OPP attend to how that project developed.

Dr. Córdova thanked the AC-OPP member for their contribution to NSF's work as stewards of polar program. She noted the responsibility shared by NSF staff and AC members, to communicate the value of their work to "everyone in the U.S., from citizens to elected officials." She noted that she looks forward to getting to know the AC-OPP members, and to their good work together.

Working Lunch/Presentation: Thwaites Project Update

Dr. Berry Lyons; Dr. Paul Cutler; Ms. Jessie Crain

Dr. Falkner reported on a 2015 NAS report focused on balancing the continued conduct of science during the AIMS project. This report identified three priority areas for research; the Thwaites Project addresses one of these. Dr. Falkner noted that Dr. Cutler oversees this project, while Ms. Crain supports its execution.

Dr. Cutler noted that a group much larger than he and Ms. Crain are involved in addressing the proposals received, planning, infrastructure, and logistics. He noted that planners are currently involved with potential awardees in planning for the coming seasons, and noted the contributions of colleagues from the UK's Natural Environment Research Council (NERC).

Dr. Cutler provided a slide for orientation. He remarked that the Thwaites Glacier is roughly halfway between McMurdo and Rothera Station, and is difficult to get to. Dr. Cutler remarked that the region is vulnerable to instability; as the glacier retreats, it does so into a basin where the grounding line is

increasingly below sea level, which creates a positive feedback loop that may cause accelerated retreat and increase the threat.

The motivating question for the Thwaites Project is how much ice will contribute to sea level rise and how fast will it happen. Several strands of evidence suggest the retreat is accelerating. The western flank, which is moving at 2-3 kilometers per year, is declining in surface elevation at 2 meters per year while also accelerating at 50-70 meters per year. Dr. Cutler reported that the region centered on Thwaites glacier contributed 177 gigatons of lost ice in 2013, which approaches the total mass of ice lost each year from all of Greenland in recent years. This volume and acceleration create the urgency to conduct research on the Thwaites glacier and to better understand what is happening there.

A 2015 NAS study outlined the arguments for NSF to focus on this project; NERC shared the same sense of import, and a joint program was launched. A single solicitation was released; proposals were jointly reviewed, and both NSF and NERC will contribute funds and resources. The objective of the Thwaites Program is to substantially improve both decadal and long-term (century-to-multi-century) projections of ice loss and sea-level rise originating from the Thwaites Glacier.

The program is community-driven, originating in the NAS report, SCAR priorities, and community workshops. The NSF-NERC solicitation was released in October 2016, with submissions due in March 2017. Most NSF and NERC polar-related program officers were involved in managing the evaluation process; a US-UK logistics meeting was held in September 2017, and awards will be announced in late 2017/early 2018. The field seasons will begin in 2018/19 with logistics staging and initial science. The main field seasons will be 2019/20 and 2020/21, with recovery of some instruments conducted in 2021/22.

Program staff are currently finalizing the logistics of proposals still under consideration, and refining the joint logistics framework that will be used when the program launches in 2018. Dr. Cutler noted that the program seeks to support a variety of activities, including helicopters from ships; autonomous undersea vehicles; and aircraft, satellite, and through-the-ice monitoring. Dr. Cutler noted that the parallel modeling is a key complement to the field work and will inform the placement for measurements.

Ms. Crain reported the logistics teams are working to simultaneously determine what the science requires and the programs can provide. The goals are to approach these projects as a single program and to explore how projects might be integrated with one another, as some projects will work on the same ground and with the same resources as others. Ms. Crain noted that the review process typically differs between the U.S. and the U.K., with the U.K. program conducting a logistics review of every submitted proposal, while the U.S. waits for the “short list” to engage the logistics. The Thwaites program has adopted the latter approach.

Ms. Crain noted the challenge of the distance between the stations and Thwaites Glacier; weather is among the most challenging considerations. She noted that flight support requires good weather when the flight departs, when it arrives, and when it returns, which can require a weather window of up to 10 hours. She noted that the distance is too far for the LC-130s to support it directly, so a third location must be added for refueling. If the program were to fly LC-130s to a camp at Thwaites Glacier, every two trips to Thwaites requires a third flight to resupply fuel at WAIS Divide.

Ms. Crain noted additional logistical details that must be considered: whether to use traverse assets, and determining the best combination of traverse vehicles and flights. She remarked that the U.S. uses larger snowmobiles than the U.K., so U.K. planes cannot transport U.S. snowmobiles. A ship is under consideration for helicopter operations and some types of coring. Coring of more than 40-feet, however, requires a cable to be run across the helicopter deck, so these activities must be carefully coordinated.

Dr. Falkner asked if countries other than the U.S. and U.K. were involved in the Thwaites project. Dr. Cutler said three other countries are currently implicated; he noted that the program required that each project have a core U.S./U.K. team.

