Advisory Committee for Geosciences
October 18-19, 2017
Meeting Minutes

**AC/GEO Attendees:**

Dr. Kip Hodges (Chair)

Dr. Bill Easterling

Dr. Scott Borg

Dr. E. James Dixon

Dr. Pamela Kempton

Dr. Paul G. Falkowski

Dr. Jose D. Fuentes

Dr. W. Berry Lyons

Dr. Sumant Nigam

Dr. Joshua Semeter

Mr. David H. Voorhees

Dr. Paul Shepson

Dr. Carol Frost

Dr. Gregory Sullivan

Dr. Rana Fine

Dr. Shirley A. Pomponi

Dr. Richard Murray

Dr. Kelly Falkner

**Joining by Telephone:**

Dr. Gregory J. Hakim

Dr. Chris Paola

Dr. Cindy Lee Van Dover

Dr. Lisa White

**NSF Senior Staff:**

Melissa Lane

**Wednesday, October 18, 2017**

**Welcome & Introductory Remarks**

Dr. Hodges opened the meeting and welcomed the group to the new NSF headquarters; members introduced themselves.

***Dynamic Earth* Report (2014) Perspective and Next Steps**

Dr. Borg discussed the 2014 report, *Dynamic Earth: GEO Imperatives & Frontiers 2015-2020*, which he said remains relevant but would benefit from being updated with regard to evolving research directions and possible course corrections. He suggested this could include the intersection of coastal earth processes and the large urban areas along coastlines (Coastal and People (COPE)).

Dr. Hodges determined that a small number of committee members had read *Dynamic Earth* and said AC/GEO needs to take ownership of the report, which will require evaluating if it embraces the imperatives for GEO for the next three years. With that, he opened the meeting to a discussion of the report and the opportunities GEO has to help the community think about how to move forward.

Discussion:

* Dr. Van Dover mentioned deep sea mining and said researchers could be impacted when it starts.
* Dr. Kempton said the report appears to be missing discussion of Innovations at the Nexus of Food, Energy and Water Systems (INFEWS).
* Dr. Dixon noted a tremendous archeological record of human habitation on the continental shelf, which it is important to preserve.
* Dr. Pomponi noted an overlap between the report’s high-level priorities and those in *Sea Change: 2015-2025 Decadal Survey of Ocean Sciences*.
* Dr. Hodges said the report should capture the big picture and what has changed over the last couple years. Are there thematic areas missing, is there an emphasis that should be changed, and is an addendum needed on the current state of the system? He proposed updating the report rather than rewriting it.
* Dr. Fine said when the report was introduced, climate change was skirted and wanted to know how to approach the subject now. Cryospheric loss is not addressed in the report, Dr. Lyons said.
* Dr. Hakim asked what the report has been used for and what the revision will be used for. The report has informed NSF solicitations and has been used to defend programs to Congress, Dr. Shepson said, citing funding decisions it influenced and examples where it articulates the vision and priorities within GEO; it also communicates those priorities to the community and supports decisions by Program Directors (PD).
* Dr. Murray favorably noted the widespread overlap and synergy between specific community responses (e.g., *Sea Change*) and *Dynamic Earth.*
* *Dynamic Earth* is not a complete description of the science community’s priorities, Dr. Falkner said, adding that she had suggestions for strengthening the report.
* The NSF is taking a reactive position on climate change that is appalling, Dr. Semeter said. *Dynamic Earth* is about how to respond to the changing climate, rather than making recommendations to protect our species and habitable environment. Also, the section on space weather should be updated.
* The plan prior to *Dynamic Earth* generated the program Frontiers in Earth System Dynamics (FESD), Dr. Frost noted.
* Dr. Hodges said National Aeronautics and Space Administration (NASA) review panels trace proposals back to NASA documents analogous to *Dynamic Earth*; at NSF, the connection is not required or explicit. Dr. Borg added that NSF funds basic research while working with mission agencies, such as NASA, that have traceability to specific goals. The dialog along the spectrum of basic and mission research is healthy. But the FY 2018 request for the science agencies will create challenges, so input to inform decisions is needed.
* NSF supports the ability of scientists to pursue curiosity-driven research, which is prominent in *Dynamic Earth*, Dr. Shepson noted.
* Dr. Hodges said he supports basic research while noting that NASA prioritizes ideas for funding in a tight budget environment. Curiosity-driven research is prominent in *Dynamic Earth* to mollify those terrified that new initiatives will take money from basic research, he said. GEO will have to identify the highest priorities, not just those that review best.
* Dr. Falkner said *Dynamic Earth* should retain a place for emergent phenomenon that have not been anticipated.
* Funding is needed to protect and strengthen geoscience courses at community colleges to increase discipline diversity, Dr. Voorhees said.
* Dr. Pomponi said the report’s addendum should include how NSF’s 10 big ideas intersect with the priorities in *Dynamic Earth*. GEO should stake a claim for how geosciences plays a role in some of these big ideas. She also raised the issue of funding the big ideas when NSF’s budget may be cut.
* Dr. Murray asked about the universe of creative ideas that researchers are thinking about but not writing proposals for.
* There is no overarching theory of feedbacks, tipping points and emerging properties, Dr. Falkowski said. There are many phenomena that crosscut disciplines in science and *Dynamic Earth* does not have the structure that leads to an articulation of a basic theory of feedbacks in the Earth’s system. Dr. Pomponi said there was widespread concern during the *Sea Change* discussions that doing away with stovepipes, as Dr. Falkowski suggested, would result in the loss of core support. The community overwhelmingly supported maintaining core programs as they are, she added. Rather than thinking of core disciplines, it may be better to think of science on a different scope, Dr. Borg said, adding that core programs undergo significant evolution. Dr. Pomponi suggested maintaining a disciplinary focus and the ability to do integrated work.
* NSF has not found a way to pick out high-risk proposals to fund, Dr. Fine said. Dr. Borg added that NSF is supposed to be about high risk and it owns high risk at the program officer level. Being supportive of high-risk proposals requires extraordinary work in reviewer selection, Dr. Shepson said.
* Dr. Falkowski said science itself has been stovepiped by disciplines becoming so narrow. GEO should be a hub in NSF that reaches to all disciplines and it should be used as an integrator of science, while maintaining individual sub-disciplines. Dr. Falkner spoke in support of Dr. Falkowski, noting that convergence is one of the 10 big ideas.
* Dr. Simon Stephenson, Section Head, Office of Polar Programs (OPP), said a holistic approach requires managing the portfolio and pushing communities to embrace their discomfort zone to learn how others are working and come together. One principal investigator (PI) alone is capable of doing transdisciplinary science, Dr. Hodges added. Many proposals do not get funding because of something idiosyncratic about the panel or reviewers.
* The report, Dr. Kempton said, should promote the value of geoscience jobs.
* Dr. Leonard Johnson, a Division of Earth Sciences (EAR) Project Director, spoke of his experience as PD for Integrated Earth Systems, which funds horizontal gene transfer and geo-genomics.
* Dr. Van Dover supported including the points made by Dr. Falkowski, but not to the exclusion of disciplinary science. NSF’s interdisciplinary research is limited by the way universities are structured, Dr. Dixon said. But nimbler universities will respond if there is funding for interdisciplinary research, Dr. Falkowski said.
* The committee needs to formulate actionable items, Dr. Hodges said. He also urged raising the profile of *Dynamic Earth*.

