Advisory Committee for Geosciences (AC/GEO)
Spring Meeting, April 13-14, 2023
Meeting Held Online
Meeting Minutes

AC/GEO Attendees:
Dr. Kaatje Kraft (Chair), Department of Sciences, Whatcom Community College
Dr. Lihini Aluwihare, Scripps Institution of Oceanography
Dr. Robyn Mieko Dahl, Department of Geology, Western Washington University
Dr. Kusali Gamage, Austin Community College
Dr. Vernon Morris, Chemistry and Environmental Sciences, School of Mathematical and Natural Sciences, New College for Interdisciplinary Arts and Sciences
Dr. Francisca Oboh-Ikuenobe, Department of Geosciences and Geological and Petroleum Engineering, Missouri University of Science and Technology
Dr. David B. Parsons, School of Meteorology, University of Oklahoma
Dr. Tammi Richardson, Biological Sciences, University of South Carolina
Dr. Barbara Romanowicz, Graduate School, University of California Berkeley
Dr. Cathy Whitlock, Department of Earth Sciences, Montana State University
Dr. Daniel R. Wildcat, Haskell Environmental Research Studies, Haskell Indian Nations University

AC/GEO Members Not Attending:
Dr. Kristin Wilson Grimes, University of the Virgin Islands

AC-OPP Members Present:
Dr. Meredith Nettles, Lamont-Doherty Earth Observatory, Columbia University, Chair, AC-OPP
Philip J. Bart, Louisiana State University
Dr. Ryan E. Emanuel, Department of Forestry and Environmental Resources, North Carolina State University
Dr. Allyson Hindle, University of Nevada, Las Vegas, School of Life Sciences
Mr. Steve Iselin, US Navy (Ret), Iselin Consulting Enterprise, LLC
Dr. Vera Kuklina, Department of Geography, George Washington University
Dr. Kristin O'Brien, Institute of Arctic Biology, University of Alaska
Dr. Jessica O'Reilly, International Studies, Indiana University - Bloomington
Dr. Brittany Schmidt, Department of Astronomy, Cornell University
Dr. Mary-Louise Timmermans, Earth and Planetary Sciences, Yale University

NSF Senior Staff and Other Meeting Participants:
Dr. Sethuraman Panchanathan, NSF Director
Dr. James Ulvestad, Acting OPP Director
Ms. Rhonda Davis, Office Head, Office of Equity and Civil Rights (OECR)
Ms. Amanda Greenwell, NSF Office of Legislative and Public Affairs (OLPA)
Dr. Alexandra Isern, Acting Assistant Director, GEO
Ms. Melissa Lane, Staff Associate for Information Management, GEO
Dr. Ben McCall, Advisory Committee on Environmental Research and Education
Dr. James McManus, Division Director for the Division of Ocean Sciences (GEO/OCE)

Dr. Karen Marrongelle, NSF Chief Operating Officer (COO)
Dr. Patten, Deputy Assistant Director, GEO
Ms. Stephanie Short, Section Head, Antarctic Infrastructure and Logistics (AIL), OPP
Dr. Dena Michelle Smith-Nufio, Program Director, EAR
Dr. Sharon Mosher, Department of Geological Sciences, Jackson School of Geosciences
Dr. Shelby Walker, Senior Advisor for Facilities Planning and Management
Ms. Sarah Williams, Branch Chief, OECR;

Thursday, April 13, 2023

Welcome
Dr. Kraft opened the AC/GEO meeting, being held jointly today with AC-OPP, with excitement about the joint meeting in anticipation of the coming merger of the two ACs. She said there is a great knowledge base across the two ACs that will enrich conversations into how to think about Earth through a systems approach. Dr. Nettles echoed what Dr. Kraft said about the opportunities for the merged committees and called on members and staff to introduce themselves.

Geoscience Directorate Updates
Dr. Isern began with an update on a capability just added to GEO regarding data analytics, and a new staff member, Josh Trapani, who joined GEO in late March 2023 as a Data Research Analyst. Dr. Isern said he will be central to enhancing the capability for data analytics and for telling the geosciences story and better demonstrating that the money we're receiving to invest is making impacts.

Moving on to FY24 priorities and NSF-wide activities, she discussed the CHIPS and Science Act, which supports and empowers NSF's three major priorities:

- Strengthening Established NSF
- Inspiring The Missing Millions
- Accelerating Technology and Innovation

She listed some of the things the CHIPS and Science Act has put into place:

- Authorizes a doubling of the NSF budget over 5 years
- Strengthens fundamental research
- Establishes Technology, Innovation & Partnerships
- Invests in STEM Education
- Advances diversity in STEM
- Addresses research security

Turning to NSF's FY24 budget request to increase the budget to approximately $11.3 billion, an increase of 18.6 percent, she listed the main emphasis areas as:

- Building a Resilient Planet
- Create Opportunities Everywhere
- Advance Emerging Industries for National and Economic Security
- Strengthen Research Infrastructure

She went into more depth on the focus areas, starting with building a resilient planet, discussing:

- Response of Earth's systems to changing climate
- Adaptation and resilience
- Clean energy technologies
- Nature-based solutions
- Greenhouse gas measurements and removal

Building a resilient planet is an NSF-wide effort that includes two pillars:

- US Global Change Research Program
    - Mandated by Congress to coordinate federal research and investments in understanding the forces shaping the global environment, both human and natural, and their impacts on society.
- Clean Energy Technology (CET)
    - Foundational and translational research and education investments to support transformative CET to achieve a carbon-neutral, equitable, resilient and sustainable US economy.

She said her office has worked over the past year, year and a half with our staff, the research community, and across the agency to develop some of the key ideas that are the basis for building a resilient planet:

- National Security
- Climate Change
- Tech. Leadership
- Clean Energy

When thinking about building a resilient planet, NSF is unique in bringing all the disciplines to the table, she said. Building a resilient planet advances priorities laid out in the CHIPS and Science Act, including creating opportunities that are equitable and accessible to all and encouraging and investing in people helping their communities while also helping to understand the changes happening in those communities.

Moving to GEO and major NSF investments for FY24, she listed:

- National Resilience Research Network: $47.50 M
- ObsX - Investing in observing infrastructure: $20 M
- GEO Access: $8 M
- Climate Equity Fellows: $15 M

Dr. Isern provided a brief TIP update, discussing Regional Innovation Engines:
• April: Type I Award Announcements
• Spring-Summer: Type II Awards in Review

The goal is to foster innovation ecosystems around the country. Type I awards were focused on planning grants to help assemble a team that could compete for a Type II, which is for a full regional innovation engine for up $260 million.

Staying with TIP, she highlighted the announcement of new Convergence Accelerator Tracks:

- Track K: Equitable Water Solutions
- Track L: Real-World Chemical Sensing Applications
- Track M: Bio-Inspired Design Innovations

Another TIP opportunity, launched in March, is known as the Prototype Open Knowledge Network (Proto-OKN):

- New opportunity: March 2023
- NASA, National Institutes of Health (NIH), NOAA, US Geological Survey (USGS), and the Department of Justice's (DOJ) National Institute of Justice
- $20 million initiative to build a prototype of an open knowledge network
    - Publicly accessible
    - Interconnected data repositories and knowledge
    - Enables data-driven, Al-based solutions

She said TIP can catalyze the innovation already being done within the geosciences and help build capacity in the geosciences. In January, GEO released a Dear Colleague Letter (DCL) for a new IPA to get a rotator with expertise in the geosciences and expertise in the innovation space to be a joint appointment with TIP and help build bridges and understand each other's needs, strengths and where we can make significant investments.

Dr. Isern also addressed NSF-wide opportunities announced in February called Accelerating Research Translation (ART). The program will support:

- Activities to build institutional infrastructure and capacity for research translation
- Educational/training opportunities
- Immediate translational research activities

She also provided an update on Growing Research Access for Nationally Transformative Equity and Diversity (GRANTED), to grow the capabilities of emerging institutions to compete within the research enterprise to level the playing field:

- DCL (NSF 23-037) to encourage conferences and workshops
- Updated Program Description published February 15, 2023

There have been a lot of discussions lately with the EPSCoR team, which is working to improve program impact within different jurisdictions and states. There have been discussions on broadening the institutions we're investing in. She provided a summary of EPSCoR funding:

- Research Infrastructure Improvement (RII) Programs
    - (78-84% of budget)
- Co-Funding W/ NSF Directorates & Offices
    - (16-22% of budget)
- Outreach and Workshops
    - (0.5-1% of budget)

Within the EPSCoR FY24 budget request is a new focus area on advancing climate change research and resilience capacity to expand opportunities to disproportionately affected communities.

Turning to GEO incubators, the FY23 budget requests includes incubators focused on:

- Global Climate Challenges
- Diversity and Education Programs
- Special Emphasis Programs
- Geoscience Cyber-infrastructure

To bring these incubator spaces to life, GEO has received approval for the new Division of Research Innovation, Synergies, and Education (RISE), which will take its place alongside the Division of Atmospheric and Geospace Sciences (AGS), the Division of Earth Sciences (EAR), the Division of Ocean Sciences (GEO/OCE) and OPP. RISE has four priorities:

- Catalyze new systems-level approaches to climate science
- Attract underrepresented groups to geo careers & support geoscience education
- Join with other parts of NSF in major integrative research and education efforts
- Foster exchange of scientific information nationally and internationally

She listed the following RISE opportunities:

- Geosciences Open Science Ecosystem Program (23-534)
    - Improve openness and scientific value of cyberinfrastructure
    - Democratize access to cyberinfrastructure
    - Strengthen capacity of geoscientists to access, utilize, and collaborate around open science resources
    - Advance open science principles

Dr. Isern highlighted a DCL titled GEO-EMpowering Broader Academic Capacity & Education (EMBRACE):

- Expand access and participation of investigators from
    - Historically excluded groups in GEO disciplines
    - Historically excluded institutions
- Solicitation forthcoming

She also highlighted preparations for the great American solar eclipses of 2023 & 2024:

- NSF 23-014 DCL:
    - Invites submissions to AGS for science and outreach
- Solar Eclipse Observations with the Airborne Coronal Emission Surveyor (ACES)

Re geoscience student admission and retention, she cited US Department of Education statistics: "Between 2009 and 2020, total undergraduate enrollment decreased by 9 percent (from 17.5 million to 15.9 million students)." Looking at data specific to the geosciences, she said that from about 1955 to recently, there was an overall increase in the geosciences till about the 1980s. At that point, graduate student numbers more or less plateaued. Undergraduate numbers showed a more dynamic range, but in the graduate student numbers from about 2016 there has been a long-term decline, as there has been in the undergraduate numbers. There has been about a 10 percent drop in graduate enrollments. Of those, the master's were about 23 percent and doctoral degrees about 29 percent.

She listed student enrollment drivers as:

- Decline in college-age population
- COVID-19 pandemic
- Energy transition

Discussing strategies for change, she cited:

- Connecting science to careers
- Partnership across the pipeline
- Strong mentorship
- Financial assistance
- Fostering research and community engagement experiences

Reflecting on the ongoing discussion about changing GEO's name, she referred to the US National Academy of Sciences, Engineering and Medicine (NASEM) report and said the directorate studies the Earth system, from geospace to the center of the Earth. She Some professional societies tied to the geosciences articulate their audience as Earth and space sciences. The budget requests call for understanding Earth's systems. GEO is increasingly funding transdisciplinary research across the Earth system. Even the GEO website categorizes GEO within Earth in the environment. Earth resonates better with the public and congressional appropriators. They know what the Earth is; they're not necessarily sure what geoscience does. GEO needs to think whether its name tells the story about its investments. AC members to provide were encouraged to provide feedback online regarding student admission and retention and the potential name change.

Discussion

Dr. Timmermans said the name geosciences has connotations of geology, which is traditionally the broader earth sciences and over the years became more specific to hard rock geology. That relates to the enrollment statistics. She asked if there were emerging areas that took away from the enrollment numbers, that would traditionally be thought of as in the geosciences.

Dr. Isern said she wondered if the drop post '80s and early '90s in undergraduate numbers was when a lot of environmental science degrees came in; maybe that changed the counting.

Dr. Morris said in Arizona there are large increases in the college-age population among Latinx and asked what may have led to the recent decreases beyond the recession and if the decreases were differentiated by region or discipline.

Dr. Isern stressed thinking about getting to the next level of regionality and why it is different when we move into a domain level. We need to have more of this data. The challenge is that geoscience is considered in some collections as physical science. GEO gets mixed in with other things. We can work with the American Geosciences Institute (AGI) and other groups.

Dr. Parsons said the breakdown by discipline by minoritized groups and regions is important. Artificial intelligence (AI) is changing the field and we're losing masters students like mad and changes how we teach our undergraduates and graduate students. Dr. Isern mentioned RISE, co-located incubators and said cyber infrastructure has been looking into how we can advance our connection to AI.

Dr. Parsons said it's strange to have the undergraduate senior class over 50, when it used to be almost half that, but doctoral students are being reeled in by these companies.

Dr. Nettles raised the shift from geology to environmental science and how that's getting counted. Having the major called Environmental Science was a great way to bring students back in. Now the pressure is on climate science. It's not fundamentally different curricula. It's an understanding in this discovery type of major of what you want to study and where that fits in sustainability. And there is the aspect of what career you can do; we have quite a few students interested connecting with environmental and climate science, but they're also excited about machine learning and things they hear about that maybe they don't really understand. The idea that engaging with Earth Science, broadly, is a way to learn how to handle complex data and real world applications is attractive. Maybe that's part of telling the story of the careers you can do with a GEO degree.

Dr. Isern said GEO thought of whether it could leverage the informal education program in EDU. That could get into the cool things you can do with observations and data and machine learning. Also, the EPSCoR workshops and conference opportunities are a way to get investigators and students together to explore ideas and collaborations for forged partnerships.

Dr. Gamage said at community colleges there are less and less geoscience majors. Since 2020, her school's classes are offered mostly online and it's very popular. It is difficult to continue undergraduate research with this group. We have to think differently about how to bring research into these online classes. Dr. Kraft said her school's our online classes fill first. Where overall enrollment is declining for community colleges across the country, there is a mini surge of students interested in Earth systems. Community colleges have struggled at tracking what their students do after they leave. And there aren't science degree programs at the two-year college level.

Dr. Isern responded to a question in the online chat regarding where biology belongs and renaming EAR. GEO does a lot of biology. It's never going to be a clean stovepipe. We want it to be porous. GEO also does astrophysics. No name is going to be perfect. It's a benefit to rebrand and shows we're forward thinking. We shouldn't fear a new name.

Dr. Bart said his university is seeing declines in enrollment at the graduate and undergraduate levels. It attracts many students interested in the energy sector. Some of that softening in the market has affected enrollment. But we've seen other units pick up folks and they're geo-centric. Environmental Sciences has seen a bump; also, oceanography. His department is thinking about rebranding.

Dr. Dahl said she works with pre-service teachers. Since COVID, she has seen a rise in students interested in Earth science teaching, even though that's not a big component of high school science. It may be related to climate change, which is a big factor in students' minds. We often forget about that as a pathway for scientists, but K-12 teaching is also a big part. Dr. Isern said that's our pipeline and Earth science educators in K-12 are going to use our science to teach math, physics, and chemistry.

Dr. Kraft said one challenge is that it's a discovery-based science. If they're getting more exposure in high school, there is less of that discovery process.

Responding to a comment in the online Q&A that the public does not recognize the difference between Earth with a capital "E," and earth, with a lowercase "E," which de-emphasizes ocean sciences with respect to its role in addressing climate change, Dr. Isern said the Earth is about 77 percent water and referred the comment to ocean scientists. Dr. Kraft said there was a similar question in the online chat asking if AC-OPP members not in geoscience or science departments have comments on the GEO enrollments with respect to their engagement with students' interdisciplinary work.

Dr. Aluwihare said that with Ph.D. students at Scripps, the application pressure has not decreased. But there have been a lot of retirements. So, the number of Ph.D. students Scripps is accepting into areas like the geosciences and biological sciences is decreasing. Whereas in oceans and atmospheres, there is a slight increase. On the name change, this is an ongoing debate at Scripps, because it is an institution of oceanography. People say it doesn't reflect the Earth. She said what "Earth" means to the public versus to us is something to think about.