Dr. Heimbach noted that the Southern Ocean Regional Panel was asked about the Year of Polar Prediction, and recognized that most of these efforts were directed to the Arctic; the panel recognized that the Southern Ocean might also be of interest. He asked if the Thwaites Project might benefit from a pre-staging or regional focus. Dr. Cutler said that it might; he also noted other activities occurring in the region at the same time. While he noted that the core of the program will be focused on Thwaites, and that the program cannot take on any additional logistical burden at this time, he agreed that any additional knowledge from other projects would be welcome and valuable.

Dr. Manahan noted the challenge of hardware incompatibility in the international collaboration, and asked whether the effort to collaborate was worth the challenge. Ms. Crain said that it was, and noted that collaboration doubles the strength of each program, even as the touch points prove challenging. She noted that more traditional collaborations place scientists from one country at another country's station, or on their ship. This type of collaboration is more challenging, but Ms. Crain shared her confidence that it will be worked out.

Dr. Manahan suggested that there might be some limit at which additional collaboration is not additive. Ms. Crain replied that expanding collaborations are most helpful when additional programs contribute discrete resources (e.g., underwater vehicles, specific instruments). Integrating equipment or instruments can pose challenges in assuring the right kind of power, for example. She agreed that this was more difficult than working with a single country, but noted that some science cannot be conducted without collaboration.

Dr. Isern agreed that a point of diminishing returns exists, but stated that this collaboration has not yet reached that point.

Dr. Stephenson asked if there were plans to share all the data among all the projects under the Thwaites Program umbrella. He suggested that synthesizing the data collected by these projects would be a worthwhile effort to follow the Thwaites Program.

Dr. Cutler reported that data management was one of the first topics addressed in the NSF-NERC negotiations, and NERC has agreed to OPP data policy. He also noted that one of the awards will focus on promoting and facilitating sharing among the projects in the period before the public release of data. He also noted the value of making these data available to the broader community.

Dr. Cutler reported that NERC has secured funding for these data sharing efforts. He noted that data will likely reside in multiple locations, but a coordination center will provide a website or portal through which all the data, regardless of where it is housed, can be accessed.

Dr. Stephenson encouraged the program to make the data available as widely as possible, as quickly as possible. Dr. Cutler reported that the British Antarctic Survey is leading by example on this, with plans to make airborne geophysical data they collect as an overall contribution to the program available within 6 months of collection.

Wrap-Up and Agenda Items

Dr. Berry Lyons; Dr. Kelly Falkner

Dr. Lyons facilitated a discussion of final items.

Next AC-OPP meeting

Dr. Backe announced that the next AC-OPP meeting would likely be held in March or April of 2018. He asked that members report any major conflicts they foresee, and to consider the other directorates with which they would like to coordinate a meeting.

Dr. Falkner noted that NSF has seven directorates and several offices; a representative from ODI spoke with the AC-OPP at this meeting. Dr. Falkner acknowledged that Dr. Córdova had suggested the AC-OPP might like to hear from the head of that office; Dr. Córdova had also mentioned OLPA and the Office of International Science and Engineering. In addition to these, Dr. Falkner listed the directorates: Biological Sciences (BIO), CISE, Education and Human Resources (EHR), Engineering (ENG), Geosciences (GEO), Mathematical and Physical Sciences (MPS), and Social, Behavioral and Economic Sciences (SBE). She asked AC-OPP members to consider which of these areas seem particularly timely or important to hear from at this point.

Dr. Viereggs suggested AC-OPP members might each like to hear from different directorates. She noted that the MPS includes physics and astronomy, which might be of interest, given IceCube and other projects.

Dr. Manahan noted that interactions with GEO will continue to be important to the AC-OPP; he also noted the Director's description of how the BIO directorate organized itself around the Rules of Life. He suggested participation in other directorates beyond brief presentations.

Dr. DeGrandpre expressed interest in exploring how OPP might collaborate with ENG and CISE. Dr. Falkner remarked that ENG has been a collaborative gap for OPP, and that Navigating the New Arctic opens opportunities for new partnerships.

Dr. Heimbach suggested that the Office of International Science and Engineering might be able to provide insight into structuring successful collaborations. He also noted Dr. Manahan's interest in participation across directorates, and reported that NAS sometimes establishes liaisons across different boards.

Dr. Falkner replied that NSF has similar roles, and noted that four AC-OPP members will serve as liaisons to AC-GEO. She invited Dr. Fuentes to describe the roles he serves.

Dr. Fuentes reported serving on the Equal Opportunities in Science and Engineering Committee, which reports its deliberations to Congress and the NSF Director. Each committee member serves as a liaison to at least two other groups—Dr. Fuentes served as the AC-GEO liaison prior to joining the AC-OPP.