**General Discussion Regarding Strategic Development**

Dr. Pomponi summarized a discussion among some committee members about AC/GEO priorities, how the committee can be most effective, whether AC/GEO can speak for the community, ways to get broader community buy-in and the question of how the directorates and divisions can focus priorities to support the foundation’s strategic plans. She also discussed the possibility of setting agenda topics in advance for AC/GEO meetings so members can be better prepared to provide input and raised the possibility of closed-door AC/GEO meetings for members only.

Ms. Lane informed the committee that closed-door sessions are prohibited.

Discussion:

* Dr. Hodges said the committee is ready to do more than it has in the past, acting as a sounding board for the community. There are some hazardous funding days ahead in geosciences, which calls for careful prioritization, and AC/GEO would enjoy being in that discussion. Dr. Borg said that suggestion was not out of line and supported setting agenda topics in advance for future meetings, adding that Dr. Easterling, who was unable to attend this morning’s session, would agree. Setting an advance agenda meshes well with the previous discussion on *Dynamic Earth*, Dr. Pomponi said.
* Dr. Nigam said some GEO funding might me skewed toward physical sciences and wondered about extending some interdisciplinary programs to behavioral and social sciences.
* Dr. Kempton urged AC/GEO to be more proactive and less freewheeling. But to formulate action items requires knowing what advice GEO wants from the committee. GEO has asked the committee to look at *Dynamic Earth* and prepare an addendum, Dr. Pomponi said. But Dr. Kempton said she did not come prepared to do that work, not having received notice in advance.
* Dr. Nigam asked about the difficult decisions where GEO is struggling and the committee can offer advice. Internal NSF discussions about the area of most importance, the FY 2019 budget request, must remain confidential, Dr. Borg said. NSF wants input and AC/GEO’s ideas about the trends and themes that NSF should be emphasizing. NSF does not want prescriptions to hand off to Program Officers, which would limit their creativity, but seeks input and course corrections for documents such as *Dynamic Earth*. But Dr. Kempton said that is not something AC/GEO can do during its limited meeting time.
* Dr. Shepson offered for discussion the question of how well AC/GEO is expressing the importance of geosciences in *Dynamic Earth* and other such documents.
* Dr. Semeter referenced *GEO Vision* (2009), which included areas related to Earth and life, geosphere and biosphere connections, climate change and dynamic earth, and asked why they were thrown away. Dr. Fine said everyone knew why.
* Dr. Fine also agreed with Dr. Kempton about limited meeting time and said AC/GEO needed to be more proactive. Dr. Kempton called for a targeted document focused on areas to be discussed that would be circulated before each meeting.
* Dr. Hodges said it would be helpful to use the meeting to think about how to approach things in the future.
* AC subcommittees can have closed sessions, Dr. Borg said. Subcommittees report back to the AC, so subcommittees do not provide advice to NSF. He suggested thinking about how subcommittees can be used effectively to explore topics offline. That requires the AC leadership to say what they want advice on at the next meeting, Dr. Kempton said.
* Dr. Semeter raised the question of whether system science is a hard science.
* Dr. Hodges suggested coming up with action items and deciding on a subcommittee structure. He also said AC/GEO has to do the difficult work of setting priorities.
* AC/GEO should consider commenting to NSF on, or stimulating the community to respond to, the priority issues raised in a recent Dear Colleague Letter (DCL) derived from the American Innovation and Competitiveness Act (AICA), Dr. Borg said. AC/GEO is meant to represent the community and be part of the dialog between NSF and the community, Dr. Falkner said. But AC/GEO does not represent all the diverse fields in the geosciences, Dr. Hodges said.
* Dr. Falkner said AC/GEO can use the subcommittee format to look at the big picture of existing studies, paying attention to what NSF is trying to do in its initiatives and how existing studies do or don’t dovetail with *Dynamic Earth*, as a way of having an impact and amplifying community voices.
* AC/GEO is not receiving truly representative feedback, Dr. Hodges said. The community’s concern is that there are many more good proposals than can be funded. A huge percentage of the community is frustrated and feels proposal submission is a crap shoot, which means there is no point in trying to write a better proposal.
* Dr. Murray said he commonly hears people say their program has a 5 percent success rate, but it isn’t true. AC/GEO can play a valuable role by bringing objectivity to the discussions of how good or bad things are. Dr. Hodges supported disseminating these data but cautioned that numeric scores are subject to idiosyncrasies; many good proposals get low scores. The message to proposers should be: We’re almost funding all the proposals worthy of being funded; yours was not.
* If PIs commonly feel they don’t receive actionable information when their proposals are declined, that would be important to know for Atmospheric and Geospace Sciences (AGS), where there is significant self-assessment, Dr. Shepson said.
* Dr. Hodges said in his experience there is a perception that it is increasingly difficult to get funding for good proposals because proposers are not getting a fair shake.
* Dr. Borg suggested AC/GEO consider the mismatch between what is funded and what could be funded that would benefit the nation.
* Dr. Kempton suggested AC/GEO provide a landscape analysis looking at existing reports and advice it is collectively giving to NSF.
* AC/GEO could say now that once input is collected from the DCL about Mid-scale Research Infrastructure, it will weigh in, Dr. Borg said.
* Dr. Hodges said AC/GEO needs to collect more metrics on the inclusion of women and underrepresented minorities and have more discussions about how GEO is performing in this area. Dr. Fuentes suggested aggregating data on success rates and underrepresented groups and sharing it with AC/GEO and the community. Dr. Shepson said this type of data has been shared with the subcommittees. Dr. Fuentes added that information is needed on what has been down to increase the number of proposals from underrepresented groups. Dr. Stephen Meacham, Staff Associate, Office of Integrative Activities (OIA), offered to make a future presentation on NSF and GEO efforts to broaden participation. GEO has been a leading directorate in trying to focus on broadening participation, he said. The presentation could set the stage for a broader conversation to provide helpful input to NSF. He also offered to provide data on success rates, which AC/GEO could best improve by articulating visionary directions for helping NSF achieve its mandated mission. Dr. Hodges said this would help address the fact that people think success rates are not just low, but skewed.

