NATIONAL SCIENCE FOUNDATION

Advisory Committee for Geosciences Directorate

(AC-GEO)

October 6-7, 2010

Room 1235, Stafford I

MINUTES

Members Present:

Dr. Louise H. Kellogg, Chair, Geology Department, UC-Davis

Dr. Robert C. Beardsley, Dept. of Physical Oceanography, Woods Hole

Dr. Margaret L. (Peggy) Delaney, Ocean Sciences Dept. UC-Santa Cruz

Dr. Donald J. De Paolo, Dept. of Earth and Planetary Science, UC-Berkeley [via phone]

Dr. Douglas E. Erwin, National Museum of Natural History, Smithsonian

Dr. Efi Foufoula-Georgiou, Dept. of Civil Engineering, University of Minnesota

Dr. Tamas I. Gombosi, Dept. of Atmospheric, Ocean and Science Space, University of Michigan

Dr. Vanda Grubisic, Dept. of Meteorology and Geophysics, University of Vienna [via phone]

Dr. Claudia Mora, Los Alamos Scientific Laboratory

Dr. Walter A. Robinson, Dept. of Marine, Earth and Atmospheric Sciences, NC State University

Dr. Paul B. Shepson, Purdue Climate Change Research Center

Dr. John T. Snow, National Weather Center, University of Oklahoma [via phone 10/7 only]

Mr. Craig Strang, Lawrence Hall of Science, UC-Berkeley

Dr. Orlando Taylor, Dean of Graduate School, Howard University [via phone]

Dr. E. Bruce Watson, Dept. of Earth and Environmental Sciences, Rensselaer Polytechnic Institute

Members Not Present:

Dr. Claudia R. Benitez-Nelson, Dept. of Geological Sciences, University of South Carolina

Dr. Joseph S. Francisco, Dept. of Chemistry, Purdue University

Dr. Norine E. Noonan, Division of Academic Affairs, USF St. Petersburg Bay 204C

Dr. Andrew A. Rosenberg, Sr. Vice President for Science and Knowledge Conservation International

D. David S. Schimel, Principal Investigator and CEO, NEON

Dr. Lonnie G. Thompson, Byrd Polar Research Center, the Ohio State University

GEO Staff Present:

Dr. Tim Killeen, Assistant Director, GEO

Dr. Margaret Cavanaugh, Deputy Director, GEO

Dr. Robert Detrick, Division Director, Earth Sciences

Dr. Michael Morgan, Division Director, Atmospheric and Geospace Sciences

Dr. David Conover, Division Director, Ocean Sciences

Mr. William Smith, Staff Associate for Budget

Ms. Elizabeth Zelenski, Staff Associate, OAD

Dr. Maria Uhle, Senior Staff Associate for International Science Affairs, OAD

Dr. Louis Brown, International Officer, OAD

Ms. Melissa Lane, Executive Secretary, AC-GEO

The meeting of the Advisory Committee for Geosciences Directorate (GEO) was held October 6-7, 2010, at the National Science Foundation in Arlington, Virginia.

**Wednesday, October 6, 2010**

**Welcome and Introductory Remarks**

The meeting was called to order at 8:30 a.m. Dr. Louise Kellogg, Chair, AC-GEO, welcomed all those present in the room, as well as Drs. Orlando Taylor and Donald De Paolo, who were participating by phone, and noted that several other members would also be joining the meeting later by phone. She also acknowledged the two new GEO Division Directors, Dr. Michael Morgan, Director, Atmospheric and Geospace Sciences, and Dr. David Conover, Director, Ocean Sciences.

In opening remarks, the Chair commented that the many geologic events that have occurred throughout the world this year, including earthquakes, hurricanes, floods, oil spills, etc., that have resulted in a rapid response from NSF scientists and NSF-funded scientists, raise questions and issues for the Advisory Committee to discuss as to how the scientific community responds to such events.

She further noted the AC has a packed schedule planned for the two-day meeting that will provide opportunity for the Committee to hear presentations and offer input to the NSF on the four crosscutting areas of activity corresponding to the four subcommittees/task forces established at the last Committee meeting: Education and Diversity; International Activities; Facilities; and Data and Informatics.

Following brief self-introductions by members and other attendees, she invited Dr. Tim Killeen, Assistant Director, GEO, to present on the state of GEO.