Dr. Kraft read a comment in the online chat regarding a name change at Yale from geology and geophysics to Earth and Planetary Sciences; a distinct uptick in undergraduate majors followed. Dr. Kraft asked if "Earth" is better than "GEO," if people don't have a fundamental understanding of either of those concepts.

Dr. Romanowicz said at Berkeley, "geology and geophysics" was changed to "Earth and Planetary Science" a long time ago, which was beneficial. She asked about using "Earth and Planetary Science," though planets are part of NASA. She also asked about using "Earth's Atmospheric and Ocean Sciences," and if it's ambiguous without added attributes.

Dr. Kraft said part of the discussion is about which acronym resonates. She referenced the online Q&A regarding how to look at data once the geosciences are defined, using NCSES for more granularity. Dr. Isern said it is possible to disaggregate data in the Science Indicators report. She was not sure about undergraduate numbers for international students, but it is important to capture.

Dr. Kraft said there is a broader narrative happening across the country regarding how expensive higher education is and whether it's worth it. She asked who that narrative is impacting and referenced information indicating Black Americans are economically disadvantaged in some cases with college degrees, because of the tax structure. It is necessary to think about how that narrative is playing into the declining numbers.

Dr. Nettles spoke about partnerships, saying computer science departments have huge increases and have launched interesting cross-disciplinary programs, including courses related to programming and data science for the humanities. She suggested working on sucking in students with those kinds of interests, with a role for joint programs that tap into that interest in a way that that allows people to get into the data science machine learning computer science realm, but with

a focus that pulls them into whatever we're going to call it. She asked about RISE catalyzing systems level approaches to get the more deeply interdisciplinary work off the ground and the tension between needing experts within a discipline and the time it takes a for them to learn to speak the same language to move an interdisciplinary piece of work forward.

Dr. Isern talked about ways to get around barriers about language differences. You've got a panel with four different experts and they each review their part and don't really like the rest of it. She asked about being creative in breaking this down in the review process to be more effective at reviewing these broader activities. Keeping the connection to the divisions is critical, as is building partnerships and ensuring existing connections remain. One challenge is RISE is not only going to be for GEO, it's a central area for thinking about the Earth system. We can use some of the funds for venture capital to encourage things, but we're also doing this for the agency. Scaling is something we're struggling with and what success looks like in five years. We've opened this space up to have computation connected to climate connected to education and workforce and having that flow into the rest of the directorate in a more permeable way. We're trying to create something that's scalable, so if we don't get the resources we expect, we still want to do something impactful.

Discussion of Pending AC Merger and Future Directions

Dr. Nettles said she and Dr. Kraft would like to kick off a discussion about the merger by looking at what members of both ACs think about bringing expertise in the AC-OPP into GEO and leveraging activities and thought processes in GEO in the context of RISE and cross-disciplinary efforts within the larger framework of GEO. She asked for thoughts on where members see activities within OPP that might connect with RISE or other directorates on catalyzing the system's level approach, attracting underrepresented groups to GEO careers, joining other parts of NSF in integrative research and education and fostering the exchange of scientific information nationally and internationally. One of the issues is OPP sometimes has expertise from areas that might not traditionally be thought of as GEO and whether OPP can bring that in.

Dr. Isern said the social and behavioral sciences are going to be critical at the start from anything we do in climate and systems research. We'd like to share a staff member because they're understaffed and under-resourced in SBE. We want to enhance these areas that are not traditional.

Dr. Kraft referenced yesterday's AC-OPP session and topics that came up that AC/GEO might not be as familiar with. The ARV is in the design phase, working its way through the approval process to bring it on board by 2027. Bringing a giant research vessel from design phase into implementation is exciting, but also the GEO community is familiar with the idea of big research vessels. She referenced conversation across different communities thinking about this through different lenses, the OPP subcommittee on polar logistics and conversations around physical qualifications for serious remote work and the challenges that come with preparing for it. She spoke about the many places these conversations have been happening and bringing those different conversations together.

Dr. Nettles asked what can be done to better connect research that's traditionally happening within OPP in the polar disciplines and infrastructure with what's happening in other areas of GEO.

Dr. Whitlock suggested looking for the overlap in RISE and asked about enhancing capacity and reaching out to emerging research institutes and how they relate to building a new research vessel and polar logistics. The Environmental Research and Education Committee is talking about making research more sustainable with a lighter environmental footprint. That affects both programs. She'd like to look at some of the OPP areas they're growing in and linking that to RISE.

Dr. Nettles said a big part of the discussion around the proposed ARV looks at reducing the environmental footprint and OPP is looking at how to do field research in a way that is effective but minimizes the impact on the environment. That connects directly to discussions in other parts of GEO.

Dr. Isern said regarding bringing more intentionality to working across traditional boundaries, that will help develop some of these connections. We've been talking about a makerspace of partnering and bringing the disciplines together. OPP has tended to be self-contained. In Arctic science, for example, it is part of the definition; it's things that happen in the Antarctic. Because it's geographically defined, it creates a geographic boundary, but it still does biology. It could provide an opportunity to think about the sciences differently by enhancing those bridges and helping us think from this facility standpoint. We can't ignore our facilities, it's half of our Geo budget. So how can we better leverage those capabilities across all of what we do, including the polar regions. It is important to carry that experience and understanding to what the rest of GEO does.

Dr. Nettles said the AC-OPP yesterday discussed a report by a subcommittee that looked at how to prioritize use of South Pole Station which is oversubscribed and used by many agencies and; that's an equally difficult question for a number of big facilities and infrastructure pieces within GEO. We had a positive experience going through that difficult exercise of having a group tasked to look specifically at how to do rules of engagement for that prioritization.

Dr. Parsons said there's an opportunity with cooperation. A lot of large ice loss events in the Arctic are associated with Arctic cyclones influenced by midlatitude Rossby wave breaking, for example. Sometimes there have been barriers to looking at research problems that extend across the Arctic into the mid-latitudes or tropics. There's an opportunity as an atmospheric scientist for polar to learn more about how things are operating. And there's much we on the GEO side can learn about OPP and how things work. A good opportunity is talking about the marginalized in minoritized communities living in Oklahoma on land acquired with 38 tribes and nations. The people in Oklahoma are excited about having the links to the tribal nations and nations in the Arctic. So, there's opportunities to learn from each other. He said he was excited about the merger; there are challenges, but opportunities for learning on both sides.

Dr. Nettles said there's been an equivalent frustration from the polar side. There are a lot of glaciers south of 60 degrees latitude. Bringing that knowledge across has caused frustration. OPP

spent a lot of time working on principles for the conduct of research in the Arctic. That shouldn't just be the Arctic; we need the same kind of principles for conduct across the globe. It's something for upcoming discussions of the ways we can inform each other about working with local communities of all types, but particularly recognizing that when we're working with indigenous peoples, it's not just a question of the Arctic, because it's a global question.

Dr. Gamage asked if once the merger happens, will there be a three-day meeting or a two-day meeting? Dr. Nettles said the intent is one AC without additional days. The new AC will likely rely on subcommittees, but the intent is not to have a separate part of the agenda for OPP. Because of specific infrastructure and logistics and safety concerns, we want to make sure we're really getting robust continuing input into polar programs and stand up a subcommittee focused on polar infrastructure, logistics and safety. That group will report out through this merged committee.

Dr. Isern referenced an online Q&A comment that there was one committee before. Though we've done this before, we should think about the meetings and how long they should be, and how long is fruitful. We have a lot of ideas of things we want to talk to the AC about, but we recognize you're busy.

Dr. Ulvestad said when he was in NPS, little pockets of the AC would go off and talk to individual divisions. He said that didn't work because it was divisive. It detracted from the system level and overall strategic thinking.

Dr. Kraft said we've been saying we have important ideas across this community and to separate it out is a false narrative. Conversations around the Antarctic research vessel are relevant to all of us. The Sexual Assault/Harassment Prevention and Response (SAHPR) Program report was produced by the polar community, but its deeply relevant to the GEO community. Bringing them together is going to benefit all our communities by having these conversations together rather than separating them out.

Dr. Nettles said key issues that have emerged from the AC-OPP discussions are being tracked and she will work with Dr. Kraft and Dr. Ulvestad and Dr. Isern to make sure that in the transition there are appropriate means of continuing to track those and bring them to the full group.

Dr. Timmermans said the idea that it's all one system resonates. From a physical oceanographer's perspective, as the mid-latitude ocean structures are found further and further north into the Arctic, it seems a shame to delineate these two regionally the same way as for atmospheric dynamics. Overall, it's a positive merger.

Dr. Nettles said the Office of Polar Programs is not being merged with another division, rather the advice-giving mechanism is becoming less isolated and can take into account all those connections. This comes up in different places, particularly around DEI efforts and sexual assault and harassment prevention efforts. But there are things that need to be done on the ground within the individual offices or divisions, and then we need to find effective ways to connect those to break down the disciplinary or other structural barriers. You've got to do some of the research in

the poles in regions that rely on the kind of support OPP can provide. And you've got to be able to connect that effectively across what's in a different bin at NSF.

Dr. Romanowicz asked about the membership of the merged committee. Dr. Nettles said people rotated off each committee. Joining the two makes a relatively big committee. There have been discussions with Dr. Isern and Dr. Ulvestad about the balanced plan. We don't want a huge committee. But we want to make sure we keep bringing in voices from other folks in polar science who have an intellectual home in one of the other directorates like SBE or BIO to strengthen the committee. We'll be looking carefully at who is rotating off and who we need to bring on and make a committee that is not enormous, although initially it is just the gluing together of the two individual committees. Dr. Isern said it is a delicate balance, because we don't want a huge committee, but you want representation. We also want to make sure we continue and strengthen ties to the other directorates.

Dr. Bart said his community is interested in the oceanographic part of the story. He looks at the continental margin and reconstructing the ice retreat. Much of the modern observations indicate the oceanographic influence is dominating, whether the ice advances or retreats. Maybe this is the perfect platform where some of those processes going on in the mid- and northern latitudes can be better incorporated.

Dr. Hindle said she was considering topics for a merged committee, which would be boring for people on the GEO side. She raised the issue of a quorum if the committee is too large. But it's not a disadvantage to have a large committee, because the work of putting together the meeting is the work and it doesn't add effort to have more people at that meeting.

Dr. Nettles said it is difficult to have a robust discussion when you have too big a committee. The combined committee is going to try to have a robust in-person meeting in the fall and encourage everybody to attend.

Dr. Isern said there have been discussions about meeting at a facility such as the National Center for Atmospheric Research (NCAR), which is central and gives the opportunity to have part of the meeting focused on the systems level.

Dr. O'Brien said there will be synergies by combining the ACs. With respect to the Antarctic research vessel, it'd be helpful to have more input while we're continuing with the design from people who have expertise with logistics.

Dr. Emanuel emphasized that an example of a potential synergism comes up in the DEI subcommittee report AC-OPP just finished. Dr. Nettles said that's an example of a place where you need agency-wide leadership and strategy within the directorates and divisions figuring out how to respond to that DEI subcommittee report in a way that's effective. This ought to benefit all of GEO and set good examples for the rest of NSF.

Preparation for Meeting with NSF Leadership

Dr. Kraft and Dr. Nettles led the joint session through the process of developing a list of questions and talking points to use at the upcoming meeting with the Dr. Panchanathan and Dr. Marrongelle.

NSF in the Federal Landscape

Dr. Nettles said the AC invited Ms. Greenwell after talking about NSF in the broader federal landscape and the challenges and opportunities of a budget of about $10 billion, which puts it in a different category of federal agency. The AC would like Ms. Greenwell's perspectives on where NSF sits in the federal landscape and what it might want to be aware of and the challenges and opportunities.

Ms. Greenwell said NSF has had support on both sides of the aisle for its mission. That means more awareness from those who didn't pay attention to NSF before. It gives NSF an opportunity to talk about the mission, things we're doing and how we are critical to national and economic security and the future of STEM for the country. It also means we need extra awareness about the things we're doing internally and how we are pulling things together, and things we need to relay to the scientific community and other stakeholders. There are folks that don't want to see NSF succeed in the ways we're trying to and would try to use some of those things to their advantage.

Dr. Nettles asked about additional things at this higher budget level that may impact operations. Ms. Greenwell said regarding the budget levels and the CHIPS and Science Act, there are many things we're working through that are not going to happen in the first year. But the agency is having conversations at higher levels about the structures in place or not in place so we can meet the current mission, but also looking at the requirements placed on us through that legislation to make sure we get that done by the end of the five-year authorization.

Dr. Patten asked about administrative congressional priorities and the research the community would like to do and workforce development challenges. Ms. Greenwell said NSF has been trying to do more messaging and packaging towards the workforce issue. Congress and industry are clamoring for that, finding the workers we need today. We can package some of the direct ties of investments that the GEO community is making into those things. This doesn't need to be four-year or Ph.D. degrees. There are many areas where folks need those workers, so being able to tie some of the investments or specific programs is critical. GEO has a lot of examples of things that lend itself to the national security and economic security messages of research that has created jobs and an ability to stay competitive globally. Dr. Nettles said that connects to a discussion this morning of enrollments and recruitment and retention of students. Highlighting that workforce piece is useful to hear, in addition to national and economic security.

Dr. McManus asked about changes to expectations per interagency activities. Ms. Greenwell said that expectation was there before, but it's stronger now. When Congress gives that level of funding, they expect us to leverage that with other partners. They don't want redundancy. So, making sure we continue to work closely with the Department of Commerce when looking at implementing TIP and other new programs, and not just in funding areas, but where we have synergies in some missions, where we can utilize our community but also connect with this group over here that's going to make what you're trying to carry out on in your agency even

stronger. The director has put that front and center for one of his key priorities for us to work throughout the federal government and with industry, foundations, etc.

Dr. Nettles asked Ms. Greenwell to expand on that train of thought with respect to international cooperation and greater visibility. The AC was recently talking about the importance of making strong connections with partner nations as the only thing that allows us to do the work we need to do. But there are challenges inherent in that.

Ms. Greenwell said that's been a huge priority for the director and referenced the Laser Interferometer Gravitational-Wave Observatory (LIGO) announcement. NSF had a big role in working with them to make sure we have partnerships like that. The director continues stressing the importance of international partners, making sure we're talking about those that share our values and are going to continue to help us strengthen STEM for the nation and globally. And we know not everyone is sharing those same values. We need to make sure we're protecting the federal investments and the taxpayer dollars.

Dr. Isern said she and Ms. Greenwell have talked about how GEO can tell its story better and asked her how to amplify the climate message from NSF and the work we do with communities and education. Ms. Greenwell said they talked about the workforce messages, and she mentioned Congress and industry. How we can make those connections and help at all levels will be critical. Wherever we can tie it to national economic security, showing this research led to X, which has done this for the economy, is vital. GEO has some of the most amazing visuals and tools and places; not just Antarctica, and the Arctic, but things we can bring people to. The more the community can bring this local official or member of Congress or person from my community to check this specific thing out, and not only tell the story, but show the visual and make that clear connection with these federal dollars that go here and make this happen, that supports these students, that makes it more real for the folks making these calls in terms of what funding and language we get and the flexibilities we have.

Ms. Greenwell said the director is visiting institutions, including places NSF hasn't been before, and bringing members of Congress, so they can hear directly from faculty, students, and the community that's impacted by the investments. That that's made a huge difference in support and understanding more about what NSF does and why it's so important.

Ms. Greenwell said OLPA is constantly working to make sure we can get good information and connect with folks. Her office works with the communications liaisons. Her team helps Dr. Isern and GEO have that connection point. Her office has created a form it sends internally to make sure it is getting out to a broader group. It is doing a better job of archiving the things that come in. It is important to have information on a paper coming out, or a student who worked on an amazing project, for social media or when something comes up that's timely.

Dr. Nettles said it sounds like a question of encouraging all of us to communicate back to the program officers we work with about what's coming out of the research. Ms. Greenwell said her office is also looking for visuals. There are a lot of inquiries for B-roll video from some of these places your community works.

Dr. Isern suggested a Town Hal or luncheon for the community and office hours to talk about what would be useful. There's an assumption that it's only after papers are out, whereas some of the notes we get from the field and images and nice stories that tell about the impact of our investments are important.