**Brief Update on NSF GEO Activities**

Dr. Easterling said he would like AC/GEO to be an engaged and consultative group that is unconstrained and speaks truth to the organization and feels its advice is always accepted and considered. It will take one or two meetings to reach the right level of advance preparation and written communication members would like to have ahead of meetings.

Dr. Easterling announced GEO front office changes. Marge Cavanaugh is now BIO Deputy Assistant Director. Dr. Borg is serving as Acting Deputy Assistant Director for geosciences. The search committee to select a permanent hire for that position is chaired by Dr. Frost; someone should be in place by year’s end.

Dr. Easterling discussed his vision for GEO. He expressed strong support for fundamental research but added that much of it can and should be able to provide usable information to better understand the big challenges, such as climate change, geophysical hazards and developing sustainable systems of energy, water, food and natural resources. Questions about how the world works can lead to the development of new knowledge that is immediately helpful in understanding real world problems. He expressed his commitment to addressing problems that are politically divisive, such as climate change and hydraulic fracturing. Decisions on proposed research will not be based on politics, he said.

GEO must take back its narrative of the value of geosciences to convince those in power to provide resources for the directorate’s research. He is working with American Geophysical Union (AGU) to look at the great geosciences breakthroughs that have made a difference in society.

He also expressed his commitment to transforming the geosciences workforce and student body into a racially, ethnically, and gender-diverse set of disciplines, including a meaningful experience for students.

Discussing the budget, the FY 2018 request is 9.5 percent lower than the FY 2017 plan. Current funding, because of a Continuing Resolution, is at the same level as the previous fiscal year. This is the first year there has been a budget decrease. Though Dr. Easterling said he is unable to lobby Congress, he reminded AC/GEO members that they can exercise their civic duty, if desired.

The principles for distributing the budget reduction stress protecting core research programs. There is also a commitment to maintain support for INFEWS, continue development of the Antarctic Infrastructure Modernization for Science (AIMS) project and continue construction of Regional Class Research Vessels (RCRV).

Dr. Easterling briefly reviewed the history of the debate over the water, food and energy interconnections before turning to a discussion of INFEWS and the program’s goals. One INFEWS study funded through GEO is of the Energy Neutral Greenhouse. North Carolina State University is developing self-sufficient greenhouses by integrating semi-transparent, wavelength-selective organic solar modules with plant growth engineering and system design optimization to synergistically provide food and energy sources while conserving water.

Turning to risk and resilience investments, Dr. Easterling discussed the Prediction of and Resilience Against Extreme Events (PREEVENTS) program, which:

* Enhances understanding of natural processes underlying geo-hazards and extreme events;
* Improves the capability to model and forecast hazards and events;
* Reduces the impact of extreme events on life, society, and economy;
* Improves prediction and warning systems that support mission agencies, such as the National Oceanic and Atmospheric Administration (NOAA), the Department of Homeland Security (DHS), and the United States Geological Survey (USGS).

He also reviewed the natural hazards addressed by PRFEEVENTS-funded research projects, with about $34 million research funding.