**The State of GEO**

Dr. Killeen’s overview included the following:

* GEO has new leadership team in place
* OMB-OSTP science and technology priorities for FY 2012
  + Promote sustainable economic growth
  + Achieve better health; reduce health care costs
  + Move toward clean energy future; reduce dependence on imports
  + Understand and mitigate global climate change
  + Manage competing demands on land, water, etc., as well as ecosystems based on sustainability and biodiversity
    - Biodiversity solicitation announcement has just been released
  + Develop technologies to protect troops, citizens and national interests
* All above priorities/challenges involve efforts in:
  + STEM education at all levels
  + Vitality and productivity of research university and national and private laboratories
  + Infrastructure for information and communications, transportation and energy
  + Collaborations with all partners (researchers, private sector universities, civil society and international) to achieve U.S. foreign policy, global health, energy, climate change and global development objectives
  + Space capabilities germane to outward exploration as well as Earth observation
  + Economic and policy environment that promotes and rewards research, entrepreneurship and innovation
* As relates to GEO Directorate:
  + ARRA (American Reinvestment and Recovery Act) GEO investments of $601 million
  + Significant infrastructure developments, which include OOI (Ocean Observing Initiative) and R/V Sikuliaq; fully funded Earthscope; and work begun on NCAR/Wyoming supercomputer center
  + AC-GEO GEO Vision released
  + FY 2010 Budget is 10.2 percent increase, and includes agency-wide climate initiative
  + FY 2011 Budget Request would represent a 7.4 percent increase for GEO
  + 2012 Budget package has been submitted to OMB

Dr. Killeen stated the FY 2011 Budget represents opportunity for advances in research, infrastructure and education including SEES (Science, Engineering and Education for Sustainability. SEES goals/portfolio include:

* Advance climate and energy science in tandem
* Augmentation at the energy-environment-society nexus requiring interdisciplinary approaches
* Emphasize data analysis, modeling and simulation and intelligent decision-making
* Look at societal factors such as vulnerability and resilience. Environmental disasters illustrate importance.
* Short and long-term research enabled by new generation of experimental and observational networks (NEON, OOI, ships, aircraft)
* Build research and education partnerships nationally and internationally

Dr. Killeen further noted that SEES will be a five-year effort (FY11-FY15) that looks at systems-based approaches, and that a “Dear Colleague” letter has been drafted, soon to be issued, that will inform the community of what the “opportunity space” for SEES will look like in FY11. He requested that the AC think about the SEES’ emphases, including research networks, postdoctoral scholarships, international partnerships and a focus on energy research and the coupling of human/natural systems.

He then detailed Research Coordination Networks (RCNs), an important element of the near-term FY11 Initiative, noting that RCNs don’t require new solicitations. Objectives are:

* Promote open communication
* Integration of research in education activities
* Nurture sense of community among young scientists
* Minimize isolation and maximize cooperation across institutions

Dr. Killeen stated RCNs will have a five-year outlook with research themes and extend across all areas of GEO. Management plans will include evaluation, which is a top priority for the administration, and there will be shared resources, meetings, events, etc.

CRI (Climate Research Investment) is FY 2010 SEES focus. It includes five areas of solicitation, all of which are multidirectorate but many led by GEO. Solicitations are being staggered to help mitigate workload stresses. 67 awards totaling $66 million, many with regional emphases, have been made. Dr. Killeen highlighted some examples of awards: water sustainability and climate (WSC); ocean acidification (OA); and dimensions of biodiversity (DB).

He then stated an area of emphasis for the Foundation going forward is Cyberinfrastructure 21st Century, CIF21. He requested Advisory Committee input on GEO opportunities/activities expanding beyond the initial thinking expressed in GEO Vision, which could include elements such as hazards; space weather; basic research in fundamental physical processes; how to preserve good budgets; the concept of Earth-Cubed, the Division’s own vision of cyberinfrastructure for the geosciences.

Other highlights of Dr. Killeen’s presentation included:

* Plan to develop three regional research vessels as replacements for academic fleet.
* 69 preproposals have been received related to Frontiers in Earth-System Dynamics.
* NSF/GEO’s response to Deepwater Horizon oil spill. Dr. Walter Robinson noted NSF did not get enough public credit for the role it played.
* U.S. Global Change Research Program (USGCRP), $2.6 billion/13 agency effort, underway. Dr. Killeen is vice chair for Strategic Planning and Research; Dr. Joann Roskoski is NSF principal; Dr. Craig Robinson heading Integration Team which will develop strategic plan.
* Task Force on Merit Review established by NSB in February 2010 to examine effectiveness of two merit review criteria (intellectual and broader impacts). Report due spring 2011. Dr. Killeen requested Committee input.
* Introduction of new GEO Directorate staff

Dr. Killeen concluded his presentation by noting the GEO Directorate is committed to both excellence and the resolution of problems. He acknowledged there are workload problems to be addressed and stressed the importance of the Advisory Committee’s input.