Dr. Isern said there has been discussion about NSF's name. Because it is a foundation, people think it's private. As NSF gets bigger, that might get exasperated. Our brand is well known in the academic community, but beyond that it's not that well known. We've traditionally pushed away from having a brand because researchers produce the outcomes. But as we grow and get more attention on how we invest so you get outcomes, that confusion and lack of understanding of our brand and who we are is going to be more of a challenge.

Ms. Greenwell said the brand is critical and hopes there will be a policy soon. This isn't just discoveries that are going to be made decades from now. Folks can do things today because of investments NSF has made in the past. We need to step up our game, not only in the visual branding of pieces, but asking those we invest in to make sure they're clear in the ways they're communicating. Dr. Nettles said it was about making sure when we speak with the media that it's clear it's NSF-funded research.

Dr. Schmidt asked about groups or societies outside of the audience, like AGU, that NSF works with to help disseminate these messages and enable scientists to do advocacy and outreach to Congress. Ms. Greenwell said her office works with many different societies, such as the Coalition for National Science Funding (CNSF) and the Association of Public and Land-Grant Universities (APLU). NSF is also trying to reach out to industry and others, which have a different type of influence, and reach people in places we haven't really been able to connect with before.

Dr. Whitlock said she has a large project in Yellowstone National Park with a strong paleo climate component. The park is interested in that and using that to communicate big issues to the four million visitors that come through. She hadn't thought before how to connect with NSF on that. She asked who to talk to and about opportunities to connect with a park service.

Ms. Greenwell said the Park Service has been doing a great job on their social campaigns for the parks around the country. She offered to connect her team with Dr. Whitlock to look at potential opportunities for outreach and partnering with The US Department of the Interior.

Dr. Nettles emphasized the message that being involved in the geoscience workforce does not necessarily mean you have to be able to or want to travel to extremely remote places. It's not something everyone wants to do or is best suited to or can do. Making visible the support for the people and other types of research getting done is important, so we're not relying entirely on the image of the super outdoorsy who want to get lost in the wilderness for three months.

Ms. Greenwell said her office has used GEO-funded students and scientists and the scientist selfie has been popular on our social media, where we're having those folks tell their story. It doesn't have to be somebody in an extreme environment, but students talking about how they got excited about science and engineering and what it is they're doing and how that work is relevant

to others. Those have been popular. She welcomes those kinds of connections to keep that pipeline going.

Dr. Nettles said many folks didn't realize it was an option to be a scientist until something came across the desk. It's great to have a lot of options for all the different ways you can be engaged with science, technology, etcetera, for people to imagine themselves there.

Dr. Kraft said she was unsure whether to tag NSF and asked about guidelines for thinking about social media. She was hesitant so as not to imply NSF is endorsing something they may not endorse. Ms. Greenwell said NSF loves getting tagged in social media. Her office does an NSF in the news that goes out every day and does a highlight for social. There is a social media policy internally for NSF workers. But if NSF helped fund the work you're doing, or something connected to something you're putting out there, that's the only way we're going to reach so many other people.

Dr. Ulvestad asked people to be mindful of the complicated international situation. NSF wants to promote international cooperation, but a big part of the CHIPS and Science focus is making sure we sustain US leadership in certain places. So, there's a dichotomy that people need to be aware of. NSF was tasked by CHIPS and Science to stand up a risk assessment center for helping universities and researchers evaluate the risk of their programs and collaborations. He said that's going to be coming in the next couple years. CHIPS in Science told NSF to stand it up at arm's length where NSF funds a group potentially from the research community to run this risk assessment center and interact with our colleagues.

Dr. Kraft referenced the challenges that occur as a function of being a federal agency and how communication works internally versus what gets communicated externally and challenges that might come with that. She asked about the nuances as NSF gets to be a larger agency and gets more scrutiny.

Ms. Greenwell said she assumes what we're talking about or sending internally would go externally. But now it's more true, because before you may have folks externally that may see it, but not have NSF on their radar and not think anything more of it. .Now that we are getting more of that attention and some folks that want to put NSF in a bad light or media where they're always looking for a headline, we need to be extra aware of that internally but also in how communities are talking about things that would reflect on the agency and the mission and especially for us trying to make sure we're getting out the strong messages about how important our mission is and how that's impacting people on a daily basis.

Dr. Nettles observed that it's an interesting place to be with the benefit of a bigger budget and the challenges that brings. The big message being that we need to work hard on communicating back to NSF as projects go along, so they have the opportunity to help us show people what the tax dollars are getting used for and having concrete examples.

Dr. Bart asked if anyone had experience inviting out a local representative or elected official, something he had never thought of doing.

Dr. Hindle said her congressional delegation returns calls and likes coming out and it's worth inviting them or their staff. She had them tour the labs in the animal facility as part of initiatives to inform folks about animal welfare legislation and working on research practices related to animal use. She said it's harder to get them in the field because of the geographical challenges. She suggested reaching out to a professional society and their legislative affairs group. Dr. Hindle said the people who hold the science portfolios like science. They like seeing what you do and like being able to say, our money went to these people and here are the students being supported. Some are passionate about education, some about biomedicine, some about economic development. You can figure that out quickly and highlight that part for them.

Dr. Kraft said her institution has strict requirements in terms of who can make official invitations on behalf of the institution. It would probably be frowned upon if she reached out to the person. Then the information can get diluted.

Dr. Hindle suggested introducing yourself to your university's government liaison office. The rule is you can't advocate on behalf of the university, but you are a researcher receiving funding from the National Science Foundation, particularly if one of your delegates is on one of the committees that's responsible for NSF appropriations. If your university is also angling for money from your delegation at the same time, you don't want to confuse your message. So best to run it through them.

Briefing with Office of the Director

Dr. Panchanathan thanked the ACs for their help and said the convergence of OPP and GEO to the earth systems view of the world is most appropriate and is energizing this entire systems portfolio. Dr. Isern is doing a fabulous job. He will be having a meeting on SAHPR and OECR and acknowledged their hard work. We need to make sure there is a safe, healthy, productive environment for all researchers, staffers, and everybody else. There would be details on the website on the hotline this week. The hard work of NSF and many of the external constituencies is paying off. NSF got the largest ever increase of 12 percent in the FY23 budget. Coming with that are the desires of the administration, the Hill and others to do certain things which you need to prioritize and clearly know. A climate resilient planet falls squarely within their interests, which is not different from what we are all prioritizing. And the president's FY24 budget of $11.3 billion is also fantastic for NSF. He listed his appearances with members of Congress around the country and testimony before Senate and House committees. He is trying to keep the message of the importance of the moment in terms of investment for impact, inclusion, and ideas.

Dr. Nettles thanked the director and reviewed discussions with Ms. Greenwell. The ACs are interested in following up on the SAHPR report and response, which originally came out of OPP and she thanked Dr. Panchanathan and Dr. Marrongelle for how that has been recognized as not only a polar programs issue and not only a GEO issue, but as an agency-wide issue and elevating the response to the level of a cross-agency effort and she acknowledged the individual leading the response and the importance of effort and expressed appreciation for the director's leadership. She reviewed other items on the agenda, including DEI in polar science. That's an interest shared across the GEO community. There is a potential for cross-agency strengthening and taking advantage of the pieces that need to be owned within different divisions and

directorates for an on-the-ground response and the broader strategic agency-wide response. She asked about the ways Dr. Panchanathan sees the agency moving forward with supporting a broad agency-level response and the connections to the on-the-ground response.

Dr. Panchanathan said he wanted to address it as a systemic problem and a cultural issue, rather than just a response to a particular incident, so we are going deeper into this, and you will find the common idea laid on the DEI. It's not just saying, Okay, let's hire this guy to do this or that. The objective is changing the culture. The actions can contribute to it, but they will not necessarily address the issue head on. One of the things we are focused on, therefore, is addressing the cultural issue on both these fronts. He was glad the AC-OPP met with Dr. Charles Barber because he exemplifies that, bringing a perspective of addressing the core issue of the culture. There was recently a two-day retreat with the leadership team, probably the most diverse of any agency. You must make the efforts to embrace excellence in every form and use that excellence to see how the culture of the entire agency can be addressed through that, and not just talk about it. At the retreat, the single point talked about was culture. There was an external consultant on culture who gave a set of ways in which you can look at where we are, where we need to be, and how we get there. It's not a one-time effort, it's an ongoing activity. On SAHPR, we want our actions to be immediate, actionable things that make people feel safer. That is, looking at the problem and finding a solution to the moment. But we are addressing the cultural issue also.

Dr. Marrongelle said permeating the conversations around the agency, particularly in the DEI space, but also the sexual assault and harassment prevention space, is that our communities are unique. We serve all of science and engineering and there are unique features of those communities. A hot button issue in the DEI space in computer science looks different from the hot button issue in the DEI space in biology. Communities have a good pulse on those parts of the of their own cultures and their own inner workings that they need to do significant work in. We want to develop strategies supportive of all of that, recognizing there are unique features within different disciplines. In cyberspace, we had an opportunity with OPP to address a critical issue in a unique and isolated space. We're learning from that what we can take and fan out to other unique scientific spaces. There will be elements of what we put in place in the SAHPR response that we're going to translate to other field sites, vessels, and other locations, but there will be things about other locations that are unique that we will need unique solutions to. We have to find the right solutions for the right communities for the right environments.

Dr. Kraft said the work around DEI is something GEO and OPP have been involved in and the subcommittee for OPP recently completed its report. She mentioned the AC-GAO subcommittee of climate justice. These are around different issues, but also concerned with how we become a more inclusive and thoughtful community and issues of who is entering into these spaces and how we think about bringing people into the GEO directorate, writ large, and from the standpoint of the workforce and what that means in terms of the different pathways.

Dr. Morris said he appreciated the earlier comments and commitment to culture change as a critical first step towards addressing systemic issues around the SAHPR report and hopefully this can be a model for extending that to other systemic issues. He asked about channeling the Arizona State University (ASU) charter in accelerating how we include people but making sure

they're successful and stay and thrive in the community. At ASU our online population is far more diverse than some of the immersion populations in geosciences, but they don't necessarily have access to research. Getting the research and professional development elements into the online space in ways can lead to the same type of success. He asked how NSF might catalyze innovation in that space. He said NSF has funded him for a two-year pilot program that has panned out and he's trying to figure out how to now translate that as a model. He asked where NSF is on thinking about this to create systemic change.

Dr. Panchanathan said there are some good lessons learned from the pandemic. This feeling that online means lesser quality is starting to fade. But learning includes research, maybe. So how do you enrich the learning process to provide opportunities for creative work and research. NSF is encouraging pilots in this regard. Also, in some cases, we are starting to increase the idea of internships and experiential learning, not necessarily limited to on-campus students, but also non-traditional learners. We're doing some of that through those targeted programs and we are making forays in terms of programs that are exemplifying the theme Dr. Morris talked about.

Dr. Marrongelle said there are a lot of lessons learned through the pandemic that we're in danger of losing sight of. There is a critical issue around access to data for researchers, for several decades, especially in the EDU Directorate. We understood that someone may not have the ability just to pick up and go do field work in a remote site for three weeks. And we have the ability to provide data, so with the right mentoring and access to data, we can provide those research experiences that are as rich for a variety of individuals. There has been work that has been undertaken throughout the foundation but spearheaded in EDU with a lens of trying to study and understand those research experiences. Through the pandemic, we spent a lot of time on projects understanding what mentorship was like in a virtual environment, what works and what doesn't. We're doing some things with our NCSES to make government-wide datasets available to a wider variety of people. These datasets are sometimes hard to come by. The training needed to get access to them is cumbersome. NCSES has been charged with making those datasets more accessible and testing ways to enable access to that data so critical questions can be addressed. She raised that as a way to keep our eye on how that's working. This is going to roll out this year. The question is how that is working when we make these large datasets available to a wider variety of people and whether we are taking down the barriers of access to the data. There are new questions we're going to be able to ask and answer because of widening that access. That is a model we intend to learn from and look at replicating that throughout other disciplines. Data we collect in Antarctica, from telescopes, and so on — we should solidify some of these models. We want to understand how better models can work and how to improve those for greater access.

Dr. Panchanathan said the other thing the pandemic taught is you don't have to be physically in Antarctica to do all the work in Antarctica. A fifth grader in rural Montana should not be precluded from having access to a quantum foundry to excite inspiration. That provides more remote students getting access to the instrumentation, in addition to the data, so they can have research experiences that typically on campus students don't have.

Dr. Nettles said there is excitement about the progress with the ARV design process. At the same time, there are questions around aging infrastructure, and re-capitalization, everything from

aircraft fleets, to drill ships. And for a particular community, it can be a big perturbation when we have one going offline or a delay in coming online, and it prompts us in the context of next generation facilities being even more expensive. She asked about long-term facilities and strategies to building the portfolio that spans disciplines in a way that has a robust process for deciding what to stop, start and continue.

Dr. Panchanathan said the terms Dr. Nettles uses were used in the retreat discussions. Start, stop continue is a theme he has been inculcating in the directorates at all levels, not just in terms of facilities and infrastructure. What are we starting? What are we continuing and evolving? What are we stopping? Also, the National Science Board has been increasingly focused on the prioritized list of infrastructure things and facilities we are going to be thinking about for the advancement of science into the future. We're putting an extra emphasis on that. Regarding facility maintenance and ensuring they are kept refurbished and operating, we are trying to see how that budgeting process does not take away from the ability to fund research. NSF is also trying to make a strong case for investments that must be increased in terms of infrastructure, and the angle we are using is national. We cannot lose the tremendous scientific promise we have by seeding leadership because we didn't invest at the appropriate time in the appropriate way. Even if the NSF budget were to double or triple tomorrow, we still will not have enough resources to do what we want to do. But we always have to have the mindset of two things. One, what do we stop, because we have done and we have achieved, or we tried, and it didn't work. What do we continue, but not just continue because it's good, but because it is evolving. And then what do we start. In all of this, we can never leverage enough assets from the federal government for what we need to do. We have to do interagency partnerships, industry partnerships, international partnerships of like-minded partners.

Sexual Assault/Harassment Prevention and Response Update

Ms. Davis said OPP has been at the forefront of the sexual assault and harassment prevention response effort and has been a super partner, ensuring all the efforts we've made so far and are continuing to make a significant dent in the short term. As the director said, we are looking at it from a holistic way. A focus has been on Antarctica, but we are trying to get at some of the other locations too.

Ms. Williams said OPP served as the launching pad for getting this started and unblinkingly focusing the light on this. This week, the biggest update is launching the NSF Antarctic helpline, a crisis support line that went live Monday. This is specific to the USAP community. The intent is to provide 24/7 on demand crisis support for individuals and participants in USAP, both current and past, to give access to a compassionate trained human to talk to and be with and make someone feel less alone and help direct them to different resources. One is the USAP victims advocate, which OPP can take full credit for; it's a resource available to all USAP participants and is confidential. It provides information on options for reporting and engaging with OECR using the safer science inbox. Also specific to USAP, OECR has initiated an incident review team, a collaborative activity with OPP. We are reviewing every incident, report, communication and complaint to make sure we're not missing any because we want to make sure people have multiple avenues to report and contact us. We are taking a joint approach to ensure everything is being looked at and making sure each is addressed in an appropriate and timely way. The helpline is staffed by trauma-informed individuals who have been through

training. OECR, alongside the Office of Inspector General, is undergoing trauma informed interview training. OECR is implementing an ongoing marketing and communications strategy to ensure everyone in the NSF community understands what constitutes sexual harassment and sexual assault, make sure they understand their options for reporting, and when there are supportive services available, making sure they're fully aware of those and how to access them. OECR is also making progress in the development of an IT-based case management solution to better ensure case processing accountability and accessibility of reporting data. This is the office's means of making sure we're being accountable, timely and accessing information and having a better understanding of the landscape with regard to sexual assault and sexual harassment. OECR is currently in the process of reviewing responses to requests for information that includes a variety of services and expertise relative to what we hope will be a robust prevention and response strategy, including culture change management, analysis and evaluation, restorative justice, mental health and support counseling services, and advocacy services. OECR has outreach and engagement with other federal partners who may be dealing with similarly challenging environments to gather information on promising practices for supporting safe field research. OECR has engaged several international partners, including meeting with Forum of Arctic Research Operators (FARO). OECR is pursuing a DCL to support research into promising practices around creating healthy and supportive organizational climates, and inclusive work environments.