Next, he provided updates on GEO infrastructure: Antarctic Infrastructure Modernization for Science (AIMS)

* Construction possible as early as FY 19;
	+ Replace major facilities at McMurdo Station, Antarctica to meet anticipated science support requirements for the next 30 to 50 years;
	+ Enable faster, more streamlined logistical and science support by co-locating or consolidating warehousing, skilled trades work, and field science support within four connected enclosed buildings.
* Academic Research Fleet (ARF, via the University-National Oceanographic Laboratory System (UNOLS))
	+ RCRV: Major Research Equipment and Facilities Construction (MREFC) construction awarded in FY17 to Oregon State. Up to three vessels to be built;
	+ Two new Navy vessels (Armstrong, Ride);
	+ Refits of Thompson (University of Washington (UW)) and Revelle (Scripps Institution of Oceanography (SIO));
	+ Other projects: Coring, Synthetic Rope, Seismic.

Dr. Easterling concluded his presentation with a discussion of one of NSF’s 10 big ideas: Navigating the New Arctic. The Arctic is experiencing dramatic changes in permafrost and ecosystems, ice loss, and sea ice loss, with wide ranging implications world-wide. It is warming at twice the rate of the rest of the world with far reaching consequences for indigenous populations. There is a critical need to develop comprehensive observational systems and networks to improve forecasting of environmental changes and for systematic forecasting that includes natural and human systems.

The initiative is likely start in next year and Dr. Easterling solicited AC/GEO’s advice and involvement, particularly regarding asking the kinds of questions that are likely to bring significant answers if the right investments are made.

He also noted two directorate reports, *Dynamic Earth* and *Strategic Framework for Education & Diversity, Facilities, International Activities and Data and Informatics in the Geosciences* (2012).

Discussion:

* In response to a question about the declining budget and the New Arctic initiative Dr. Easterling said the foundation remains committed to big, forward-looking projects. But NSF’s big ideas were developed in an era of expanding budgets and Navigating the New Arctic will be much more modest than it would have been. This is our time to either say we can’t do it or we want to put at least enough money into it to start a discussion of what we would do when funds are more available.
* Dr. Falkowski raised the issue of diversity in the geosciences and said the remedy is at the elementary school level and he advocated leveraging resources to help those who want to teach to understand scientific concepts and teach it in a way that’s fun. He also asked if there was a way to have an international Arctic initiative to leverage resources. Dr. Easterling said that might be the only way to get a foot forward on Navigating the New Arctic. Dr. Borg added that there are venues that can discuss international cooperation. He said Dr. Falkner is thinking about this.
* Dr. Stephenson discussed an international study under development for 2019 – 2020 to look at the new Arctic. Organized through the International Arctic Science Committee (IASC), the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) will be the first such year-round study. NSF has made three awards. Fifteen or more countries are involved. He also mentioned an international science ministers meeting focused on the Arctic in 2016 that is to convene again in 2018.
* Dr. Easterling returned to diversity, discussing Inclusion across the Nation of Communities of Learners that have been Underrepresented for Diversity in Engineering and Science (INCLUDES), an NSF-wide effort that GEO contributes to substantially. But he said more was needed to attract minorities and other underrepresented groups into the geosciences. One of his goals is to help students and faculty be appreciative of and able to function in a productive way and feel good about themselves as they progress through their degrees and careers.

**Committee of Visitors (COV) Reports: Earth Sciences**

Dr. Kempton presented the EAR 2014 – 2016 review update. Seventeen programs’ decision-making processes were reviewed at the division and program levels. They were in the categories: disciplinary, crosscutting and special. A total of 406 proposals, of which 145 were awarded, were reviewed. Those at the boundary were given special attention. Jackets and EAR material from staff were used. The committee examined the integrity and efficiency of processes focusing on the competitive actions based on a template with four areas for review (merit review, selection of reviewers, program management, portfolio planning and other (no-deadlines pilot)).

The review had two overarching conclusions:

* The Earth sciences are critical to virtually all issues facing our nation in the 21st century;
* COV expresses strong and clear support for the growth of the US Earth sciences effort.

The committee made 19 recommendations across the template categories:

* Merit Review (1-7); Selection of Reviewers (8); Program Management (9-12); Portfolio Planning (13-18); Other (19);
* Grouped into thematic areas: Review Process, Broadening Participation, Communications, Workload, Strategic Directions.

Recommendations (Review Process):

* The COV supports continued ad-hoc and panel review (on-site preferred) – Recommendation 1;
* Improve ad hoc review return rate – Recommendation 2;
* Explore means to incentivize ad hoc review return – Recommendation 8;
* Program Officers to ensure adequate information in RA for decisions that vary from ad hoc and/or panel – Recommendation 5;
* Consistent information on panel activity in RA – Recommendation 6;
* Consistent clear feedback to PI on IM and Broader Impacts (BI) in panel summaries, PO comments, context statements – Recommendation 7.

Recommendations (Broadening Participation):

* Improve ad hoc and panel review of BI. Panel templates must include BI – Recommendation 3;
* POs should use PO Comments to signal importance of BI – Recommendation 4;
* COV supports continuing activities on BI and improving ad hoc review system – Recommendation 12;
* EAR outreach to broaden geographic participation – Recommendation 16;
* EAR outreach to underrepresented institutions – Recommendation 17;
* Broaden participation of underrepresented groups based on best practices, success metrics, assessment, new approaches – Recommendation 18.

Recommendations (Communications):

* Communicate process of developing new initiatives in solicitation and DCL; communicate on EAR website and list-serve – Recommendation 11;
* Improve communications to PIs and public – Recommendation 15.