The Chair offered members the opportunity to comment on Dr. Killeen’s presentation:

* Dr. Robinson commented on tensions between production science, impact science and curiosity-driven science. Is GEO agile in its response to these tensions? Dr. Killeen responded NSF is not a mission agency and adequate budget is critical to preserving balance. Success rates are clearest indicator of health of GEO.

AGS Highlights

After a brief summary of his own background, noting he has only served 107 days as AGS Director, Dr. Michael Morgan noted some of the division’s accomplishments, including:

* Development of AGS Postdoctoral Research Fellowship in final stage
* Development of AGS Strategic Plan guided by input from program officers and community priorities, which will formulate a clear mission statement and address organizational effectiveness, as well as budget, infrastructure and facility priorities

Committee discussion followed Dr. Morgan’s presentation:

* Dr. Gombosi and Dr. Delaney both reiterated importance of addressing workload stress.
* Dr. Gombosi suggested AGS review NCAR to determine if it is being managed in most effective way.
* Dr. Foufoula-Georgiou stated leveraging that NSF does through NCAR is understated.

OCE Highlights

Dr. David Conover, newly appointed Division Director, Ocean Sciences, briefly reviewed his background. He then reviewed the Directorate’s activities:

* Participation in global change research programs
* Support of major facilities
* Ocean Section-supported projects include (1) research on ocean acidification’s impact on phytoplankton; (2) complexities of circulation of the conveyer belt in the North Atlantic
* Marine Geoscience Section-supported projects include (1) GeoPrisms; (2) Cascadia Amphibious Experiment; (3) JOIDES drillship launch in March 2009 following retrofit
* Integrative Programs Section supports infrastructure facilities (Sikuliaq and final design review completed for the Alvin
* Several GEO/OCE PIs have been awarded MacArthur Foundation Fellowships
* Huge investment in Deepwater Horizon oil spill ($19 million in Rapid Awards)

Dr. Beardsley thanked Dr. Conover for accepting the position as Director and reiterated big infrastructure projects (OOI and vessels under construction and ones being planned) represent exciting time for GEO community engagement.

EAR Highlights

Next, Dr. Robert Detrick, Director, Earth Sciences Division, reviewed EAR’s accomplishments in the past two years, including:

* 17 percent growth in budget enabling augmentation of core program budgets
* EarthScope facility fully funded
* Major investment in critical zone observatories fostering interdisciplinary community research
* Support for early career investigators; participation in CAREER program
* Two areas of focus of strategic planning: (1) earth dynamics; (2) coastal processes encompassing impact of climate change and human activity on coastal systems
* Collaborative investment with AGS to support COCONet (Continuously Operating Caribbean GPS Observational Network) to improve understanding of seismic hazards and hurricane forecasting
* Six important vacancies in Division have been filled

Committee discussion followed:

* More information on COCONet program and award requested
* Dr. Mora noted there are overlapping missions and goals of all federal science agencies. Dr. Killeen responded GEO is playing leading role in terms of this cross-fertilization. Working groups, MOUs, and joint workshops are helping to coordinate and eliminate duplication of effort.
* Dr. Anderson stated coastal states are making policy decisions on future of coastlines in some cases without benefit of good science and recommended that GEO increase outreach and interface with state agencies, which may strengthen political support. Dr. Conover responded the National Ocean Council (NSF is a member) is the body which coordinates ocean sciences that inform the policies that are part of National Policy Act.

The Chair thanked the team for their presentations and all the work they’re doing for the scientific community writ large. Following a short break, the Committee was reconvened to consider the next agenda item, the first two of four breakout committee reports.

**Committee of the Whole: Reports of Topical Subcommittees**

Education and Diversity

After first noting recent staff changes, Dr. Jill Karsten reported that activity in climate change education area has resulted in 15 new awards. She noted there is coordination with NASA and NOAA to identify common metrics and shared evaluation of the investments related to climate change education. Finally, she noted the strategic plan for education and diversity has been completed and appears on GEO Web site.

Mr. Strang followed Dr. Karsten. He stated the landscape in science education is shifting rapidly and then briefly highlighted recommendations contained in the NSB’s STEM Innovators Report and PCAST’s report, Prepare and Inspire. He reviewed in fuller detail the third report, NRC’s Framework for Science Education, noting this report will service as the guidance document for developing the common core science standards. Areas of significance include:

* Engineering added as equal discipline
* Entire science Framework designed as progression of learning
* Fewer but deeper ideas
* References to practices of science
* New emphasis on reading, writing, discourse, and argumentation specifically related to domain of science
* New emphasis on ocean/climate/earth science literacy

Committee discussion followed presentation:

* Dr. Erwin asked how controversial issues such as climate change and evolution were handled. Mr. Strang responded from a scientific point of view document is balanced. Framework does make unequivocal statement that climate change is happening and resulting, at least in part, as result of human release of carbon in atmosphere; evolution also not in question by Framework.
* Dr. Mora mentioned another complementary report, Gathering Storm Revisited: Rapidly Approaching Category 5, emphasizes how STEM education is not being adequately translated into innovation in the marketplace.
* In response to Dr. Watson’s inquiry about impact of climate change and evolution on adoption of science standards, Dr. Karsten responded debate and political battles are yet to come.
* In response to Mr. Strang’s question as to whether the AC would like to engage in the process of finalization of the framework and development of standards, the Chair responded she believes the Committee has a great deal of interest. Better question would be is there any objection to AC getting involved?
* The Committee expressed its support of involvement, and the Chair suggested a letter be drafted by the subcommittee and staff, which will be circulated by e-mail after the meeting.
* Chair requested a link to Gathering Storm report be posted and stressed the need of AC to move quickly with its input.
* Dr. Foufoula-Georgiou thanked both Drs. Patino and Karsten for their vision and support leading to creation of a water resources science program in a tribal college.

International Activities

The International Activities Subcommittee presentation followed. Dr. Jamie Allan first acknowledged Dr. Louis Brown, who is retiring, and thanked him especially for his valuable mentorship, and then introduced Dr. Maria Uhle, who will succeed Dr. Brown.

Dr. Jennie Thomas, a AAAS fellow in GEO, provided the update. Dr. Thomas stated that following formation of the International Subcommittee, an internal International Team was formed to look at all international activities within GEO. She introduced the members of that team and requested Advisory Committee feedback following her presentation.

Dr. Thomas reviewed the charges to the team:

* Coordinate with AC-GEO International Subcommittee to provide strategy for best ways to invest in international activities
* Gather information
* Define best practices
* Coordinate international activities
* Communicate activities taken
* Serve advisory role as the go-to group for international activities discussed within GEO

She reminded the AC of its advice in GEO Vision: use international cooperative arrangements to enable research and to develop scientific capabilities. International engagement (PI to PI, formal international bilateral agreements, international science programs) is essential for both understanding global problems that cross national boundaries and fostering development of the next generation of interdisciplinary, globally engaged scientists.

Since the spring AC-GEO meeting, discussion has centered on determining the ideal mix of activities ranging from bottom-up (community driven) to top down (NSF and internationally led), or a hybrid mix; the appropriate level of management, coordination and support of activities; and prioritization mechanisms.

Dr. Thomas summarized three case studies of international activities in GEO (International Ocean Drilling Program; International Continental Scientific Drilling Program; and Super Dual Auroral Radar Network) that have been completed and will serve to aid in learning and assisting in the strategic planning process. Each case study included: participants; summaries and objectives; NSF investment; historical perspective and international context; metrics for evaluation; current status, challenges and lessons learned.

She noted some common themes that have emerged as a result of these studies include:

* Persistence and long-term vision are essential
* Preference for less restrictive/less prescriptive international agreements
* Decentralized and flexible structures for management of programs
* Scalability of program is important
* Activities initiated by community and facilitated by NSF have proven successful
* Data sharing and standards are important

Dr. Thomas expressed hope that the way forward would include continued dialogue and knowledge sharing within NSF and that the knowledge gained from the case studies and input from the Advisory Committee might serve as a platform for the development of a strategic framework.

Committee discussion followed:

* Dr. Robinson questioned the role of GEO as it relates to OISE (Office of International Science and Engineering). Dr. Thomas responded that the case study exercise has been an internal effort to understand how GEO works so that it can better engage and leverage activities with OISE. Dr. Leonard Johnson noted often OISE is not involved with GEO international activities, but it is helpful in resolving problems/issues that sometimes arise with individual PIs in foreign countries.
* Dr. Delaney cautioned that increased workload and resultant stress often occur with increased focus on interdisciplinary programs/partnerships.
* Dr. Delaney requested elucidation of use of terminology “assessment” and “evaluation.”

The Chair thanked the presenters and informed the Committee members that the case studies with executive summaries are available on the AC-GEO Web site.

**Briefing on Belmont Forum by Dr. Killeen**

Before beginning his briefing, Dr. Killeen thanked Dr. Thomas for her help in systematizing the way GEO thinks about its international activities.