Ms. Davis highlighted international engagements and work with the Air Force. We can't work in a vacuum and don't want to reinvent the wheel. OECR had a meeting with an Air Force person responsible for this and learned that if they tell the soldiers what not to do, those are the things they do. But if you tell them how you want them to behave, they adhere to that better. Learning information like that is great to complement our proactive compliance approach and trying to get a handle on this topic. She asked anyone with suggestions to contact her office.

Ms. Short said an important next step on the USAP side is a culture survey coming this summer. It's important that as we're doing measures at the agency level and unique to the Antarctic Program, that we're able to measure progress and pinpoint where the issues continue to be and how those are moving over time. It will be an incidence and prevalence survey of current and recent USAP participants to make sure the efforts are pointed in the right direction, and trends are measured over time.

Ms. Davis highlighted restorative justice and restorative practices. OECR has been having discussions with NIH, with international colleagues and university colleagues about the potential use in settings where people come back and work together. And it may be a perpetrator there or a victim and they need to work together. We're trying to complement the compliance role to help these communities come together and work on healing trauma in a way they can be productive. We recently learned on a Title Nine compliance review the university had taken action to address bad situations. But the faculty and the students felt bad about the environment because with non-disclosure agreements they had no idea what happened. OECR is curious if restorative community practices would help these communities move forward and not have negative baggage and energy when the victim and the perpetrator are no longer in the workspace. She asked for any suggestions around restorative practices and restorative justice.

Dr. Ulvestad said he talked at the AC-OPP meeting yesterday about a visit to the Air National Guard from New York, which flies ski-equipped LC-130s into Antarctica and the Arctic. They discussed SAHPR and their approach to having deployed personnel act appropriately. The leadership is on board with that. It's complicated on the ice. There's a lot of players, a lot of jurisdictions, and people who have requirements to the universities. It's a challenging situation. We're going forward on all the fronts we can and affecting cultural and behavioral change.

Discussion

Dr. O'Reilly said the helpline is a wonderful step forward. These practices and research show a serious commitment to working multi-dimensionally. As an anthropologist, she has been studying and working with Antarctic people and climate scientists for 20 years. She asks broad questions about their holistic experience. It's clear when something has come up that needs to be reported. She has encouraged interlocutors to do that. The description of the Air Force and modeling good behavior and explaining appropriate behavior is great. When she interviews scientists during a major project or intervals in a field season, or over the course of a research project, the last interview often brings up things that happened that don't get to the level of reporting. Things that gave them pause, that might deter them from going into the field again, or feeling unwelcome, are uncomfortable and it feels like a cultural thing. But not something they want to escalate to the level of calling a helpline; it's not acute and it doesn't feel like it needs to be reported. There's probably something like an exit interview to give people an opportunity, in a lower stakes environment, to express cultural concerns when it's fresh in mind. And in training for the next year, it's something that can address gray area issues that might help shift some of the practices. Ms. Davis said those things are equally as large if it's deterred someone from coming back to do research in that area.

Ms. Short said there are a lot of harms that may not be at a level that somebody feels is quote unquote reportable but makes them uncomfortable. OECR and OPP are expanding the training and toolkits for next season. They want bystander intervention training and other messaging to help people feel comfortable intervening or reporting in lower stakes ways. A consultant is building a lot into that training around building protective factors, so where there's quote unquote, lower-level behaviors, there are interventions or a way to handle that. And for the survey itself, it hasn't been determined when the optimal time is to conduct it. The first one is going to roll out in the summer and then look at the responses for information about what Dr. O'Reilly referenced.

Ms. Williams said one of the quotes from the listening sessions is how many yellow flags make a red flag. That's been a long-term hope to build a better relationship with the community, building more trust and opening up communication channels. So, that and getting information around what is assault and harassment, but also the gray, orange, or yellow area of stuff we want to hear about too to understand what's going on. Having surveys, maybe exit interviews, would be great. And being very open door and welcoming and being in a place that people can come to you and feel comfortable doing that.

Dr. Ulvestad said in this community of the ACs, you're thinking about researchers, but the majority of our people on the ice are contractors. And many are seasonal employees. If you wait

until summer, a lot of them are not employed by that contractor anymore. They may be off fighting fires.

Dr. Nettles said it seems like it's going to take a variety of tailored approaches. The exit interviews we do with a lot of students are done as they're leaving, one-by-one as they come off ice.

Dr. Parsons asked about extending these NSF policies to have a safer, more equitable environment on NCAR aircraft or a university doing oceanographic work on their own vessels but funded by NSF. He asked how to broaden the impact beyond NSF facilities to people using the facilities with an intermediate or just universities funded by NSF research.

Ms. Davis said OECR doesn't want its focus to be so narrow it misses these other locations. We see the space as almost anything that includes field sites, vessels. The goal is where our money goes, we want our outreach to go. If we don't have a direct compliance arm, we need to use another entity, whether DOJ, Commerce, Labor, or other federal agencies. We have reached out to say, this is what we expect. We cannot be so narrow we don't broaden our reach.

Ms. Williams encouraged idea submission. She discussed the new requirement for the safe and inclusive field research plans to start to push award recipients to think about this and contemplate being supportive of their folks in the field. For the most part, it is a certification plan exists. But a couple directorates are requiring submission of those plans for review.

Dr. Morris asked about restorative justice and said geosciences tends to be a small in-group community and academically incestuous. He asked for an example of how that that looks. They may leave the field site or leave the program or switch to another university, but still be connected. At conferences, he's been at a table when that triggering was happening. He suggested a workshop that would help him be more trauma informed.

Ms. Davis said she went to San Diego for a training last year, because we're always trying to think of tools we can use to make a difference. When thinking of restorative justice, the individuals have to agree, first of all. We think of the victim and the perpetrator. There are situations where it's been hijacked because of what happened in that community. They gave a scenario at a campus where someone put the N-word on a whiteboard in the dorm, and it had everybody in an uproar. They decided to have a restorative practice community in that dorm. They were kicking off, and an African American male said it was him, joking with a friend and called him the n-word and wrote it on the whiteboard. Now they know who the person was, and it wasn't ill intentioned. They invited this person into the circle. And they facilitated that circle, because of the trauma everybody experienced. If you don't look African American, everybody's looking like it was you. After you get the perpetrator, whole communities are still impacted. And they still could probably be deterring other people from coming into the science discipline. We also have people who come to NSF that had trauma, and it's hard for them to hear of a PI they felt was involved in something and never dealt with.

Ms. Williams said not every scenario is right for restorative justice. A lot of thought would have to go into the right time and place to look to employ some of those practices. Some of them

aren't going to be ripe for it; everybody has to be ready and want to engage for it to be successful.

Dr. Nettles said several questions in the Q and A related to the theme of people in Antarctica working for a contractor. She asked what efforts are going to be applied to the contractor. Ms. Davis said her office has to look beyond the compliance work it is going to be doing. The Office of Budget, Finance and Award Management (BFA) is tweaking the process to address some challenges, knowing there are contractors on the ice who are impacted. Some don't feel they have a resource to go to and the organization is not looking out for them. The Equal Employment Opportunity Commission stated that it would accept complaints filed for them, which her office was not aware of until a few months ago. Her office is engaged in a holistic way to talk to all the people involved, to make sure contractors are covered.

Ms. Short said there were contract changes aimed at screening contract deployers before they were employed and reporting more information to NSF than previously. NSF continues to follow that up with reviews of how the contractor is implementing the requirements in their contract all the way down to how the HR teams on the ice are receiving and responding to complaints. Systems of informal and formal practices and policies must be analyzed and change, and NSF is attempting to march through on the contract side starting with the contract terms and training and how the teams on the ice are behaving when somebody comes to them with those kinds of concerns.

Dr. Nettles asked on behalf of the Q and A whether there'll be an advocate or prevention trainer present at the South Pole next summer season. Ms. Short said there was overwhelmingly positive feedback regarding the advocate at McMurdo Station this past season. As a result, they extended that resource in the offseason virtually and are working with OECR on expanding that going forward. She could not promise an in-person advocate at the South Pole but is mindful of the impact it had at McMurdo. They are looking at ways to expand that to Palmer and other venues.

Dr. Nettles asked about adding protections or recording ability for scientists in the deep field. The hotline might not be possible for them if they can't talk on a satellite phone privately from a camp of tents. Ms. Short said that's a group we're mindful of. They did unique training for field teams before they went out and increased the number of communication devices. She welcomed other ideas.

Dr. Nettles also conveyed a question regarding changes to hiring practices for winter positions for next season. At the smaller South Pole and Palmer stations there were problematic incidents that may not immediately qualify as firing offenses but are significantly amplified. Ms. Short said we're changing hiring practices going into next season, particularly at places like South Pole, by hiring and building teams earlier. They heard in several listening sessions, particularly those focused on the South Pole, that when you come together as a team, sometimes these yellow behaviors can become problematic late in the season. Because of recruitment and retention struggles throughout COVID, it's going to be a heavy lift.

Dr. Nettles said as these practices are implemented, it becomes a more attractive place that hopefully some of that recruitment and retention will ease as you have a bigger pool of people to

draw from. She also conveyed a question about the Antarctic contractor and subcontractors. Ms. Short said part of the initial engagement with Leidos around the report was ensuring it had workplace policies comporting with what we expected and reviewed all the subcontract terms and conditions to make sure those requirements were there. OPP is working with Leidos and the subcontractors to understand if the policies and procedures are working and looking at training and outcomes on the ice. The NSF deployed footprint is small, and NSF is limited in its ability to do direct on-ice oversight. That's why the new reporting mechanisms are an important tool to get insight into whether these processes are in place and working. OPP is trying a top-down approach in terms of conditions and procedures and is encouraged by the reporting it is getting.

Dr. Nettles relayed a thank you to OPP for its work and courage to address systems and a question about ensuring institutions of higher education have meaningful, safe, and inclusive research environments. Ms. Williams said NSF has a lot of room to grow in this regard. Initial efforts, like the safe field research plan, will help NSF engage in conversations with them about what needs to be going on. These are big, hairy problems.

Dr. Nettles said you can take a compliance approach, or a culture and meaningful change approach. Different institutions approach that differently. We, as people within institutions of higher education, need to engage with the institutions around how these plans are implemented. There's a play to copy from something that has worked around risk management in OPP, which goes back to a workshop and follow-up workshops that were run around bringing researchers in to learn and help develop good practices and generate a community of practice to help us all learn how to do this better, so we have meaningful, safe and inclusive research plans. NSF can't control what the institutions do other than having to check a box to submit the plan. She asked about strengthening work with risk management and Title Nine offices on the campuses and if some community of practice could come out of the research community.

Ms. Davis said her office has started more practical compliance approaches to its portfolio. When program officers do stakeholder engagement, outreach, and technical assistance, it is looking to tag along to listen, observe, and stay behind after they leave and have more engaging conversations with the university about what they learned to gain more information in a proactive compliance way to bring back and share with whatever applicable office went out there. Trying to create a community practice by having workshops is worth talking more about because it marries well with what we're trying to do on the stakeholder engagement side.

Ms. Williams mentioned the DCL and funding research in this area to look at what is going to be effective, or what's a promising place to start digging into further.

Dr. Nettles said the AC will be coming back repeatedly to this discussion. She conveyed a concern in the online Chat about addressing culture first as common and an empty DEI answer in higher education and that systems, practices and policies have to be analyzed and changed. Ms. Williams said there isn't one avenue for success. We all have different levers to pull, and all those levers need to be going for something to be effective. There is the DEI culture approach, the system's approach, a compliance approach and more. She wants to better understand them all and make sure NSF engages with the appropriate partners to make a difference.

Ms. Davis mentioned the CHIPS and Science Act and funding agencies speaking with one voice. We don't spend as much time with the level we have with the Department of Education and having them work more collaboratively with us. Expanding collaborations is going to be key. That's why we started doing that internationally and in professional societies; speaking with the same voice, we can shift this significantly.

Dr. Nettles conveyed a question about whether there have been early quantifiable signs of success since NSF started implementing new measures and policies, such as fewer incidents or better morale, and the plan for holding perpetrators accountable when those people may not be NSF employees. Ms. Davis said it's too early to tell. A reduction right now probably is not necessarily a good sign because no one even knows you're doing something. We are starting these steps but haven't done them long enough to evaluate. Dr. Ulvestad said there is a requirement in awards that universities notify NSF if an administrative action has been taken against senior personnel on their award. It's been in place for several years, originally aimed at sexual harassment, but can be broader. If NSF is notified, it will consider whether to refer it to the inspector general.

Dr. Bart said in the field this past year several things were different, including the verbiage to the chief scientists about being aware of these issues. Also, when we got on board, the Marine projects coordinator, the subcontractor, did a nice job talking about sexual harassment, proper behavior, and showed some videos. Those are good things, and it would be great to continue doing it in in the future.

Ms. Williams responded to an online question about sexual harassment and bad behaviors as it relates to research misconduct. She said, yes, it's in the CHIPS and Science Act that NSF enter into an agreement and update the responsible conduct and research report to include issues related to sexual harassment.

Wrap-up

Dr. Kraft reviewed agenda items for the fall meeting, including:

- Thinking about the CHIPS and Science Act and the international aspect of science, challenges, and opportunities that come with that.
- Inviting Dr. Rebecca Keiser, NSF Chief of Research Security Strategy and Policy.
- Outcomes of the online surveys Dr. Isern discussed
- An NSF response with regards to the DEI subcommittee report.

Dr. Isern added:

- A discussion about working with indigenous communities.

Dr. Nettles added OPP-specific items:

- Discussing a path forward related to the physical qualification program.

She said the last item is in the realm of things to strategize on for the transition of the committees and tracking issues that are closely linked to the DEI and sexual harassment prevention aspects and of specific interest to OPP.

Dr. Kraft said a question came up yesterday about DEI and the impact on marginalized populations and digging into the data for a better sense of who's being excluded. The idea that it's colorblind is probably not legitimate. So, recognizing there's sensitivity within the data and how to separate those out. PQ is specific to the polar community, but physical disqualifications are factors to think about from a broader GEO community perspective.

Dr. Nettles also mentioned:

- The new subcommittee that will be standing up for AC/GEO related to polar infrastructure, logistics and safety. There are safety topics to follow up on related to crevasse risk mitigation, sea ice, and concerns within the community and NSF broadly about risk management.

Friday, April 14, 2023

General Discussion: Follow-Up Issues from Joint Session

Dr. Kraft and Dr. Patten introduced the new EAR Division Director, Dr. Dena Smith-Nufio, and Dr. Kraft opened a general discussion following up any issues from the previous day's joint session with AC-OPP.

Dr. Whitlock said it seems like a large, unwieldly group and asked if there are plans for a smaller committee in the future, and how the co-chair roles will work. Dr. Kraft agreed it is unwieldly, but noted there are people rotating off both ACs. The group will be on the larger side, but not as large as yesterday. She will be co-chairing with Dr. Nettles; what that means is still being figured out, making sure we're not losing track of important issues from the different perspectives and divisions. Ms. Lane said the ACs are aiming at an ultimate size of 15-18. Dr. Kraft said as people rotate off, we'll be able to be more intentional about who we replace people with to make sure we're not losing track of key perspectives.

Dr. Richardson asked about funding and Dr. Patten said there have been programs within the Office of the Assistant Director over the years that have developed and been managed there. RISE is going to be comprised of moving those programs over, so that's baked into the budget. He said Dr. Isern would provide more details later in the meeting.

Dr. Romanowicz referenced the discussion of improving how data are accessible to a larger community and asked how people are going to use this data if they don't know how to use them. Dr. Kraft said with access comes responsibility, adding we're required in NSF proposals to have a data management plan and through the public funding program it's required to be open at some point. But there are challenges. The social science research she does is with human subjects. She asked about keeping interview data private for the interviewee's security.

Dr. Pope said the most recent GEO open science ecosystem solicitation should address some of these issues. It is not just supporting open science, but the things that facilitate open science for the rest of the geoscience community. That could include different kinds of cyber infrastructure as well as capacity building, and how best to use that cyber infrastructure. Speaking to the example of human subjects, it includes ethical considerations about how we share data, how to facilitate fair and care data as much as possible, while respecting data sovereignty and ethical

data governance. We're trying to use particular use cases and workflows that can be generalized and take those lessons learned for the rest of the GEO community.