Recommendations (Workload):

* The COV emphasizes the need for increased personnel and fiscal resources to help sustain the important contributions of EAR staff – Recommendation 9;
* The COV recommends that EAR move forward with the No Deadlines pilot, but should undertake more in-depth research into any unintended consequences, including impacts on proposal quality or participation by prospective PIs – Recommendation 19.

Recommendations (Strategic Directions):

* Evaluate balance of infrastructure and research; develop process for evaluating (and, if needed, sunsetting) infrastructure – Recommendation 10;
* Improve communications regarding how program funding levels are set via strategic planning driven by transparent process – Recommendation 13;
* Engage in long-term strategic planning with community input – Recommendation 14.

Dr. Eva Zanzerkia, EAR Program Director, reviewed the EAR response to the recommendations by category:

Review Process:

* EAR appreciates COV support for EAR’s review process;
* Best Practices review committee has been constituted.

Broadening Participation:

* EAR fully agrees that more can be done to broaden participation;
* Increased effort for program director outreach and E&HR focus;
* Best Practices review committee is charged with focus on BI.

Communication:

* EAR agrees that disseminating discoveries to PIs and the public is critical;
* EAR communications team activities are improving communications;
* Program officers will include strategic drivers in solicitations and DCLs.

Workload:

* Nine program director recruitments in EAR will help address workload;
* No deadlines pilot has been extended;
* EAR will continue evaluation of impacts of the pilot.

Strategic Directions:

* EAR plans better communications on EAR strategic directions;
* EAR has initiated an external study including community input;
* EAR plans a Working Group on instrumentation and facilities.

Overall, Dr. Zanzerkia said the review was a good mechanism for EAR to review its merit review processes and the COV provided helpful guidance. A response is underway and it will be updated annually.

Discussion:

* Dr. Hodges said his anecdotal information is that strategic priorities at the program level are not well defined. Dr. Kempton responded that what the COV saw as programmatic priorities were not necessarily scientific priorities. The strategic drivers at a higher level are not clear and are not filtering down to the program level, she said.
* Dr. Hodges asked if people who have written proposals could be surveyed about their experiences. Dr. Frost responded that the COV scope is limited to the merit review process. Dr. Sullivan added that a survey would be useful, but difficult to carry out for a representative sample. In the absence of survey data, an asterisk is needed for the conclusion that everything is fine, Dr. Hodges said. Seventeen people on the COV, who saw the whole process across all the programs, were convinced that by and large everyone was very comfortable with the decisions, Dr. Kempton said.
* Dr. Frost suggested creating a synthesis of a half a dozen recommendations from historical COV reports that can be communicated to the community along with an explanation of the steps involved in submitting proposals.
* The Office of Integrative Activities looks at many COVs across the foundation, Dr. Falkner noted.

AC/GEO voted unanimously to accept the COV report.

**GEO Education and Diversity (includes polar education)**

Dr. Lyons began his presentation with a list of the seven COV members and said they reviewed educational programs in GEO and OPP. The former included Improving Undergraduate STEM Education: Pathways into Geoscience (IUSE: GEOPATHS), GEO Opportunities for Leadership in Diversity (GOLD), the Global Learning and Observations to Benefit the Environment (GLOBE) program and Polar Special Initiatives.

The charge was to review actions taken by GEO programs related to focused educational and Polar Programs related to education between 2013 and 2016. It reviewed 72 jackets, of which 72 were funded. The COV also examined the integrity and efficiency of the process to solicit, review, recommend and document proposal evaluations and actions. It also looked at decisions and program goals and the effectiveness of merit review procedures, reviewer selection and the resulting portfolio of awards.

The review was very positive; the programs were found to be well managed; the review methods were appropriate and fair; and for the most part the merit review criteria were addressed. The wide breadth of activities were integrated and supported GEO goals; they were innovative and important to the foundation’s mission. The program, he said, is critical to the recruitment of underrepresented minorities, enhanced teaching outcomes and increased the GEO workforce.

He cited key observations in four areas:

* Quality and Effectiveness of the Review Process.
	+ The overall understanding of BI by reviewers appeared narrow and there was a need for more reviewer training in this area. There was a need in some cases for more detailed reviews from Program Managers to proposers. There was a need for more standardization of protocol feedback to the PIs on whether they were funded or declined.
* Reviewer Selection
	+ There was a broad participation of a diverse set of professionals as reviewers, although insufficient information was available on their expertise. In one instance, there was a need for a clearer rationale for a panel member’s selection.
* Program Management
	+ All programs were well managed and responsive to emerging issues in GEO. But the COV concluded the program should have some prioritization and there was a need for more information to the COV prior to the meeting. There was also a need for more information on the demographics of reviewers.
* Resulting Portfolio Awards
	+ Many projects had components that were innovative and transformative. There was good geographical distribution of awards and institutional variety. The COV could not assess the balance of awards across disciplines and could not determine if the awards were the appropriate size or duration. There was a high representation of women, but a low representation of underrepresented minorities. It was not possible to tell how many of the new investigators were PIs on the grants. There was good integration of research and education in all the programs. The impact on education and diversity within GEO is and will continue to be of great importance.

COV Process Recommendations:

* PO guidance information on context, history, process and prioritization of the programs should be provided;
* The COV should get more information about programs prior to the meeting;
* The demographic data should be improved and shared with the COV;
* Additional information on the final proposal decisions should be provided to the COV and access to the COV materials should be improved.

COV Program Recommendations:

* There should be increased training and clarity in BI for PIs, reviewers and panelists.
* There should be a continued expanded effort to increase participation of underrepresented minorities in all the programs. Workshops for underrepresented groups could be held to train on best practices, evaluation and grant writing.
* More detailed reviewer guidance is needed to encourage more comprehensive reviews.
* There should be more detailed feedback for providers of proposals on declination.