He then summarized the history of the Belmont Forum and its current status. Key points included:

* Name “Belmont” refers to conference center in Maryland where meeting was held.
* Predecessor group, founded in early 1990s, was IGFA (International Group of Funding Agencies for Global Change Research), a group of 25 countries, whose purpose was raising the level of funding for global change research
* Belmont Forum was effort to reenergize international momentum
* Meeting in January 2010 produced a document, The Belmont Challenge, which articulated the challenge: deliver knowledge to support human action and adaptation to regional environmental change. It also resulted in the agreement that the Forum would become Council of Principals of IGFA
* Both ICSU (International Council for Science) and ISSU (International Social Sciences Council) are members.
* Forum seeks to engage funders directly in framing analyses and visions, coordinating outlooks, and providing vehicle for alignment of international scientific organizations for funding purposes
* Forum funded ICSU to conduct study and produce report on the state of international readiness to address the Belmont Challenge. Report with a set of recommendations was released in August 2010
* Next meeting of IGFA and Belmont Forum, acting as Council of Principals, to be held October 2010 in Cape Town, South Africa. Focus likely to be on food security and other food/water issues , capacity building in Africa, regional climate change, regional modeling and prediction
* The meeting planned for 2012 will consider “Planet Under Pressure.” Goal will be to articulate 10-year vision for addressing Belmont Challenge with funding commitments across IGFA

The Chair thanked Dr. Killeen for his presentation and asked how this all feeds back into what NSF and GEO, in particular, are doing. Dr. Killeen responded that potentially we would gain leverage, not by subsidizing but rather by aligning research funding opportunities. He also stated country development agencies, such as USAID, may be attracted to the endeavor, and that will also help build capacity and increase leverage.

Brief AC discussion ensued as follows:

* Dr. Robinson asked about international coordination on earth system modeling. Dr. Killeen responded a workshop was recently held at George Mason University where that topic was discussed.
* Dr. Foufoula-Georgiou asked what actual “change,” not “improvement,” will be evident in the next year or so? Dr. Killeen responded there is a lot of energy around global change, which does present international opportunity to “harness the international brain trust.” There is need for robust quantitative science to be ready to address need for Earth-cubed knowledge base, and it will be important for U.S. to have leadership role.

At 12:10 p.m., the Committee took a short recess to get lunch and return for the working lunch presentation.

**Working Lunch: MREFC Presentation by Dr. Jean McGovern, OOI Program Director**

The Committee reconvened at 12:24 p.m., for Dr. McGovern’s presentation.

Dr. McGovern detailed the Ocean Observatories Initiative, a large infrastructure project in the Ocean Sciences Division, noting:

* May 2009, NSB recommended that the Foundation move forward with OOI project. September 2009, it was funded with Recovery Act and/or MREFC account monies
* OOI is multiscale observatory—global, regional and coastal
* $386 million effort/66 month construction period
* Design criteria plan is for observatory with 25-year lifespan
* OOI will form a framework for providing sustained high-resolution measurements
* OOI is system of systems that will gather data from air, sea, water column and seafloor processes
* $28 million funding for GEO cyberinfrastructure investment to establish messaging system to move data and the integration of modeling aspects
* Education infrastructure incorporated to provide interface for education users
* 800 sensors across water column. All data provided directly to Internet real-time. PI data will also be made publicly available
* Project team is Consortium for Ocean Leadership. NSF is awardee. Other partners include Woods Hole, University of Washington and UC San Diego
* Detailed design review. Design, build, deploy
* Project status—ahead on cost; behind on schedule
* OOI has profile of project risks; MREFC allows for adjusting of cost estimates. Risk adjustment is called contingency managing
* Ocean Observing Science Committee (OOSC) will be established that can engage the external community
* Workshop on science utilization of the Pioneer Array being planned

Questions/comments from Committee followed:

* Dr. Kellogg asked how remote locations receive needed power? Dr. McGovern responded the power system is under close scrutiny and will employ solar, battery, wind and fuel cell power. She noted data communications, not sensors, are largest user of power.
* Dr. Robinson noted criticality of engagement of modeling community. Dr. McGovern agreed this is challenge during construction phase and stated a strategy is needed to deal with that.
* Dr. Beardsley inquired about funding for modeling activities. Dr. McGovern stated funding for O&M for OOI would be only for the network. New instrumentation and utilization of data would be done competitively via core programs
* Dr. Conover emphasized complexity of this project, stating many parts have to be integrated, but it is likely to be much more transformative than past projects and will literally transform the way oceanography is done.

Dr. Kellogg thanked Dr. McGovern for the presentation, and the Committee took a short break and reconvened at 1:14 p.m., in Afternoon Session.