Dr. Romanowicz asked about the European Plate Observing System (EPOS), an effort to build a portal to combine data from various communities in geosciences and make them available in a way that is easy to use by the community.

Dr. Pope said because we do work with broad and interdisciplinary communities, we're trying to work on data standards to enhance interoperability, in particular the interoperability of search. It's easy to go where at least some of your data are and search there, and find the other places where those data are, as opposed to one super repository for everything. We'll never capture everything. The disciplinary repositories know best how to document and handle their data. That small-scale approach within OPP, as well as a broader approach across the GEO cyberinfrastructure (CI) group to build on projects like GeoCODES, help share metadata more effectively. Dr. Romanowicz said it is important to not duplicate efforts and make it interoperable and be able to exchange data internationally.

Dr. Smith-Nufio said there have been effective ways to bring different communities and their data together and not just make those data available and have standards and accessibility but engage communities that don't typically work together. Once those data are available and people start to talk, you can bring communities together and develop new tools, new research questions, and new directions. This is the beginning stage of an explosion of new ideas. We've seen that from other communities that have had these types of initiatives, the big digitization efforts from the museum community that included biological and geological samples, is an example. And EarthCube, where you started to integrate communities working together and coming up with standard language to ask new questions with different types of data.

Dr. Aluwihare spoke about offering remote participation options for students doing undergraduate research. If students don't know how those data are collected, or what the challenges are associated with that, it's difficult for them to get a true appreciation of the scientific process. It's important to have those in-person experiences and make them as accessible and as inclusive as possible.

Dr. Kraft said online experiences are not a substitute for in person. But in terms of the population taking online courses, we're seeing our more minoritized populations increase. She asked how to allow an opportunity for a deeper experience. Some are doing online classes because they're working moms or caretakers or have jobs. She asked about how to be sensitive to those realities, while giving opportunities that allow them to think this is something they could do.

Dr. Aluwihare said we can't just say we've ticked that box of having underrepresented students taking online classes but must think why in some cases those research experiences, for example, aren't available to those students and address these underlying issues.

Dr. Kraft noted that access is not inclusive. Just because we put it out there doesn't necessarily mean we're creating those experiences that lead to authentic experiences. She has colleagues who have figured out how to do a course-based undergraduate research experience and integrate

undergraduate research into the course curriculum in an online space. It isn't the same, but it's exposing them to the idea of undergraduate research.

Dr. Morris said his office tried to enrich the online research experience to engage students. They interviewed professors who worked in the field, modelers, and people working in geoscience and industry. They kept a relationship with their interviewees throughout the 10-week academic year internship and built the social capital you ordinarily get when you drop into someone's office or go to lunch.

Dr. Kraft said it is important to recognize the process we might have gone through is not necessarily going to be the pathway everybody is going to be able to take. Pre-pandemic, there were not a lot of alternative models. One of the benefits coming out of this pandemic experience is new creative potential pathways.

Dr. Gamage said there aren't data showing how impactful online research is. This is a problem because we see decreasing enrollment in GEO and are concerned students are not getting a sense of belonging to the field. We need to continue to measure new efforts and online modalities. And bringing them back to in-person. We cannot ignore the hands-on activities we used to do and give that sense of belonging. If they don't see themselves in the geosciences, we're going to lose them.

Dr. Parsons said some personalities prefer online and others want to meet in person. But in a lot of fields, it's important to build on connections with the private sector. Faculty are geared to reproducing people like ourselves who are researchers or instructors. He mentioned a student who had 20 email exchanges with someone from Tomorrow.io, who spoke virtually in class. A lot of companies have moved to this virtual world. Especially for marginalized, minoritized groups, it's important to show there are job opportunities.

Dr. Kraft noted an online Q&A post that OCE supported a successful virtual Research Experiences for Undergraduates (REU) in 2020.

Discussion of Advisory Committee for Environmental Research and Education White Paper on Minimizing the Impacts of Research on the Environment

Dr. McCall said he is on the AC-ERE and provided its objectives:

- Provide advice, recommendations, and oversight concerning support for the NSF's environmental research and education portfolio;
- Be a base of contact with the scientific community to inform NSF of the impact of its research support and NSF-wide policies on the scientific community;
- Serve as a forum for consideration of interdisciplinary environmental topics as well as environmental activities in a wide range of disciplines;
- Provide broad input into long-range plans and partnership opportunities; and Perform oversight of program management, overall program balance, and other aspects of program performance for environmental research and education activities.

AC-ERE is not tied to a particular directorate but works across the foundation. In the area of environmental research and education activities, the AC's point of contact is the Office of Integrative Activities (OIA).

AC-ERE's current initiatives are:

- Broadening Participation in Environmental Research and Education
- Centering Environmental Equity in Research Activities
- Improving Interdisciplinary Collaborations
- Water Availability and Security
- Minimizing the Environmental Impact of Research

Dr. McCall provided the following background on the sustainability of science:

- Corporate sector increasingly measuring and setting targets for Environmental, social and governance (ESG) performance
- "Science-based targets" for reducing greenhouse gas emissions
- Biden administration priorities include:
    - Reducing environmental harms
    - Striving for a net-zero future
    - Advancing environmental justice
- Is the scientific community (and NSF, in particular) doing its part to provide a forward-thinking approach to sustainability practices and minimizing its own environmental impact?

Dr. McCall provided context on what NSF is doing in this regard and what NSF engagement might be:

- NSF's strategic plan recognizes the need to evolve "what constitutes or promotes responsible conduct of research," and at the same time highlights the profound challenge posed by global environmental change.
- All research activities and facilities supported by NSF come with an environmental impact, including a contribution to climate change through direct or indirect emissions of greenhouse gases.
- NSF considers environmental impact by:
    - preparing environmental impact statements for projects that are subject to National Estuary Program [?] (NEP) compliance
    - advancing sustainability plans for its facilities (in at least some cases)
    - requiring an environmental impacts checklist for certain types of proposals
- In a few cases, NSF has engaged Pls in considering the potential impacts of their proposed research activities on the environment or minimizing such impacts.

He also showed the Organizational Environmental Impacts Checklist, which most principal investigators (PI) have not seen because it's only required for types of work like drilling or weather modification, and the release of biological control agents. In a few cases, NSF has actively engaged PIs and considered the potential impacts of their proposed research activities on the environment or minimizing such impacts. NSF has successfully conditioned PIs to consider the positive, broader impacts of their proposed research, but has not taken many steps to

condition PIs to consider the potentially negative broader impacts of their research, including impacts on the environment.

AC-ERE efforts in this regard:

- Devoted sections of last two meetings to discussing environmental impacts of research
- Spawned "interest group" to explore in more detail:
    - Ben McCall, University of Dayton, Prof. of Sustainability
    - Kim Jones, Howard University, Prof. of Environmental Engineering
    - Vicki Grassian, University of California at San Diego, Prof. of Chemistry and Biochemistry
    - Arnoldo Valle-Levinson, NSF, Physical Oceanography (rotator from University of Florida)
- Broad consensus:
    - This topic merits increased awareness among Pls and their institutions, as well as within NSF
- Themes from discussions:
    - PIs do have some influence on the environmental impacts of their work (e.g., travel decisions, participation in green lab programs)
    - Many elements of impacts are outside PI control (e.g., institutional energy procurement)
    - Concern about placing additional burdens on Pls in the proposal process
    - Concerns about inequitable impact on Pls from less-resourced institutions

Dr. McCall concluded with questions for discussion:

- What role should NSF play in raising awareness about the environmental and/or socio-environmental impacts of research?
- Are there ways that NSF could encourage Pls and/or institutions to reduce the environmental impacts of research?
- What, if anything, would be appropriate to ask of Pls in the proposal process, in terms of considering actions to minimize (socio-)environmental impacts?
- Are there ways that we can engage and train students to consider minimizing the environmental impacts of research?
- Do you anticipate any other downsides to this initiative?

<u>Discussion</u>

Dr. Whitlock relayed a comment from Melanie Buser, Assistant Director for Environmental Health at the White House Office of Science and Technology Policy (OSTP), that all federal agencies may need to consider sustainability in their planning.

Dr. Richardson said for researchers who go to sea, it's tricky to be sustainable when we're on a ship spewing carbon. It sounds like something University-National Oceanographic Laboratory System (UNOLS) might take on.

Dr. McCall said he is just beginning this conversation with a tour of most NSF advisory committees. He is not familiar with UNOLS. Dr. Richardson said the Integrative Programs Section (IPS) takes on all things that involve the ships.

Dr. Dahl asked about requiring discussions with tribal communities when people are submitting proposals. Checking in with tribal communities who are related to the land we're working on is never formally required. But that's an avenue NSF can consider, generally, and maybe this is a committee that could think about how that might work. Tribal communities have an important role to play in the issues related to this committee.

Dr. McCall said his AC had conversations about socio-environmental impact. The topic of tribal communities has not come up. But there has been general concern about how communities are engaged in research, and a report was just published on engaged research. In certain types of field campaigns, people walk around neighborhoods in Tyvek suits as they're doing environmental monitoring and that has negative impacts.

Dr. Kraft said there's GEO heritage work similar to how do we do ethical practices in the field, in concert with thinking about indigenous sovereignty and good practices in the use of the land. Paleontologists came up with the idea of whether you take a fossil out of the field, which means it's never going to be where it was. She relayed on an online comment that Scripps Institute is working on a regional class hydrogen fuel ship. Another comment stated the Proposal & Award Policies & Procedures Guide (PAPPG) out for review this week has information on requiring proposals to engage with tribes about their research.

Dr. Whitlock asked about the impact on PIs and their individual research grants. Especially in the geosciences, where there's a lot of field research, some of it's in big infrastructure situations like ships, or Antarctica. She asked what sorts of things we want to ask PIs to cover, for example, in a proposal to acknowledge dealing with the impacts in a positive way. She asked if it would be part of broader impacts, or a statement in a proposal and how would it be reviewed.

Dr. McCall said nobody is proposing there'll be a scoring of proposals based on how big the environmental impact is, which would not be equitable. At most, the conversation has been around asking PIs to consider ways to minimize the environmental impacts of their work consistent with getting the work done.

Dr. Romanowicz asked if there would be a requirement for an environmental impact statement in proposals as there is for data availability and postdoc mentoring. In her field most work is on supercomputers, which has a large environmental impact.

Dr. McCall said no consensus has been reached on this, but ideas that have been floated include an add-on plan or statement, like the data management plan or facilities information. An idea has also been floated to request a paragraph inside the project description discussing efforts to reduce environmental impact. Within the ERE committee, there have been discussions about the pros and cons of those approaches. Some say it would be burdensome to take away space from the 15-page project description. People have also suggested this fits the broader impact portion of the project description, but that might take away from discussion of other types of broader impacts.

Dr. Romanowicz said she would leave the 15 pages for the research. With broader impacts, there is hardly any space left to describe the science or to address all the questions reviewers have. It

would fit better in a separate section. The length will depend on the kind of research. And she asked how a researcher can influence the supercomputer center.

Dr. Richardson related an experience with younger professors who needed to do the plan for safety in the field. It was confusing to many of them, and even to the university sponsored programs as to exactly when that requirement was going into effect. So, if there is a requirement, clear guidance about when it would be required is important.

Dr. Kraft, addressing the role NSF should play in raising awareness about the environmental or socio-environmental impacts of research, said we need to be doing it on all avenues and all fronts. She also raised under resourced institutions and what is happening in different states in terms of restrictions on what institutions are allowed to talk about or consider in their research and how that impacts what would be a requirement at the federal level.

Dr. Whitlock said it is important to consider how reviewers are going to evaluate environmental impact and to ask the institutions how they would fund any action, because so much of the environmental harm in proposals are out of the PI's control. That's the part that makes any PI nervous. Dr. Oboh-Ikuenobe said it is important to have clear guidelines that PI's can follow.

Dr. Kraft said the conversation about broader impacts has gone on for decades and that's one way to think about adding something. Dr. McCall said one idea is to begin with something low stakes and intended to open people's minds and build awareness. He suggested a requirement for a one paragraph statement outside the 15 pages discussing the main ways the research is likely to impact the environment and steps that could be taken to minimize impact and asking reviewers just to judge whether that statement is present. Then, over 10 years, socialize that into the community. And institutions might over time grow to support their PIs in preparing these statements and advancing their sustainability initiatives.

Dr. Kraft said one way that could be an incentive is getting a certain percentage more funding if you found a way to reduce impact. Dr. McCall said the question is, how does that translate into expectations for the responsible conduct of research. We don't currently have training on this topic.

Dr. Nettles said the recently revised solicitation in Arctic science requires an additional document related to ethical considerations and approaches of the proposed work that is broad. It includes a request to consider environmental impacts and ethical considerations. It's important to ask researchers to be cognizant of and thinking about these things. It's also important to think about the ways that can be effectively implemented, because we're not only asking community reviewers to be competent at reviewing plans for safe work environments in remote places, we're asking program officers to evaluate those plans competently. That's not a place where program officers have a lot of background and training.

Dr. Gamage asked if NSF is considering adding this environmental impact statement for one or two programs to see how it works before applying it across all programs. Dr. McCall said that idea has been floated. It's easier to do it in a few cases. And it may be that's already happening with the Arctic solicitation. There was also a solicitation in the Signals in the Soil program that

asked PI's using environmental sensors to consider the environmental impacts of placing those sensors in the field.

Dr. Kraft related an online comment that there have been green ships workshops. And there are some net-zero ships efforts globally.

Dr. McCall asked about ways of engaging and training students to consider minimizing the environmental impacts of research. Dr. Aluwihare said students are more vocal at Scripps about this, getting on the director's case for flying 15 people to Egypt. The biggest movement for green ships at Scripps has been the green New Deal group headed by students. Dr. Kraft suggested facilitating those discussions as not all graduate students feel empowered to have those conversations.

Dr. McCall said his aim is to gather feedback from the various ACs, synthesize it within the interest group and AC-ERE and develop a white paper summarizing what we've learned and making recommendations to NSF. It's not clear who in NSF owns this topic. The path forward depends on the recommendations. If it's moving in a pilot direction, we would try to find sympathetic program officers in various directorates and identify programs that might be well poised to start that conversation with PIs and reviewers and program directors.

Dr. Nettles said it's not obvious whether the information is out there to let us evaluate the relative environmental impacts because we're talking about flying places versus a virtual meeting and can make a ballpark estimate. Computers use a lot of electricity but how does that compare to the impact of ships and flying people to meetings.

Dr. Kraft said that from the standpoint of what's within our control, if you have to use a supercomputer, you have to use a supercomputer; that's not anything you have control over. Different institutions have different amounts of power to have control over some of these things versus others. In making decisions about what's purchased at your institution, it goes into many different rabbit holes. Dr. McCall agreed it would be ridiculous to start with asking PIs for a detailed carbon accounting of their research. But maybe there are baby steps we can take in that direction.

Dr. Kraft said a colleague got a new instrument that does an analysis of the green footprint of research equipment and has that printed out for the students.

Dr. Whitlock said we should think about those baby steps and maybe start with an acknowledgement of the impacts we have, and steps being made to reduce those impacts. Some institutions are doing very little, but other states are at the cutting edge.

Briefing on International Ocean Drilling Program

Dr. McManus began his presentation on the future of NSF-funded US scientific ocean drilling, with a discussion of the International Ocean Discovery program:

- Process of drilling cores of rock and sediment from below the seafloor and bringing them to the surface for study

- The JOIDES Resolution (JR) is the most utilized of the three Integrated Ocean Drilling Program (IODP) assets
- Activities include
    - ~5 expeditions per year
    - Sample curation and research
    - Community leadership

Much of what is known about Earth's evolution has come from or been supported by efforts inside the drilling community. Contributions to our understanding of the Earth include a greater understanding of:

- Tectonic Plates
- Impacts to Sea Level
- Continental Ecosystems
- Ocean Biology
- Mega-earthquakes
- Monsoon Formation
- Ice Sheet Evolution
- Sub-Sea Floor Ecosystems

NSF is the Majority Funder of the Drilling Vessel JOIDES Resolution:

- NSF funds Texas A&M University as the JR Science Operator (JRSO) at $48 M per year
- (FY 2014-2024)
- Non-binding international partner contributions provide the remainder of $72 M per year to run the JR
- Environmental Impact Statement of the 45-year-old vessel expires FY 2028
- Obtaining an extension is not a financially viable option.