Dr. Brandon Jones, Program Director GEO Education and Diversity, thanked the COV. GEO has been out front in the foundation in working with underrepresented communities and bringing them into the geosciences and they are continuing to work with historically black colleges to help them see the value in translating the intellectual capital from ongoing research supported by the U.S. Department of Agriculture or the Department of Defense that can be translated into geosciences.

Discussion:

* In response to a question about why there was no information on the colleagues from underrepresented groups who participated in the review process, Dr. Voorhees answered that the COV did not have the demographic data to determine diversity among reviewers. He noted the reason was because the data is voluntarily supplied.
* It was helpful to have the two COVs present at the same meeting to provide a compare and contrast on the size and focus of the two efforts, Dr. Kempton said.

AC/GEO voted unanimously to accept the COV report.

**Next Steps for *Dynamic Earth***

AC/GEO returned to the morning’s discussion of *Dynamic Earth* to consider rectifying any omissions in the report, possibly adding an addendum and improving messaging. The discussion focused on three areas:

* **Climate Change: Rising to the Challenge of Understanding and Coping with a Rapidly Changing Climate.**
	+ NSF is being reactive in this area, rather than doing something proactive to fix the system, Dr. Semeter said.
	+ Dr. Hodges suggested articulating the GEO imperatives in the full report title and deciding whether to be proactive or reactive.
	+ Dr. Nigan volunteered to develop test language and suggested reviewing the presentation by a Georgetown University representative who addressed a 2016 AC/GEO meeting. Dr. Semeter and Dr. Fuentes also volunteered.
	+ Dr. Easterling said that in the past NSF and the broader community were more focused on how to prevent climate change and be more proactive. That cycled to acknowledgment that there will be a certain amount of climate change and adapting to what cannot be prevented. He said both should be considered together.
* **Opportunities for Emphasis on** **Improved Messaging**
	+ Dr. Lyons said there is no mention of sustainability and the food, water, energy nexus in the document. This can easily be woven into the document, Dr. Hodges said. He suggested the report state that the definition of the nexus is very broad, including maintaining the soil. This information will be incorporated under Improved Messaging. Dr. Lyons will lead on this section.
	+ Dr. Dixon volunteered to work on this section. He added that the human response to climate change should be included.
* **Trans-disciplinary Research and Complex Systems**
	+ Dr. Falkowski volunteered to take the lead on this section. He also made the case for a conversation across disciplines to generate new ideas.
	+ Dr. Pomponi suggested weaving in some of the big ideas with the specific expertise GEO brings and explicitly state strategic directions.
	+ Dr. Easterling agreed and said there is a big role for harnessing the data revolution. GEO is also partnered with convergence research in Navigating the New Arctic.
	+ Dr. Falkowski explained how interdisciplinary research can potentially lead to solutions for the major problems of food and energy.
	+ Dr. Hodges said Dr. Falkowski’s point should be added to the report. He also suggested using wording to presage what might come out of funding for the big ideas, rather than focusing on the ideas themselves.
	+ Dr. Easterling said he was interested in the committee finding where progress can be made by bringing together resources on a big idea.
	+ He also said Dr. Pomponi is right that it is up to the directorates to come up with funding from their budgets to invest in the big ideas. She noted that Polar Programs received the smallest budget cut and asked if that is a reflection of the resources being invested in the New Arctic. Dr. Easterling said he was unable to answer but added it was a reflection of getting Polar Programs ready for AIMS.
	+ Dr. Falkner said the agency decided it was better to not have AIMS in the major research equipment facilities account, which is a separate line item. But it will be tracked closely; it will be new money and not at the expense of GEO.

**Preparation for Meeting with the NSF Director and Chief Operating Officer**

The committee developed a list of questions it would pose to the NSF Director.

**Meeting with the NSF Director and Chief Operating Officer**

Dr. France Córdova invited the committee members to introduce themselves and asked for questions.

**Discussion**:

In response to a question about how to move forward with the big ideas given present budget constraints, Dr. Córdova said NSF is currently looking at this issue as part of an examination of discretionary funding and proposal funding that has terminated. Each year NSF starts new solicitations to new programs, which provides a capacity to fund new projects or older ones in a new context. All of the ideas have been funded somewhat, she said, adding that all the 10 big ideas are very much alive. GEO communities are encouraged to respond to a Request for Information issued for Mid-scale Research Infrastructure, Dr. Joan Ferrini-Mundy, NSF Chief Operating Officer, added.

Asked about the directorate’s role re climate science, Dr. Córdova said the agency has been funding research on environmental change in many directorates. NSF will not diminish doing the very best research in all these different areas, she said.

Addressing a question about the priorities in *Dynamic Earth*, Dr. Córdova said such documents are the best wisdom about the directions where the field is going and are used to set priorities. NSF welcomes continually restating important goals and activities so investments can be made, where possible, in areas the community thinks important.

Dr. Hodges added that being ready with new big ideas permits a quick reaction when there is a new pot of money. Dr. Córdova said Congress is enthusiastic about decadal studies, which are most helpful when they provide different options for different budgets scenarios.

Dr. Kempton asked if AC/GEO’s vision excites the decision makers and gets them on our side and, if not, how the committee can express itself differently. Dr. Córdova said members of Congress ask why they are not deluged with visits from the public and scientists telling stories about the work of NSF fellows and what’s important to do for the future. NSF can’t advocate, but members of AC/GEO can. She urged faculty and students to visit their members of Congress in their districts and show them labs and field sites. Everybody who is, or could be, supported by NSF can make the pitch about the importance of fundamental research to the country, with examples of how it has changed people’s lives and affects the local institutions.