Dr. Falkner noted that Environmental Research and Education is also a cross-cutting structure; Dr. Lyons served as the liaison to AC-GEO from that group. Dr. Falkner noted that Dr. Qualters also supports an Advisory Committee for Cyberinfrastructure (ACCI), and would like to establish liaisons between that committee and the AC-OPP.

Dr. Manahan suggested that fewer than four liaisons be named to AC-GEO, in order to support liaisons to other directorates. Dr. Falkner replied that AC-GEO asked for four polar representatives. She noted that these representatives do not all have to come from the AC-OPP. She agreed that serving as a liaison is an additional responsibility, and acknowledged the value of having liaisons with BIO and ENG.

Dr. Falkner noted that liaisons had been suggested to OISE, MPS and ENG. Dr. Mellish supported the suggestion of a liaison to ENG; she also noted the importance of education.

Agenda Items for next AC-OPP Meeting

Dr. Lyons noted that several items for the next agenda had already been identified. These include treaty issues, international science and engineering, and OLPA. He invited other topics for consideration.

Dr. Falkner noted that Dr. Welker had expressed interest in discussion of “large” items, such as ice-breakers.

Mr. Arnaudo suggested AC-OPP members might provide suggestions via email, after they have time to reflect.

Dr. Fuentes asked if the AC-OPP was going to develop materials in response to the *Dynamic Earth* report. He suggested this might be discussed at the next meeting, if so.

Dr. Lyons replied that he was not sure of the next steps to be taken by AC-GEO, but that AC-OPP would likely respond. Dr. Falkner noted the importance of keeping this AC-GEO project in mind, and asserted that it should be on the next agenda. In addition, she suggested that the AC-OPP should remain apprised of any other priority-setting activities across NSF.

Dr. Viereggs noted that a decadal survey is upcoming in astronomy. She remarked that science which is not highlighted in this survey is difficult to advance. She suggested a strong strategic plan for polar programs could feed into this decadal survey, which will begin in a few years.

Dr. Fuentes asked if representatives from indigenous communities might be invited to the next AC-OPP meeting, to discuss community engagement. Dr. Falkner noted that Mr. Fleener is an Alaska native, and

suggested he might serve that role. Dr. Fuentes asked that he be provided time on the agenda to amplify the discussion of community engagement.

AC-OPP Subcommittee

Dr. Lyons noted that a 6-member subcommittee had been named and charged with synthesizing several pertinent reports into an outline for discussion at the next AC-OPP meeting. He noted the need to identify a leader for this subcommittee. He remarked on the enthusiasm for Navigating the New Arctic, but cautioned against forgetting the Antarctic.

Dr. Manahan suggested that this decision be delayed until subcommittee members had an opportunity to review the workload. He and Dr. Vieregge both expressed interest in the way the Rules of Life provided an overarching structure to the BIO directorate.

Drs. Falkner and Vieregge noted Dr. Córdova's suggestion to explore the ways OPP engages the 10 Big Ideas. Dr. Manahan agreed that identifying the way polar programs engage the Big Idea was an important challenge.

Dr. Flanner asked how these Big Ideas might translate into funding strategies. Dr. Falkner replied that apropos to NSF efforts to convince funders of the need for continued support; several items have garnered excitement and have been championed over the years. Dr. Falkner suggested the Big Ideas represent the Director's current approach to this challenge, a way of communicating the value of the science NSF supports.

Dr. Falkner suggested that the Big Ideas will guide a subset funding decisions. She noted the need to pursue partnerships to leverage federal resources, and the opportunity for AC-OPP to provide more specific advice regarding how the polar programs can interact with and inform the Big Ideas.

Dr. Dixon agreed that the Director seemed to be inviting feedback within the structure of the 10 Big Ideas. Dr. Falkner noted that the Director did not seek to tell the AC-OPP what to do, but instead to invite their advice on how best to proceed.

AIMS Communication Plan

Dr. Falkner noted discussion of developing a strategic communications plan for AIMS, and asked if there were associated action items for the AC-OPP.

Dr. Lyons noted that he and Dr. Falkner had spoken about how the AC-OPP might communicate in general with the community. He encouraged AC-OPP members to consider how they might encourage community input to the AC-OPP.

Meeting Logistics

Dr. Falkner and others identified a number of suggestions for improving the logistics of the next meeting. These include: Re-orienting the tables, so that the audience does not sit behind the meeting leaders. Using Web-Ex, to allow those who join virtually to be seen as well as heard. Increasing the font size on the table tents. Increasing the screen size and improving screen placement.

Dr. Falkner noted that those who joined by phone could hear the conversation and be heard. She also noted that challenge of moving into the new building and coordinating the AC-OPP meeting on a short time-frame. She offered her thanks to Ms. Pawnee Maiden and Dr. Backe, for coordinating the meeting preparations and support.

Dr. Lyons adjourned the AC-OPP meeting at 2:00 p.m.