Dr. McManus outlined how international partner contributions have declined:

- Partner funds have decreased from S34.5 M in FY 2015 to <$2 M in FY 2025
- NSF provides two-thirds of JR operational funds, but U.S. scientists make up one-third of onboard science party on average
- OCE informed IODP partners in 2021 of planned shift to U.S.-led program with flat, equitable berth rates
- Requested Letters of Interest in new program were few in number and proffered funds from international funding agencies were limited.

With this background, Dr. McManus discussed one of the ways input is gathered from the community, beginning with mention of the 2015 to 2025 decadal survey from the National Academy: the U.S. National Academy of Sciences, Engineering and Medicine (NASEM) Sea Change 2015-2025 Survey. It advised that:

- "scientific ocean drilling facilities and analysis of core collections are critical for the decadal science priorities." But it also stated:
- "OCE should strive to reduce the operations and maintenance cost of its major infrastructure…", including the JR.

Outlining NSF's decision, he provided the possible options:

- Option 1: New program using equitable berth model, JR operations end 2028.
- Option 2: end JR operations at end of current award (FY 2024)

The decision was made for winding down the current IODP:

- The JR will be demobilized by the end of FY 2024.
- Next steps:
    - Post-cruise publication responsibilities
    - Data archival activities
    - Core repository sample management

During a five-year period after demobilization, NSF will continue to support the awardee in its winding down of activities and he outlined the continuation of core and data repositories:

- U.S.-owned cores:
    - Domestic: 155 km at Texas A & M University (TAMU)
    - International: 310 km at Bremen University (Germany) and Kochi University Japan)
- NSF is committed to maintaining access to cores and related data for the U.S. and international science communities.
    - U.S.-owned cores would be kept at current locations under the same governance while long-term storage discussions are underway.

He went on to discuss the continuous evolution of scientific ocean drilling:

- NSF recognizes the importance of ocean drilling-enabled science in contributing to understanding the broader Earth system
- Time to consider how to meet scientific priorities within fiscal constraints over the next 10 to 20 years.
- Planning for the next generation of scientific ocean drilling (SOD) must start now. This will require investment and dialog.

Discussing on-going and near-future activities, he emphasized:

- That NSF has and will continue to invest in research using existing samples and data
- The March 15 DCL: Advancing Research in the Geosciences Using Legacy Scientific Ocean Drilling Cores
- Develop an innovative framework for supporting early-career scientists
- Engage early-career scientists to help determine what the future of SOD looks like
- Consider and continue to plan MSP/seabed drilling deep piston coring expeditions to meet scientific priorities
- Identify technologies (emerging or existing) that will enable a diverse portfolio of drilling approaches.

Dr. McManus said it's time to develop a strategy for the next evolutionary phase of scientific ocean drilling and further community input is needed:

- OCE has solicited a new decadal study

- Leverage the Ideas Lab approach: how technology is evolving and how to best manage scientific priorities
- Workshops to identify priorities with highest level of scientific urgency and a timeline for the future

Dr. McManus summarized the following takeaways:

- NSF wants scientific ocean drilling to be a sustainable enterprise, post-JR.
    - This requires community input and careful consideration for how we support O&M into the future.
- Science communities drive what research and infrastructure NSF funds within its budget.
- Near-future proposals for SOD activities help make the case for long-term investment.
- Message to the community: To enable your plans, we need fundable proposals, both in financial scope and scientific merit.

He concluded with updates unrelated to ocean drilling, starting with relaunching a refurbished Alvin:

- Alvin has returned as part of the NSF-funded National Deep Submergence Facility
- New maximum depth of 6,500 meters, 2,000 meters deeper than previously
- Enables researchers to reach 99% of the sea floor

The three new research vessels coming online in the fall will augment and modernize the U.S. Academic Research Fleet (ARF), which will:

- Support all "Sea Change 2015-2025" science drivers
- Enhance fundamental research capabilities
- Effect "right-sizing" change necessary for coastal and continental shelf exploration
- Expand educational and shore-based education and workforce opportunities

Finally, there will be a new National Academies decadal survey for 2025-2035:

- Last decadal study (Sea Change, 2015-2025) identified research priorities and provided strategies to balance investments
- New study will provide recommendations for OCE considering changing priorities and emerging opportunities
- Currently forming the committee

The new study will identify ocean science questions that continue our focus on the critical role of the ocean in the Earth system:

- Our science needs to continue to be attendant to issues of
    - Timeliness / urgency
    - Societal benefit
    - Technological advances/needs

<u>Discussion</u>

Dr. Aluwihare asked if money in IODP is going to be used to prioritize the community that was impacted. Dr. McManus said the plan is to invest in ocean drilling related science, specifically for deep sub-seafloor sampling. Dr. Aluwihare said for developing new technology, there's a long

time between conception and delivery, and asked what happens to the community in the meantime. She appreciated the focus on early career support. But one of the things about the JR cruises was the level of participation in terms of career stage, a crucial part of developing a new community of scientists. Many of those older folks took a lot of hits in the in the last 40 years in terms of funding availability.

Dr. Gamage said it was saddening to see JR leaving, but there are a lot of opportunities. Of institutions that do scientific ocean drilling research, less than 10% are non-R1. This is an opportunity to encourage R1 colleagues to reach out to those primarily undergraduate institutions to diversify this community. It's extremely difficult to find collaborators. Since 2016, we've been doing a pilot program through NSF Pathways into the Geosciences - Earth, Ocean, Polar and Atmospheric Sciences (GEOPAths) to integrate ocean drilling into community colleges. Our challenge is how to bring this to online students. It took years to see how these little programs impact our students at community colleges. Dr. McManus said one of the opportunities is the possibility of constructing virtual legs that could take advantage of data resources and sample resources we already have. So, getting folks who can't go out on legs, but could participate in new ways.

Dr. Gamage asked about the instrumentation on JR. Dr. McManus said that equipment doesn't belong to NSF but will be part of the demobilization. Dr. Gamage asked about the DCL, which had a statement that you encourage community colleges and minority serving institutions to apply. But there is concern about how proposals from smaller institutions will reveal in the Marine Geology and Geophysics (MGG) Program, along with all the other proposals. Her proposal will have an educational research component. She asked if reviewers might wonder why we sent this to MGG. Dr. McManus said the hope is to be in a position where there's a balance of activities that will compete well inside our core programs.

Dr. Kraft related an online Q&A comment about the plan for United States Antarctic Program (USAP) to organize a community workshop to explore innovative ways to conduct scientific ocean drilling research. Dr. Isern said it is important for proposals to quote language relevant language in the DCL. She added that with an old ship it's important the community considers this an opportunity to make something new and exciting in ocean drilling we can sell to international partners, and we need to do things like bringing in virtual legs. We need to send a strong message to the community that this is an opportunity to bring our partners back.

Dr. Kraft added she had a student who looked at old cores and found new research results that countered what the previous research showed and is now in a master's program. She added that the loss of potential institutional memory needs to be considered by the community.

Dr. Isern said NSF is not taking any mission specific or alternative platforms off the table in the interim. But we need to be more intentional about finding opportunities and keeping the community going.

General Discussion on Follow-up Issues Continued
Dr. Isern said she wanted to add to add the following points to yesterday's joint session discussion about RISE:

- RISE Programs and staff within GEO OAD will be administered through a stand-alone division
- Search for the RISE Division Director will be initiated soon
- RISE Programs in FY23 will proceed as planned (interim management though GEO OAD)
- New programs will be planned and developed for FY24

Dr. Kraft asked for questions for the division directors present. Dr. Whitlock asked about the Dynamics of Integrated Socio-Environmental Systems (DISES). Dr. Isern said it is the Directorate for Biological Sciences (BIO), Directorate for Social, Behavioral, and Economic (SBE) Sciences and GEO. GEO has discussed it in the context of building a resilient planet, because it's tapped a community that's core to what we want to invest in. It evolved out of Coupled Natural and Human Systems (CNH). It does a lot in the resiliency space, integrating social and behavioral research. They receive many proposals, and the success rate is below average for NSF. There is an opportunity to bring DISES into the resilient Earth fold. Dr. Whitlock asked if DISES will be moving to oversight by GAO. Dr. Isern said she is not sure but there's no plan to move it now. Dr. Patten said there's a working group with representation from the three divisions that manage it, and each year management rotates among the three directorates.

Dr. Aluwihare asked how things might be going in OCE and what they're hearing from the community. Dr. Richardson asked about new hires and the staffing situation. Dr. Clough expressed excitement about the new decadal study being initiated. The last report was very influential for OCE. There has been turnover, a lot of it expected. There is a Committee of Visitors (COV) coming up. There are conversations to be had about whether these are impacted by COVID and remote policies. Recently, a new program officer for biological oceanography joined. There has been turnover in science assistants. In chemical oceanography, an Intergovernmental Personnel Act (IPA) rotator joined, and they lost the IPA rotator in physical oceanography and the postdoc rotator, but an announcement on a replacement is expected soon. On the international level, there is a new high seas treaty on biodiversity beyond national jurisdictions. For biological oceanographers, there's a lot of money to be had on gene discovery or drug discovery. The NSF lawyer who pays attention to the Antarctic is helping with the treaty.

Dr. Smith-Nufio said EAR has its leadership positions filled and is filling some positions. Several searches are active for permanent and rotating program officer positions. Some people will be rotating out, including the retirement of a mission support staff after 46 years with NSF. EAR will be hiring another science assistant and is interviewing for an American Association for the Advancement of Science (AAAS) triple and new program officers joined since the last AC. EAR is also reinvigorating its communications program, working on its touch points. EAR is ramping up activities related to DEI. It is looking at data and how it can refocus its energies. EAR is also working on DCLs to encourage the community to apply for different opportunities within the directorate and across NSF.

Dr. Oboh-Ikuenobe asked if NSF has thought how to respond to the assault on DEI activities. Her state has joined the bandwagon and it's frightening. Dr. Isern said there have been discussions about it. Getting involved in state politics is touchy. Dr. Patten said the higher levels

of NSF are monitoring the situation and he was sure they're all talking and will provide an agency response when things happen.

Dr. Clough said the CHIPS and Science Act directs that NSF facilities must have specific commitments to DEI. We're starting to think about whether there are any large facilities in states that are passing laws; that that be a collision. So, if we have specific requirements in various awards, that may be an avenue to think about where those awards sit in what states. Dr. Isern added that it is a political minefield and will be navigated extraordinarily carefully with our lawyers.

Dr. Kraft said an AC-OPP presentation from NSF's diversity, equity inclusion officer, addressed efforts to prevent the work NSF is doing from being weaponized. It's clearly on his radar of thinking about that larger lens of the political landscape.

Dr. Anne Johansen said at the division director level, we work closely towards our GEO priorities together in unison with all the four entities, Ocean Sciences, AGS, Earth Sciences and OPP. AGS is also releasing solicitations. It works to see where there are gaps in the science portfolio that meet demand and the changing trends in our communities. With regards to capturing the missing millions, AGS regularly holds virtual listening sessions with non-R1 institutions to help facilitate their ability to apply and write proposals because they often don't engage. AGS is also working on a solicitation. In terms of personnel and staffing, AGS is always looking for IPAs, had interviews for a climate program and may be expanding that for another staff member.

Dr. Kraft said regarding the conversation yesterday about revisiting the name of GEO, that AGS extends well outside of the atmosphere and the ocean is part of Earth, but people sometimes don't equate Earth with water. She asked if there have been conversations in AGS about naming. Dr. Johansen said there are meetings on a weekly basis to discuss those topics and working more closely together and we get the same messaging from our communities. Dr. Isern has been talking to staff and the survey presented earlier was sent to staff. She said the results were split. There was a fear of losing the brands. There was also the acknowledgement that there's an advantage to having a new brand to generate and that we're thinking in the future. We know we'll never get consensus.

Briefing on GEO Facilities

Dr. Kraft asked Dr. Walker to speak about the CHIPS and Science Act, DEI and major facilities. Dr. Walker said NSF major facilities are beginning to incorporate some of the CHIPS and Science Act requirements. Solicitations will incorporate that language and facilities need to be evaluated against that. It's a broad language, so there may be flexibility for major facilities, particularly in states that have more challenging postures.

Dr. Walker provided an overview of the GEO portfolio, which incorporates the polar programs and has the foundation's largest facilities portfolio. The FY 24 operations and maintenance budget request is $650 million. For comparison, the Directorate of Mathematical and Physical Sciences, the next largest, is about $330 million in operations and maintenance. Her role includes cognizance over all major facilities in GEO. The facility-specific management rests with the

division and office program directors. She also works with the chief officer for research facilities on broader facility related issues.

Dr. Walker defined research infrastructure as:

- Any combination of facilities, equipment, instrumentation, computational hardware and software, and the necessary human capital in support of the same. Major facilities and mid-scale projects are subsets of research infrastructure.

She defined major facility as:

- Science and engineering facility project that exceeds $100,000,000 in total construction, acquisition, or upgrade costs to the Foundation.

Explaining the full lifecycle of major facilities, she started with development, which is where the idea begins to turn into an actual project, which can take 10 years. Next is design, the beginning of the formal entry into the major facilities process and includes conceptual design, preliminary and final design. The design phase includes review steps to transition from conceptual to preliminary to final design, with decision points for NSF and the NSB.

The next stage is construction, once a project has been approved for construction and Major Research Equipment and Facilities Construction (MREFC) funding is available in the NSF budget. Duration is dependent on the type of facility. NSF has a no-cost-overrun policy. NSF must be sure of the cost estimate at the time of construction approval, and make sure the project sticks to that during construction.

Moving into operations, this is the time when the promise of the facility to support science is born out. The timeframe will depend on the type of the facility and whether it can be upgraded or retrofitted and may include an evolution of the facility. Because major facilities typically operate on five-year cooperative agreements, facility viability and effectiveness of the managing organization is assessed regularly, in addition to annual operation reviews.

Disposition is the end stage, which doesn't happen often, something NSF is wrapping its minds around, considering what it entails, what it costs and what to do with it.

Development, or projects being considered that may become major facilities, might be midscale size projects, or might not proceed. But they have enough promise for NSF to keep an eye on and support the community in exploring. This includes:

- Subduction Zones in four Dimensions (SZ4D)
    - A community-driven initiative for a long-term, interdisciplinary research program to define the limits and possibilities of predicting geohazards.
- Antarctic Subsea Cable
    - A sub-sea cable from New Zealand or Australia to McMurdo station
    - Potential operational (communications) and scientific capabilities
- The Coronal Solar Magnetism Observatory (COSMO)
    - The COSMO suite of instruments will take continuous daytime synoptic measurements of magnetic fields in the solar corona and chromosphere, in order to understand solar eruptive events that drive space weather

Moving to projects in the design stage, she listed:

- Antarctic Infrastructure Recapitalization (AIR) Program
    - Portfolio of investments in facilities and infrastructure
    - Work was initiated in FY2022 on the highest priority AIR activity —the McMurdo Pier Project
- Antarctic Research Vessel
    - Recently completed Preliminary Design Review
    - Next steps
        - Final Design
        - Future Budget Request
        - Construction Start

For projects in the construction phase, she described:

- The Antarctic Infrastructure Modernization for Science (AIMS):
    - Original baseline reduced. Unfunded components to be considered under AIR Program
    - Vehicle Equipment and Operations Center and Lodging facility resumed in the FY 2023 field season
- Regional Class Research Vessels
    - Three vessels in sequenced construction
    - Recently completed annual construction review
    - Anticipated delivery of R/V Taani 2024

Turning to operations, she listed:

- U.S. Antarctic Program
- Academic Research Fleet
- Geodetic Facility for the Advancement of Geosciences
- Seismological Facility for the Advancement of Geosciences

Dr. Walker highlighted the 20223 Hunga volcano eruption in Tonga, the largest explosion in recorded human history. Researchers downloaded the geophysical data from Seismological Facilities for the Advancement of Geoscience and Earthscope (SAGE) and Geodesy Advancing Geosciences and Earthscope (GAGE) to analyze the events.