Dr. Voorhees asked about coming reprioritizations in light of the proposed 14 percent cut for Education and Human Resources in the FY ’18 budget. Dr. Córdova noted the budgeting process is just starting and that Congress ultimately decides. Dr. Ferrini-Mundy added the proposed reductions are for support for graduate students, but noted that for graduate students most of NSF’s investment is in research assistantships (RA) across the research directorates. She raised the question of whether NSF is doing as well as it can across the agency thinking about those RAs, their education and mentorship, and their opportunities to learn new techniques, instruments and tools. The budget process could cause NSF to think more about the education of RAs.

Dr. Hodges discussed the crisis of confidence many graduate students have over whether to stay in academia and said NSF can help with a more effective way for teachers to make mentoring students a more fundamental part of their work. Dr. Ferrini-Mundy mentioned the NSF Research Traineeship (NRT) Program that funds universities to experiment with mentoring. She suggested finding models that have been funded through NRT in the geosciences and sharing it with AC/GEO. Dr. Córdova added that NSF is funding a National Academy of Sciences study looking at best practices for graduate education. Dr. Ferrini-Mundy also mentioned the I-Corps program, which has a focus on entrepreneurship training.

After briefly describing the transition over the last couple months to the new NSF headquarters, Dr. Córdova discussed NSF’s role in responding to recent hurricanes. NSF has to date provided 60 new grants totaling more than $5 million to help scientists understand how disasters happen and response is improved. There were also 15 PREEVENTS grants awarded in response. Next, she mentioned a number of other efforts:

* The EarthScope Transportable Array (TA), which has installed its final Alaska station to help understand earthquakes there;
* The International Ocean Discovery Program (IODP) that is exploring beneath the ocean floor;
* A recent presentation on new developments in gravitational-wave astronomy;
* An upcoming presentation on multimessenger astronomy.

Dr. Córdova turned next to the role of advisory committees and said she was looking forward to having more attention focused on Polar Programs with the new Advisory Committee for Polar Programs. She is particularly interested when ACs take on something that furthers the foundation’s mission. She concluded by asking the committee what that could be for geosciences.

Dr. Hodges responded by making the case for convergence as the answer to Dr. Córdova’s challenge. She, in turn, said partnerships were very important for leveraging resources and mentioned a meeting earlier in the day with Air Force officials on partnerships. Dr. Easterling, who also attended, said it was important with partnerships to leverage all the strengths that different institutions bring. He mentioned areas where NSF and the Air Force have collaborated, including an Air Force partnership with the National Center for Atmospheric Research to observe severe storms from aircraft. NSF has also worked with the Air Force in developing modeling capabilities in weather forecasting for understanding climate dynamics, he said. NSF is committed to supporting fundamental research, but it can also leverage resources and missions. Using what is learned in the geosciences, the foundation can efficiently move into operations in these partnerships. GEO can do a lot more to help NSF see such future partnerships. Brian Stone, NSF Chief of Staff, added that the day’s discussion with the Air Force included the continuum of basic research feeding into more applied areas. It is important, he stressed, to make the connection between funding for basic science and advances in applied areas that are made as a result.

Dr. Semeter mentioned Cubesat as an area for collaboration and urged the agency to not lose its footing in small satellites, with mission objectives transferred to other agencies. There is an opportunity for NSF to offer a whole package that includes missions, which also connects to the Mid-scale program. Dr. Córdova said NSF is part of an interagency group working on this and that it will be exciting to see what comes out of the Mid-scale request for information.

Dr. Shepson assured Dr. Córdova that AC/GEO is working hard to leverage success across disciplines and engage other directorates for opportunities in science and education. Dr. Hodges added that Cubesat has revolutionized how undergraduates look at their role in basic science. The form factor is also driving technology. Individual universities, Dr. Shepson said, can effectively have their own space programs, which is an example of the impact of the investment in basic science.

**Meeting Adjourns for the Day**

**Thursday, October 19, 2017**

**Division Subcommittee Meetings (EAR, Ocean Sciences (OCE) and AGS) were held in separate breakout sessions.**

**Division Report Out: EAR, OCE and AGS**

Dr. Hodges kicked off the first report out from the EAR subcommittee by noting that the division is gearing up for a National Academy report on priorities. A narrow scope has been maintained for the report, which is focused on EAR science priorities. The subcommittee discussed including workforce development and education in the report as follow-on steps. The Academy is to have a proposal to NSF in November with completion around 2020. Dr. Frost added that the success of the study depends on good community involvement.

Dr. Fine reported on the OCE subcommittee meeting. There has been a positive response to “*Sea Change: A Decadal Survey of Ocean Sciences, 2015-2025*” and $15 to $17 million has been moved from infrastructure to core programs, education and Oceanographic Technology and Interdisciplinary Coordination (OTIC), per the report. She also covered the seismic component, personnel changes and NSF nimbleness. In conclusion, she thanked Dr. Murray for his work.

In response to a budget question, Dr. Murray said the Academy report recommendations were roughly followed. The 5 percent fleet Operation and Maintenance (O&M) reduction was the highest dollar value. The largest decrease currently is a $10 million phased-in reduction from the Ocean Observatories Initiative (OOI). Discussing the implications, he said the community needs to examine its global capabilities.