**Afternoon Session**

**Reports of Topical Subcommittees (continued)**

**Facilities**

Dr. Russ Kelz, a Program Director in Division of Earth Sciences, first introduced the Facilities Team and then highlighted the work/thinking of the team to date, including:

* Review of initial charge: develop a Facilities Plan that realizes GEO Vision challenges
* Team has met and started work on draft plan; some sections are written and some still under development
* In developing Facilities Plan, important to:
  + Take advantage of advances in sensor technology; envision need for next generation of sensors
  + Involve networks of interactive, autonomous and smart sensors
  + Involve cyberinfrastructure community models to help assimilate/understand observations from disparate databases.
* Facilities will play critical role in addressing “planet under stress.” Observational capabilities critical to understanding state of health of planet Earth
* Series of principles or implementation framework for future facilities considered
* Fiscal realities demand economies of scale and utilization of energy efficient technologies
* Address issue of funding gap between MRIs and MREFC s.
* Need to solicit ideas from research community, through workshops and across directorates
* Future thinking includes:
  + More comprehensive baseline study of facilities supported by GEO
  + Development of future plan. Need Advisory Committee input, comments, advice
  + Establishment of regular team meetings
  + Convene annual best practices workshop
* AC input requested on the following:
  + Moving description of existing facilities to an appendix?
  + New and emerging facilities presented in context of their transformational impact?
  + Should future needs be described in context of GEO Vision crossroad challenges?
  + Are principles and tenets of implementation plan sound?

Committee discussion followed:

* Dr. Beardsley comments GEO only directorate with a vision document. This in conjunction with the follow-up future plan will be helpful for new Director
* Dr. Grubisic suggests when conducting survey of existing facilities to reach out to other directorates and programs with existing facilities, i.e., networks such as NEON. Can these be used for Geoscience research? Dr. Kelz responds one goal is to engage those outside the Directorate to learn more about other facilities being supported in NSF.
* Dr. Grubisic also advises it’s important to have good idea of life cycle planning for instruments. Dr. Kelz agrees asking how do you transition from a research facility to operations and maintenance? Should other mission agencies be involved?
* Dr. Robinson suggests a possible white paper, an explicit discussion of the business model, detailing the dollars and cents, could be written and disseminated to community so that they understand the implications of costs to maintain facilities. O&M costs come from same pot that goes toward investigator grants.
* Dr. Erwin stressed importance of identifying risks as well as opportunities.
* Dr. De Paolo commented on need to address issues of partnering with other agencies, to take advantage of facilities largely taken care of by other agencies, i.e., NASA, NOAA and DOE, with NSF being prepared to pick up the slack when others abandon their responsibilities. He also noted the importance of defining the facility space that is NSF’s sole and unique responsibility. Dr. Kelz agreed and stated a better job must be done to ensure transparency and improve communication and coordination with other funding agencies.
* Dr. Mora asked is there ongoing thinking about how funding decisions will be managed when ARRA funding ends, the problem of funding people versus funding facilities/instrumentation? Dr. Kelz agreed it’s a very difficult issue and stated that cost-sharing was specifically disallowed as an eligibility criterion by NSB in October 2005. Also, a Proposal Award and Policies Guide, due to be released in January 2011, will disallow voluntary cost sharing as well. Dr. Kelz stated this will impact the success rate of the Facilities Program. Dr. Killeen detailed the European approach for dealing with these issues and recommended now is good time to leverage their knowledge.
* Dr. Shepson also noted negative impacts of disallowing voluntary cost-sharing and the difficulty in understanding the justification for such a requirement. Dr. Killeen stated the report, which is on NSB Web site, gives arguments for the requirement, and he suggests linking that Web site to the Committee’s.
* Dr. Foufoula-Georgiou noted criticality of need for next generation of sensors that activate themselves to produce measures for monitoring the environment. She suggests a possible collaboration between GEO and Engineering directorates for development of these new sensors. Dr. Kelz responded there is an open solicitation for proposals for development of new technologies that will support fundamental research under EAR.

Dr. Kellogg thanked Dr. Kelz for the presentation.

**Data and Informatics**

Dr. Bruce Watson, AC member, chair of Data and Informatics Subcommittee, noted the tasks of the subcommittee were to review and approve charge to the GEO internal team and make recommendations moving forward, which included:

* Engage the community in evaluating the scope and needs across GEO
* Triage issues to assist in developing priorities list
* Link with Facilities internal team
* Think in terms of sustainability

Dr. Eva Zanzerkia, Division of Earth Sciences, highlighted the internal working group’s activities, as follows:

* Reviewed charge which includes developing GEO informatic strategies and facilitating outreach within NSF and to the broader geoscience community
* Reviewed two recent major activities that have impacted GEO
  + New bid for transparency in NSF’s data policy. All proposals must include data management plan (NSB May 2010 meeting) that will be considered as part of peer review process.
  + Research vision for geosciences community in the GEO Vision document
* Discussed elements of a cyberinfrastructure framework and steps toward implementation to support the scientific vision
  + Facilitate access to applications and develop set of standards for use
  + Identify elements to be accommodated by framework
  + Create integrated approach to train and produce savvy workforce
  + Ensure any CI that GEO supports or produces is supportive of geoscience goals
  + Understand assets available to increase understanding of what GEO presently supports/funds
  + Engage community. Workshop planned for February 2011 to identify gaps in data management
* Questions for the Advisory Committee
  + Guidance on how best to reach the geosciences community both in short and long term regarding new data sharing policy requirements
  + Has the suggested framework captured the elements needed to address GEO Vision document?
  + What is NSF’s role in the development of community requirements?
  + What avenues should be explored to create greater connections with other agencies?