Continuing with operations, she highlighted:

- IceCube Neutrino Observatory (joint with MPS)
- National Center for Atmospheric Research
- Ocean Observatories Initiative

Dr. Walker also discussed two landmark collaborative research findings:

- Aircraft reveal a surprisingly strong Southern Ocean Carbon Sink (Long et al, December 2021)
- Solar Illusion: Sun's coronal loops may not be what they seem (Malanushenko et al, March 2022)

She next described the disposition of:

- Joides Resolution
- Arecibo Observatory
- R/V Oceanus

Next, she turned to mid-scale research infrastructure, defining it as:

- Research instrumentation, equipment, and upgrades to major research facilities or other research infrastructure investments that exceeds the max. funded by the Major Research Instrumentation program (MRI) and are below that of a major multi-user research facility project (Major Facility).

Dr. Walker said there is a large gap between major research instrumentation and the major facilities. Within that is mid-scale 1 and 2. NSF is in its third iteration of the mid-scale solicitations. Mid-scale 1 can include projects that are in design or implementation. Mid-scale 2 can only be implementation. An example of a mid-scale 1 is the next generation Wyoming King Air Atmospheric Research Aircraft:

- Five-year project to develop state-of-art KING AIR airborne atmospheric research and education laboratory (UWKA-2)
- Will advance airborne in-situ and remote sensing measurement capabilities
    - Validation and refinement of algorithms used in space-borne measurements
    - Observational constraints on numerical models for weather, climate, air quality, and wildfire predictions
- Will serve the NSF Lower Atmospheric Observing Facilities (LAOF) program

For mid-scale 2 she presented the GO-BGC Array - Global robotic network to observe changing ocean chemistry and biology:

- Global robotic network of 500 profiling floats carrying chemical and biological sensors that take measurements from 2000-meters depth to the surface every 10 days
- Revolutionize our understanding of ocean biogeochemical cycles, carbon uptake, acidification, deoxygenation, and ecosystem health
- 90 of 500 planned floats operational (19.2% completed)
- 3249 profiles completed

Dr. Walker concluded with questions for discussion:

- Promote community awareness and engagement on mid-scale opportunities?
- Support competitive projects at emerging institutions?
- Solicit community input on future major facilities and support development?

Discussion

Dr. Romanowicz asked how much of the budget of $650 million is devoted to operations, rather than acquisition and construction of facilities and how inflation is factored. Dr. Walker said GEO, with the three divisions and the office of polar programs, is almost twice of operations and maintenance support for major facilities. Construction is a separate budget item. For the two projects she discussed, RC/RV funds have been fully expended, so construction costs are much smaller right now. As to inflation, all the facilities suffered from recent inflation spikes and received supplemental dollars to address critical issues. One of the big ones was fuel costs,

which impacted the academic research fleet and polar operations, so additional funds were directed to them. Inflation as a rule is incorporated into the budgets on a year-to-year basis when there are new solicitations or renewals.

Dr. Nettles followed up on an online question about how much of the total is in OPP. She said it depends on what account you're using. The FY23 estimates had on the infrastructure line for OPP $426 million, and another $94 million in logistics support. So that $426 would be roughly two thirds of the $650 million, but you can add these up different ways. It's going to show up differently if you look at what's listed in a facility's account. Dr. Walker said the FY24 budget request for Antarctic Facilities and Operations incorporates the bulk of the logistics support. That number was $240 million.

Dr. Isern said facilities for GEO is about $350 to $360 million in FY23. The way polar facilities get counted isn't as straightforward.

Dr. Romanowicz asked about facilities in the works and any workshops. Dr. Walker said it's a blank sheet. Because facilities take a long time to develop, we always wanted things moving through the process. We want to be on the lookout. The Subduction Zone in Four Dimensions, COSMO, and the Antarctic cable are coalescing now. And we hear feedback through portfolio reviews, or national academies studies.

Dr. Isern said there's a change in philosophy on how we're dealing with some of the major facilities coming into the MREFC account. Previously things that got into the account were assured that they were ready; the board now wants to see the project entering the development phase and more that are likely to make it through so there is more of a range. But if you look at what's coming through, say, from MPS, there's a threshold shift. These are billion-dollar things the size of the ARV, for example, which is a big shift. The max before that was almost $600 million. One thing we should think of as a community is the timeline. Some smaller things we'd like to put forward at the limit of the MREFC range could be a benefit. It's just how to start engaging the community to think about facilities on the horizon, taking into account this timeline.

Dr. Kraft raised the issue of supporting competitive projects in emerging institutions, which gets at some of the challenges of infrastructure and loads of research versus teaching and the different realities that exist. At a community college, the way she has developed relationships with people at facilities is through workshops, which is where you're bringing teachers in with researchers. That's how you start to build those relationships and collaborations. She also raised the question of how NSF helps promote that to make sure there is a broad participation at those kinds of events.

Presentation on Geosciences Graduate Education

Dr. Mosher reported on a four-year sponsored initiative looking at improving graduate student preparedness for the future workforce, undertaken with Jeff Ryan, University of South Florida and Chris Keane, American Geoscience Institute. The initiative was an outgrowth of and built on the previous initiative on the future of undergraduate geoscience education. The project goals were:

- Identify the skills and competencies that should be part of graduate geoscience education for Ph.D. & MS students in Earth, Ocean, & Atmospheric Sciences
- Investigate best means of developing these in graduate geoscience programs nationally
- Work with Heads/Chairs and Graduate Program Directors on implementation strategies to develop the skills and competencies identified by the geoscience employers workshop & other studies

The following events were held:

- 2018 Geoscience Employers workshop - broad spectrum of geoscience employers of Ph.D. & MS students in Earth, Ocean & Atmospheric Sciences
- 2019 Heads/Chairs/Grad Program Directors Summit - Earth, Oceans & Atmospheric Science programs; mainly Ph.D. granting universities/colleges - Action Plans
- 2020-2022 Action plan progress reports; Employer survey ---- Pandemic
- 2022 May & August workshops - combined employers & academics

The process gathered input from more than 300 individuals, about 100 of whom were non-academic employers.

Dr. Mosher discussed the mismatch between graduate education and future careers:

- Graduate programs: too narrowly focused on academic research
    - Students need to develop professional and personal skills valued by both academic and non-academic employers
    - Teamwork, project management, leadership, communication
- Transferable skills - for changing world & occupations
    - Transitioning to interdisciplinary/multidisciplinary/transdisciplinary research —> application
    - Increase in societally important research —> application
    - Changing research methods & technology —> application
    - Changing demographics - more diverse & global
- Students need information to identify career options, necessary skills competencies, mentoring
    - Need preparation in skills/competencies needed outside academia (as well as within
    - Acceptance of non-academic careers

She showed a graph with enrollment in the geosciences from 1955 to 2021. It shows undergraduate and graduate enrollments dropping. Another graph showed the number of degrees also declining. Meanwhile, the types and number of geoscience jobs are increasing, with 28 percent of geoscience jobs held by non-geoscientists.

She displayed graphs showing employment sectors of master's graduates and doctorate graduates from 2013, to 2020, showing the types of jobs have changed. The biggest is for masters; the oil and gas sector has gotten very small. State government and mining have increased. If you look at Ph.D. graduates, by and large, about half do go into academia. But there has been a growth in federal government and professional services. Most of the growth in professional services are singleton geologists, hired, for example, at a consulting firm. Looking at the employment sectors

for the most recent graduates, for masters, most are in government. Three times as many are going into mining as are going into oil and gas. For doctoral students, about 45% are going into four-year universities and colleges, and about an equal number of going to the federal government as well as professional services.

So, since most Ph.D. and master's students in the geosciences and STEM in general are not going into academia, she asked what they need to learn in graduate school in addition to their specialty. From the point of view of employers Ph.D. and MS graduates:

- Need Expertise/Depth in core area - leads to judgment and confidence
    - Core technical skills in relevant area of expertise is absolutely necessary
    - Deep understanding of the fundamentals/mechanics of the techniques methods they are using
    - Having foundational skill set - good education in the geosciences
        - Breadth in core area, grounding across all sciences
        - Course background in their field - even if switched fields from undergrad to grad
- Graduates generally are coming with very strong technical skills
    - Knowledge in their field of geosciences
    - Research skills; field skills

The most important skills, regardless of discipline:

- Problem solving
    - Defining problem and applying an appropriate solution
        - Establishing what is a sufficient solution vs. a precise and complete solution
    - Translating the problem to the -- so what?
        - Articulate importance of outcomes
        - What decisions will be made based on the work you are doing
    - Understanding the broader impacts of your research & how to communicate those impacts
    - Adept in independent research, self-sufficient, and self-motivated
    - Independence in problem development, execution and analysis skills
    - Many graduates struggle with being able to define a problem and identifying how to apply the solution (but could solve the problem)

Dr. Mosher also listed habits of mind:

- Critical thinking - most important
    - Pragmatic, logical, independent thinking
    - Flexible, open-minded
    - Critically evaluate information and sources
- Geoscientific Thinking
    - Geoscientific reasoning & synthesis
    - Time, scale, space - 3D, 4D
- Systems Thinking
    - Look at entire system - the big picture
    - Highly complex systems with many interacting parts

        - Parts in isolation may act differently than when within system
    - Interaction of systems
- Earth System Thinking
    - Earth as an interactive system
    - Complex, non-linear, coupled system
    - Understand processes & interactions between them

- Communication (common limiting factor) written, verbal; external and internal
  Expressing technical work effectively to appropriate audiences
- Technical writing & verbal communication
        - within specialty and other science & engineering fields
        - to non-technical audiences, management, pubic, press
    - Be able to convey complex material in a simple way
    - Express ideas logically
    - Be comfortable speaking with people when English is not their first language
    - Be able to communicate societal and or financial impacts
- Skill in editing - evaluate critically & accept criticism
    - Evaluate/recognize credible sources
- Listening Skills
    - High sensitivity to audience - reading the room
    - Pay attention to what others say
    - Answer questions asked & logical
- Computational & Quantitative Skills
    - Need for more computational skills - increase from 2018 to 2022
        - Basic programming skills
            - Scripted languages
        - Coding - able to code
            - Translate older code to newer codes & systems that are more effective
        - Ability to analyze algorithms
            - Increasing importance of Machine Learning & Al
        - Cloud - super-computing (transition) - data manipulation and storage for big data
        - Modeling - be able to develop, analyze and evaluate models
    - GIS, geospatial reasoning
    - Basics of statistics and math [should have from undergrad]
        - Statistics - communicating certainty
        - Higher math - including calculus, differential equations, linear algebra
    - Embracing technology not only as users but as creators
    - Willingness to step outside of the box to engage in genuine innovation

Across the spectrum, employers currently need and see as increasingly important:

- Data Management & Data Analytics
    - Awareness of data analytics, the applications, processes for using data
        - Answer questions not framed yet
    - Data handling -- Big Data & Datasets

        - Examining datasets to draw conclusions about the information they contain
    - Data Acquisition, Collection
    - Data Management & Analysis
    - Data Integration
        - Merging information/data to solve problem
        - Integrating different types of data; synthesize
    - Data assimilation
    - Data quality
    - Visualization & Modeling -- Data simulation, display; ability to model & know limits of modeling
        - Immersive Virtual Reality data exploration
    - Valuation: how valuable is the data - monetizing
    - Other data science - e.g., Machine Learning, Al, robotics - all increasing in future
- Teamwork, Collaboration (generally lack)
    - Ability to work with other scientists & other trained individuals towards your goal
    - Ability to get others to work together; deal with conflict
    - Valuing diversity of thought
    - Developing self-awareness & recognizing skills among ourselves & people around us
    - Evaluating expertise, knowing your own strengths
    - Personally versatile - leading, following, accepting coaching, taking directions
    - Collective competency of a team

—all needed for interdisciplinary and transdisciplinary collaborations

- Leadership - in science, education, public policy/politics, business
    - Innovators, creators, entrepreneurs

- Social dynamics (generally lacking; limiting)
    - People skills -interpersonal behavioral and cultural
        - Ability to work with people who are different & from different cultures
    - Empathy and emotional intelligence
        - Self-awareness, self-management, social awareness, and relationship management
- "95% of the issues in a corporate environment arise from the inability to work with others who are different."

- Personal traits
    - Lifelong learner
    - Growth mindset - do things to learn and improve
    - Internal drive to do well
        - Overcome inherent risk aversion in adopting new technology to address major problems
        - Overcome prevalence of fear of failure
    - Diverse and adaptable skill set
    - Understand societal connections, global perspective
        - Broader impacts

        - Diversity, equity, inclusion and justice
        - Ethics and Science

- Additional Professional Skills
    - Project & Program Management (generally lack)
        - Understanding budgets, project financials
        - Managing people, multidisciplinary projects
        - Manage time & resources
        - What factors are driving the decision-making process?
        - Know how to run a meeting (agenda, time management, relevance, etc.)
    - Time-value concepts - understand
    - Business Skills (needs much improvement)
        - Economic, data-driven decision-making; risk, uncertainty
        - Innovation & entrepreneurship
        - Leadership, teambuilding, finances/ budgeting, project management, problem solving
        - Exposure to basics of business, operations, etc.
            - Be able to distill everything down to making it relevant to the CEO or Manager
            - Time - value of money
    - Public policy, understanding rules, regulations, statutes, etc.

- Professional Development
    - Training on how to get a job
        - Resumes, applications, interviews
        - Where to search
        - Knowledge of careers
        - Knowing options & how to leverage their skills or gain skills/knowledge
    - Networking - how to do, what not to do, where to go/be
        - Importance of professional society participation
    - Virtual presence/brand
        - Current presence on social media & how that effects hiring/career
        - Self-marketing
        - Representing that extra expertise
    - Interviewing skills
        - Can be learned
        - Do's & Don'ts
    - Ability to move up & transition within organization (1st job not last)

- Skills Needed for Success
    - Expertise depth in core area, strong technical skills
    - Problem solving & critical thinking
        - Defining problem, solving, applying solution
    - Systems thinking & approach
    - Written & oral communication / listening skills
        - Expressing technical work effectively to different audiences

    - High level quantitative skills
    - Computational skills, programming, modeling
    - Data management, Data Analytics
        - Working with Big DATA & integrating different types of datasets
    - Social dynamics - interpersonal skills
    - Project management, teamwork, leadership
    - Capacity for learning/adaptable
        - Be a life-long learner & apply skills to new situations
    - Understand societal relevance, global perspective
    - Ethics & professionalism

- Need for Integration
    - What distinguishes a Ph.D./strong researcher?
        - A deep technical dive into one subject
        - Ability to discover, own, and solve a problem independently
        - High level of creativity and innovation
        - Ability to create new knowledge
    - Need to integrate these identified skills without losing the strong research emphasis
    - Make many of the non-core research skills part of program culture
- Research vs. skill development - finding the right balance
    - Conducting research is a skill - valued by employers
        - High level critical thinking, identifying and solving problems
        - Project management, completion of project
        - Written verbal communication skills
    - Value of coursework
        - Developing new skills, breadth, intentional learning
- MS vs. Ph.D.
    - What level of competency employers expect
    - Employment type

Heads and chairs met in 2019 and 2022 and looked at opportunities for developing skills during graduate school:

- Where to best develop Competencies:
    - Research
    - Graduate coursework
    - Co-curricular activities
        - Short Courses, online courses; certificate programs, invited presentations, workshops, etc.
        - Departmental activities, clubs, outreach programs, internships, professional organizations, public engagement, etc.
    - Departments & Students take ownership

Where to best develop competencies? Research

- Focused disciplinary & technical knowledge
    - Field and/or lab skills

    - Computational skills, Big data - Data Analytics, Data Management
- Communication: Written & Oral communication
    - Thesis/dissertation, publications, proposals & conference presentation
    - Presentations to research group, department, undergraduate classes
    - Writing press releases before the full proposal & publications - societal impact, diverse audiences
- Critical Thinking & Problem solving
    - Reading & evaluating literature
    - Identifying reliable data sources
    - Analyzing & evaluating data/results
    - Characterizing, managing, communicating uncertainty
    - Learning to formulate problems & solutions; recognizing societally important problems
- Project & time management -- dissertation/thesis research project
- Teamwork (as part of research group)
    - Project & time management
    - Conflict resolution
    - Diversity sensitivity
- Ethical (research) behavior & standards of practice
- Learn to take calculated risks, manage criticism & failure

Where to best develop competencies? Graduate Course Work

- Technical skills & core disciplinary knowledge
    - Integrate systems thinking
- Written & oral communication
    - Need intentional instruction & significant feedback
    - Abstracts, papers, 1-pagers, presentations
    - Writing proposals as the class project -- integration of data from the literature, identify problem & societal impact, project management plan, budgeting, & communication
    - Writing peer review works better than faculty editing)
- Case studies - within courses & entire courses
    - Synthesis, data analysis, decision making, & communication
    - Characterizing, communicating uncertainty
    - Identifying problems & sufficient solutions
- Computational skills, Big data - Data Analytics & Data Management
    - Include large datasets in classes
- Project & time management
- Teamwork -- with instruction & expectations for group interactions
- Service - learning courses
    - Identifying problems, sufficient solutions, communication, teamwork, diverse communities
- Direct discussion of ethics, standards of practice, biases & equity in science & work force

Where to best develop competencies? Co-Curricular

Departmental activities, clubs, outreach programs, internships, professional organizations, public engagement, etc.