Dr. Shepson reported on the AGS subcommittee, starting with a review of personnel changes. He also reviewed research in a number of areas, starting with hurricane research and noting that AGS is NSF’s home for fundamental research on tropical cyclone dynamics. He highlighted work from the Naval Postgraduate School about improving the predictability of tropical cyclones. In the area of fire research, he discussed an award involving a Doppler Lidar-equipped pickup truck to remotely probe fire dynamics. And he reviewed the development of an Airborne Infrared Spectrometer (AIR-Spec) for the 2017 American solar eclipse. He concluded by speaking about strategic planning, including developing a document on self-assessment.

Dr. Semeter continued by noting a disconnect between *Dynamic Earth* vs. direct results from the research Dr. Shepson discussed and said corrections might be possible in the addendum. He also discussed Mid-scale in AGS and tackling national priorities, the role of Intergovernmental Personnel Act (IPA) assignees vs. permanent staff and the absence of a policy for that mix and other problems with rotators, and the issue of research from primarily undergraduate institutions.

**Strategies in the Context of a Revisited *Dynamic Earth***

Dr. Hodges read an email from Dr. Paola with comments on earlier proceedings. Regarding *Dynamic Earth*, Dr. Paola noted areas missing from the report: coastal resilience and response to sea level change; and planetary science.

Dr. Hodges raised the issue of whether AC/GEO should revise the text of the document, or only do an addendum. Dr. Kempton spoke in favor of an addendum due to limited time and resources.

AC/GEO agreed to produce an addendum only.

Dr. Falkner suggested making the addendum available to the community to submit responses. Dr. Easterling suggested making it known to the community that AC/GEO is in process of updating the report’s language and ask for feedback to expand the committee’s expertise and signal the community that AC/GEO is interested in keeping the report dynamic. Dr. Hodges seconded Dr. Easterling’s suggestion and reiterated the value of publicizing *Dynamic Earth* to the community, which he said is not well known. In response to a question about an American Geophysical Union (AGU) Town Hall session to consider the report, he said there may not be time.

Dr. Kempton suggested getting input before the next AC/GEO meeting so members could come prepared to work on the addendum, with further work at the next meeting. Dr. Falkner asked about discussing the issue at the next GEO Town Hall. Dr. Hodges and Dr. Easterling supported the suggestion.

Dr. Hodges reviewed the four ideas developed yesterday for writing assignments to be completed before the next meeting:

* Omissions from *Dynamic Earth*:
	+ Rising to the challenge of understanding rapidly changing climate and its implications (Dr. Semeter, Dr. Nigam, Dr. Fuentes).
	+ Power of holistic perspectives in transdisciplinary research and the need to address complex systems (Dr. Falkowski).
	+ Connecting *Dynamic Earth* to NSF’s big ideas (Dr. Pomponi).
	+ Sustainability and human factors (Dr. Lyons, Dr. Dixon)

Dr. Hodges proposed a short *EOS* article publicizing the need for input from the community, which could be entered on a website or through written responses. That, and views solicited at the AGU Town Hall, will be used as input for the *Dynamic Earth* addendum.

Dr. Van Dover said the Town Hall will not be a representative sample of the community and suggested a post-AC/GEO action plan for outlining next steps. Also, *EOS* does not reach the whole community. She offered to help with a Qualtrics survey using the DCL mailing list.

Dr. Hodges agreed that AC/GEO should proceed with the survey.

Dr. Falkner said research is needed into how NSF can support a survey, given the strictures of a Federal Advisory Committee. Dr. Hodges and Dr. Easterling discussed permissible ways of putting questions to the community.

Dr. Falkowski urged including framing language around the Earth as an interactive system. Dr. Hodges emphasized that AC/GEO is authoring an addendum rather than rewriting the report. Dr. Easterling added that a separate document may be needed to put the focus on Earth system science.

Dr. Fine supported emphasizing to the community that *Dynamic Earth* is a living document.

Dr. Hakim said a more careful committee process needed to be followed to receive appropriate community feedback and that some of the committee’s work could have been could have been accomplished faster over email.

Dr. Fine and Dr. Kempton emphasized that the addendum’s subject areas frame what goes out to the community. Those working on the addendum should do a brief write-up for this purpose, Dr. Hodges said.

**Discussion of Coordination Between AC/GEO and the newly established AC/OPP**

Dr. Hodges reviewed the recent decision for a separate OPP advisory committee, the need to coordinate with AC/GEO and joint membership. Dr. Falkner described how AC/OPP members were chosen. Details are available on the OPP website. Dr. Hodges urged continued coordination as membership changes and suggested that AC/GEO meetings include an OPP update from a dual-hatted member. For legal reasons this should not be the AC/OPP chair, Dr. Falkner noted. Dr. Easterling suggested four overlapping memberships for free and open conversation between the committees.

**Meeting Wrap-Up: Open Discussion and Action Items**

Dr. Easterling thanked the members for their contributions and reiterated his interest in receiving their unvarnished views. Regarding the earlier *Dynamic Earth* discussion, he will be meeting shortly with Dr. Hodges and others to follow-up on the committee’s recommendations. He also recognized members whose terms will be ending. He noted that three division directors will be leaving over the next year and solicited AC/GEO’s help in finding the best replacements.

The retiring division directors briefly summarized why AC/GEO members should encourage their best colleagues to apply. Dr. Murray talked about having the opportunity to work with some of the best people in the field, influencing the direction of work in the discipline and being involved in science policy. Dr. Frost spoke of a desire to give back after having received NSF grant support for 30 years, working for an organization whose mission is to push forward the frontiers of science and working with professional societies. Dr. Shepson spoke of being associated with the world’s most important science, making the case for GEO’s impact on society and the comradery of his division director colleagues.

Dr. Easterling adjourned the meeting.