Committee discussion followed:

* Dr. Watson states injection of research data into education enterprise is missing.
* Dr. Foufoula-Georgiou suggests connecting with other agencies, i.e., NASA’s Data Visualization and Information Services. Dr. Zanzerka responds that the largest partners, NASA, NOAA and USGS, will be participating in planned workshop but efforts must continue to connect to partners
* Dr. Killeen asks whether a formal reproducible citation requirement for GEO should be considered? Dr. Zanzerka responds that in many communities that is one of the most important questions. Should the community develop? How to move forward?
* Dr. Kellogg asks what are current thoughts for communicating NSF data policy? Dr. Zanzerka responds “Dear Colleague” letters are being drafted.
* Dr. Robinson suggests challenge will be in getting meaningful reviews of data management plans.
* Dr. Beardsley recommends NSF encourage data that has been studied/edited, and not just “raw” data, be made available in the system.
* Dr. Killeen suggests now is optimal time for Advisory Committee to weigh in on data access policies. The Chair asks for clarification. Dr. Killeen responds AC could make recommendations to GEO on what might be considered in terms of data policies going forward. Dr. Zanzerka notes the methods of dealing with data policies are different within Foundation and within GEO. Is there a need for a GEO policy? What kinds of things should geoscience community have uniformly in their data management policies?
* Dr. Erwin notes issues with storage of physical collections. Dr. Zanzerka responds museums and other archival locations are another set of partnerships to explore.
* Dr. Robinson states storing model output is a huge issue. Dr. Zanzerka believes that issue will be discussed in February workshop.

The Chair thanked Dr. Zanzerka and Dr. Watson for their work and presentation on the data/informatics topic.

**NSF Response to Deepwater Horizon Oil Spill by Dr. David Conover, Director, Division of Ocean Sciences**

Dr. Conover detailed the NSF Rapid Response Research efforts, noting the following:

* Rapid Response Research Program created in 2009 anticipated this kind of event
* Four ways NSF has responded
  + Rapid awards issued to PIs
  + Reconfiguring/reshifting existing grants to PIs to focus on event
  + Rescheduling ship activity to bring resources to Gulf
  + Serve as link between federal agencies responsible for response actions and the NRDA (Natural Resource Damage Assessment) process
* $19 .4 million/166 awards issued NSF-wide. GEO Directorate issued 77 awards
* Many requests from scientists in Gulf States, but more than 50 percent of awards went to PIs in states outside of Gulf
* Overview of chronology of events over last five months
* First major publication released August 23. Proposal, award, and publication in 3 months. Pace of science performance unprecedented
* Going forward panel of Gulf Coast governors will oversee remaining funds committed by BP. Because funding must go primarily to five Gulf states, those PIs from outside Gulf region requesting renewal of Rapid Response proposals must compete subject to full external merit review process.
* Workshop for PIs held October 5-6, 2010 posed three questions:
  + What have we learned so far?
  + What are gaps that remain?
  + What are the information needs and long-term priorities to assess the ecosystem impacts of spill?
* Secretary of the Navy has proposed Ecosystem Restoration Task Force. Not yet determined the role NSF may play.

The Chair thanked Dr. Conover for his presentation and opened the floor to questions/comments:

* Dr. Shepson asks why NSF does not communicate its successes better to the public? Are there lessons to be learned re outreach, or lack thereof, to the media regarding NSF’s very successful Rapid Response activities? Dr. Conover agrees it’s important to get the publicity for the things NSF does right and responds there were a lot of press releases on the Rapid awards and the subsequent resultant publications, but what the media chooses to focus on is not under the control of NSF. Media in this case appeared more interested in disagreement between academic scientists and government reports.

Dr. Killeen further responded that NSF purposely refrained from getting into controversial issues of interpretation. Dr. Karsten added NSF may get more visibility over time.