- Leadership & project management skills
- Oral communication
    - Presentations, brown bag talks, and competitions
    - Diverse audiences
- Written communication
    - Reports, fliers, news articles
- Interpersonal skills
    - Conflict Resolution,
    - Ability to work with people who are different & from different cultures
- Teamwork with diverse groups
- International experiences
- Field Experiences
- Peer mentoring/feedback, informal faculty/staff mentoring
- Entrepreneurship

Other co-curricular options:
Short Courses, online courses; 1 credit courses, non-departmental courses, certificate programs, presentations, etc.

- Career development or geoscience professionalism courses
- Alumni, returning interns & other "real world" speakers
- Communicating to different audiences (Toastmasters, etc.)
- Teaching training (NAGT, university Centers for Teaching Excellence, TA training workshops)
- Business Commercial Acumen/Leadership
    - Within existing courses - Economic Geology, Petroleum & Mining Geology, Environmental Geology, Hydrogeology
    - Business schools, alumni, industry collaborators, etc.
    - Dual degrees
- True Teamwork (not group work) - partnerships with industry, agencies & societies
    - Corporate challenge in partnership with corporations and government partners
    - Team-based cross-disciplinary, longer-term projects for student groups to work on together (e.g., AAPG's Imperial Barrel)
- Case studies - involve industry partners; industry retirees
- Ethics (Institutional training)
- Professional development
    - Scientific writing, scientific methods, presentation boot camp

- Workshops & Websites
    - Diversity, equity, and inclusion training
    - Mentorship training for current and future faculty
    - Standards of professional practice
    - Conflict management
    - Time management

- Pedagogy
- Grant Writing
- Breadth of career tracks available for geoscientists
- For faculty: skills & competencies needed by students for career success
- For Students: resources available on campus & through professional societies

- Preparing students for future success
  - Effective mentoring
    - Intentional and periodic
    - Multiple mentors
    - Regular contact/meeting with advisor
    - Active dissertation/thesis committees
    - Mentoring training - faculty
  - Mentoring goal
    - Advise students of skills & knowledge needed for wide variety of careers
    - Provide opportunities for development of these competencies
    - Mentor students throughout program
    - Accept value & importance of non-academic careers

- Students create Individual Development Plans (IDP): customized roadmaps for professional training & goals
  - Customized roadmap for professional training & goals
  - Skills assessment: What skills do I currently have?
    - Research, Professional Time Management, Interpersonal, Management & Leadership
  - Career Aspirations - what career pathways interest me? What do I like to do?
  - Desired Skills - setting goals for the skills I want
    - Specific & Sensible, Measurable, Action-oriented, Help needed, Time-bound
  - Professional Development - what support can I take advantage of?
  - Reflect on self-assessments & career aspirations & professional values
  - See AAAS Science Careers: my IDP

  - How can departments improve graduate programs?
    - Institute & formalize IDs
    - Deliberate planning & coordination of graduate coursework to include needed skills & build competencies
      - Define learning outcomes - graduate program & courses
    - Electives or special topics courses - develop new courses
      - Big data, coding, statistics, machine learning, data analytics
      - Science communication
      - Case study/project based courses
    - Integrate needed skills into existing courses
    - Onboarding course - required new graduate student course
      - Build cohorts, discuss ethics, DEI, emotional intelligence, time management, etc.
    - Establish certificate programs or co-teach courses with other departments

    - Bring in alumni, employers to give presentations, advise, mentor, etc.
    - All tried & successful in case studies

- How can departments improve graduate programs?
    - Encourage team-based, cross-disciplinary longer-term projects (e.g., Reynolds Cup, Imperial Barrel Award, Google's coding ox ROV competitions, etc.)
    - Integrate skills & interests in big data, coding, scientific communication into theses & dissertations
    - Hold student poster symposia - with judging and prizes
    - Reevaluate qualifying/comprehensive exam within the context of broader expectations
        - Press release, 3 minute thesis presentation, project plan & budget
    - Define expectations & mentoring plan (i.e., paper authorship, timeline, etc.)
    - Provide career development for faculty
    - Provide mental health support, etc.

- Case Studies - Action Plan Reports
    - “Success has occurred across the spectrum, with most coming at the grass roots level by faculty that are responding to the challenges of a changing workforce landscape in the geosciences. This has been supported by the Dean and DGS Chair.”
    - “Having the students personally see how helpful the IDPs were for them as a reflection tool, and in aiding communication with their advisors, has in turn allowed the faculty to see that they (the students) actually want this for their own accountability. I suspect that has gone a long way towards the faculty Graduate Committee seeing the IDPs as something worth requiring.”
    - “We held a full faculty retreat during August 2019 to discuss improvements to our Graduate Curriculum, inspired by the NSF Workshop I attended in May 2019. As anticipated, Department faculty were enthusiastic about attempting to implement many of the improvements that I was able to propose on the basis of the Workshop experience. A number of such improvements were subsequently implemented or are in progress.”
    - “The easy things were successful. Things that required more faculty effort (like establishing new courses, etc.) are taking more time, and have been somewhat side-tracked by reacting to the impact of the COVID pandemic and having to do deal with modifying instruction and research activities.”
    - “Effectively onboarding of new students eases inequalities in mentoring across the department and helps students' develop a cohort.”
    - “The Summit approaches have given students and postdocs even further ease and confidence in discussing their progression planning and futures.”
    - “The course is specifically designed to introduce graduate students to career possibilities beyond academic paths, and thus fulfills a major goal of our curriculum improvement, to better prepare our students for careers in industry.” The “first cohort of graduate students has already benefitted from the class and from the networking opportunities in provided.”

- "Convincing the Central Administration that the Dept was worth some investment - - It took some effort, but once you have their ears, and you make a good argument, they can be swayed."
- "Increase open debate and discussion to improve awareness of the need to adapt in the geosciences or be left behind."

Additional topics addressed in 2022:

- Graduate program cultures
  - How do you change culture - e.g., preparing Ph.D. students only for academia & replicating self?
  - Student focused education instead of advisor centric education and control?
- Issues with implementation
  - Heavy workloads, resistant upper administration, time constraints, budget issues, burnout, etc. - how overcome?
  - No required courses for degree program -- how do you incentivize faculty to offer and students to take them?
- How to convince faculty to change?
  - What will convince faculty and upper administration of the importance of improving skills for graduate students and mentorship?
  - How do you overcome resistance to change through incentives and rewards?
- Preparing geoscience graduate students to be leaders, innovators and creators

- Stakeholders: Employers, Alumni What should they do?
  - Advisory Boards/Councils, visit departments
  - Co-teach classes, give lectures in classes - in-person or online
  - Provide datasets, training, case studies
  - Give lectures or serve on career panels
    - Career path, skills needed, what look for when hiring, etc.
  - Help with resumes, interviewing and networking skills, do mock interviews
  - Serve on thesis dissertation committees
  - Mentor
  - Provide internships, externships
  - Financial support - research, scholarships, field trips, use of labs, etc.
  - Employer-facilitated modular training and certificate opportunities
  - Serve as judges for contests, lead fieldtrips
  - Consortiums and partnerships between industry or government agencies/labs

- Stakeholders: Professional Societies. What should they do?
  - Disseminate results of this initiative
  - Develop short courses and/or workshops focused on these skills
  - Set up certification and/or accreditation programs
  - Provide online resources and videos, including interviews with geoscientists about careers
  - Expand mentoring programs
  - Hold student research forums
  - Include graduate student members on committees

- Promote closer engagement between academia and industry
- Require mentoring plans on proposals with funding for graduate students
- Provide grant support for
    - Departments implementing change to graduate programs, including "proof of concept" or pilot studies
    - Faculty developing shared databases - for Big Data analytics
- Broader impacts proposal part include developing links to private sector for training students and fostering interactions
- Encourage modifying the curriculum for our changing field

Dr. Mosher concluded by saying volume of the vision and change to your science document will be available in September.

Discussion
Dr. Romanowicz asked if much of what was presented could be part of the broader impacts. Dr. Mosher agreed, adding that faculty have struggled with what counts with broader impacts.

Dr. Dahl said there are so many changes that could be made to graduate programs it feels overwhelming, and she did not think a department could make all the changes at once. Something like developing research workshops or courses not housed in a single university that address some of the topics could be valuable for programs that don't have the capacity to develop a new course. She suggested NSF think about funding the development of some of those courses to make them more widely available for students. Dr. Mosher said there was a collective feeling that professional societies could make a difference in that sense and if we could have these things available on a national level, that it would make a big difference.

Dr. Isern said GEO has been talking about providing things like basic communication and persuasive writing and other soft skills, maybe in cohorts where there's other elements of learning. GEO has been thinking about tying it to a fellowship. It's an overarching training issue. Dr. Mosher said a section of the report talks about career development for faculty. I wish my faculty had some of these skills. We were told not to use the word soft skills; a lot of people call them power skills.

Dr. Kraft said she refers to them as employable skills and talked about tapping into a larger community to leverage the expertise that comes from different spaces when you are a smaller institution and having no one person to be the mentor for all things.

Dr. Nettles said they should be called hard skills. The skills of communication, writing, and being able to say what you're doing concisely, why you're doing it, and what the impact is, are the hardest for everybody. It's a lot easier to teach people math. She supports the training the trainer approach, because a lot of successful researchers are not that great at these skills either. So, I think training the trainer is recognizing that these are some of the most difficult things to learn. In terms of getting buy-in from faculty, there are some ways it would be helpful to redefine success in training graduate students because there is a tendency to ask where have your students gone. It's considered successful if your Ph.D. student went to a faculty position. Whereas if you say your student is working using their data analytic skills that they got as a seismologist, or

1working at Ford Motor Company, that's not viewed by your colleagues as a success. Dr. Mosher said one of the quotes presented earlier was saying it was arrogant to suggest anybody, but the student's advisor could know what the training was best for. There are a lot of people on faculty that are successful if their students get jobs, but if they're at a liberal arts school, that's not success and that's flat out crazy.

Dr. Kraft said after she finished graduate school, and was teaching at a community college, we used to have a preparing for an academic career [session], where they would take tours of different kinds of local academic institutions. They stopped doing it at two-year colleges because there was not an incentive; the school didn't get credit for that in the larger national ranking system. The school president was given the incentive of a major raise if he increased the level of the school in those national rankings. So, it's not just faculty. The Board of Trustees is pushing the president, the president is pushing the faculty. It's a systems level problem. Dr. Mosher said one of the things addressed in the report is how to show the upper administration and your faculty that doing this is going to help your enrollment and is going to help you getting money. It's a hard sell, but it's necessary.

Dr. Kraft said online Chat comments noted an NSF switch to a mentoring plan, rather than a postdoc mentoring plan is posted for comment. And many programs have included student mentoring plans in their solicitations.

Dr. Whitlock said her institution is just barely an R-1 and struggles to keep that classification. It makes the administration aggressive about doing things to keep that going. One is the number of Ph.D. students we graduate. There's pressure to not accept master's students or move master's students into the Ph.D. program. That's a mistake because a master's is a good training degree and a good working degree. It also fits a lot of the aspirations of the students that come into the program. Dr. Mosher said she had seen that too. A president at the University of Texas in Austin absolutely did not think master's degrees were worth it. It's unfortunate, because the optimal degree for geoscientist is a master's and that problem is difficult to overcome. The way you do it is showing that most of the jobs for geoscientists were not bachelors and they weren't for Ph.D. graduates and pointing out how many of those master's graduates were big donors.

Dr. Kraft relayed an online comment that younger faculty are more willing to recognize the value of the soft skills and the education of their grad students. Another commented that even graduate students who go on to obtain R1 positions aren't adequately prepared for the job because faculty positions require far more skills than just research. Another pointed out that we know from recent literature that most 80 percent or more of R-1 faculty positions and grad admissions tend to be reserved for a small subset of total programs.

Dr. Gamage said at her community college, faculty were mentors and when students were doing a research program at the University of Texas at Austin, they had mentors at the four-year institution. That worked out well. Students went to different mentors for different reasons. When NSF asks for the mentoring plan, it's important to help the PI's create a thoughtful plan, because not all PI's understand the importance of it until you start working with the students.

Dr. Oboh-Ikuenobe distinguished thesis and non-thesis master's students. Years ago, her institution, trying to move up to R-1, discouraged admitting master's students. But in the last two years, because of dropping enrollments, they are looking at non-thesis master's as cash cows. Dr. Mosher said the report addressed that. It was said that the process of coming up with and/or solving a problem or doing the research itself and writing it up, gave them skills that were valuable when they went to work. She discussed an experiment at an interdisciplinary program with law, business engineering and geosciences and public policy. It required a thesis of some sort. And business decided they wanted to do the same degree without a thesis. It lasted for a year; they couldn't get anybody to apply. They could get the same degree with a thesis, and they discovered employers wanted theses. Even if it's a thesis light, employers value the skills they learn when they do research. You can have a good piece of research done in two years, while taking courses as well, it's just not as easy.

Wrap-Up and Action Items

Dr. Kraft said she wanted to revisit meeting timeframes, whether the fall meeting will be at a facility, and potential meeting dates that are responsive to the Arctic field season, possibly in August or early September. Dr. Nettles said September would be better. Dr. Kraft suggested before the academic quarter begins in September.

Dr. Dahl said getting to Washington, DC, is challenging, in terms of distance. NCAR might be easier. Dr. Kraft said at NCAR an extra day could be set aside for those interested in a field trip to the supercomputer in Wyoming. Dr. Nettles said it would be useful for the polar group to see facilities related to the rest of GEO and vice versa. The main thing is the human connections, so I don't think it matters where we have the meeting. NCAR as a facility would be interesting, but it's a long trip to Wyoming. Dr. Kraft said it's about a 1.5-hour drive.

Dr. Aluwihare said she would prefer to be in a place where she can discuss more directly with the program managers and NSF leadership.

Dr. Kraft said it's important that we get the date finalized soon. And we want to commit to being in person and keep that commitment.

Dr. Richardson said September might be a little better.

Dr. Nettles suggested a poll to have the full group weigh in. Dr. Kraft said most of the online comments favor September.

Dr. Kraft mentioned looking at the GRFP and inflation for the fall agenda. Dr. Aluwihare said that is at the forefront of our minds at the Ph.D. institutions. Michigan and Rutgers students are striking. Dr. Patten said this would be a good topic for one of the organizational meetings, because this is an academic institutions issue. He suggested thinking through how to frame this for an AC discussion. Dr. Aluwihare said t's an academic institution level discussion, but students are pushing back on it being a DEI issue also because with the rising cost of living, those least likely to have access to these institutions are those who don't have generational wealth. It goes beyond the GRFP.

Dr. Kraft asked if we are we providing them opportunities they can take advantage of if they don't have generational wealth when talking about recruiting students into programs. Are there opportunities that are compelling reasons to go to graduate school if they're not going to get paid a living wage? That part of this workforce development degree program we've been talking about feeds into that. This becomes a pathway discussion. She relayed an online comment that GRFP salaries and educational expenses are set to rise as a result of the CHIPS Act.

Dr. Parsons said with the NSF budget rising so much and the number of proposals that program managers handle rising over the past couple of decades, do NSF staff feel they're being supported enough for their growing workload? Dr. Patten said that's always a discussion and it is something to possibly frame up for an AC discussion. Dr. Kraft said the overworked aspect of staff at NSF comes up in almost every COV.

Dr. Kraft adjourned the meeting.