* Dr. Foufoula-Georgiou asked for clarification on “fine print” associated with BP’s research grant. Dr. Conover stated it is being managed by Gulf Alliance without strings attached.
* Dr. Beardsley inquired whether PIs who received Rapid awards are being encouraged to submit renewals, and what is the mechanism for that? Dr. Conover responds that a renewal request will have to be a full proposal, go through the existing program and compete with other proposals.

Dr. Killeen asks for input from the Advisory Committee re what kind of infrastructure is needed in the Gulf for longer-term, observationally-oriented monitoring. Dr. Conover believes there will be some federal funding for long-term research.

* Dr. Kellogg noted NSF has data policy that requires PIs to make their data and results available to public and BP may not have such a transparency requirement.
* Dr. Kellogg asked what lessons have been learned about the Rapid Response mechanism as a result of the large number of Rapid Responses to all the geological events that have occurred in past year?

Dr. Killeen responded two lessons learned that contributed to NSF’s success were the importance of funding flexibility and the expertise base of program officers that facilitated effective interaction with the community. Dr. Conover stated it’s still early to assess all lessons learned. It will be valuable to look back with hindsight in a year or so to examine what was funded and determine if the quality of science was of the same scale as peer-reviewed work and to review the lessons learned about coordinating this whole activity within NSF.

The Chair commended the team for its very impressive response to all geologic events over the past year.

**Preparation for Meeting with Dr. Cora Marrett, Acting Director**

Following a short break, the Chair reconvened the Committee. Members discussed possible questions to present to Dr. Marrett during her visit planned for later this afternoon. Topics raised were:

* Workload/workforce issues. What is the vision for addressing across the Foundation?
* Role of facilities in GEO. How to incorporate the community view in challenging long-term prioritization questions?
* Advice for the new Director
* NSF’s role going forward in coastal processes science post-Rapid response grants
* Gap that exists in mid-size infrastructure
* Status of NSB Task Force on Merit Review
* Where should responsibility for leadership in science education lie? The roles of Department of Education and NSF

**Meeting with Acting NSF Director, Dr. Cora Marrett**

Dr. Kellogg welcomed Dr. Marrett, the acting NSF Director, to the Committee. Following brief self-introductions by the members, Dr. Marrett made a few opening remarks. Highlights included:

* Arrival of new Director, Dr. Subra Suresh, who has been confirmed by the Senate, expected mid-October
* Re budget, the NSF is under Continuing Resolution, which maintains funding at FY 2010 levels. Possible 8 percent increase when FY 2011 budget is passed, which may be as early as December
* Key initiative for 2012 is SEES (Science, Engineering and Education for Sustainability)
* Importance of GEO Vision document as Foundation sets priorities in recognition of the context in which it’s operating
* Data and informatics work; translating data into information is the goal
* NSF’s role as model for U.S. government agencies

In conclusion, she thanked the members, especially those rotating off the Advisory Committee, for their contributions.

Dr. Kellogg thanked Dr. Marrett for her remarks. Before opening the floor for specific member questions and comments, Dr. Kellogg summarized the work of the Advisory Committee at today’s meeting, speaking generally of the Committee’s support and enthusiasm for GEO’s many accomplishments over the past year, noting that GEO is very much at the core of societally-relevant science and research and is poised to take a leadership role in the areas of education and diversity, facilities, international activities, and data and informatics. She recognized the entire GEO team for the excellent job they have done, particularly with the Rapid Response Program, in dealing with the many recent geologic events, both natural and manmade.

Committee questions, comments, and Dr. Marrett’s responses follow:

* Dr. Robinson asked what is Foundation’s long-term strategic plan for dealing with workload issues? Dr. Marrett stated there are both internal and external considerations. Securing resources for additional staff is often met with pushback. She requested engagement of external communities to formulate appropriate arguments. Within NSF, the workload model for determining optimum staff levels must take into consideration all demands on staff.
* Dr. Mora commended the efforts and work of Dr. Killeen and encouraged support of his leadership as he has been a visible and positive face in the scientific community globally. Dr. Marrett agreed and congratulated Dr. Killeen for his leadership, acknowledging his very visible role externally, but also within the NSF, working to help create a more dynamic organization.
* In response to Dr. Delaney’s comment on the challenge of achieving balance between creation of facilities/infrastructure, with their operations and maintenance demands, and support for research, Dr. Marrett acknowledged the Foundation does not have an effective strategy and requested the Advisory Committee’s advice, input, and new ideas on the best way to move the knowledge forward and build capacity. What should the priorities be? Infrastructure is essential but must be in support of research, education, science and engineering.

The Chair responded the Committee is engaged in a continuing dialogue to address these issues.

* Dr. Foufoula-Georgiou asked should NSF take a leadership role in addressing the problems of sustainability of deltas and coastal systems? Dr. Marrett noted there is an ongoing discussion on how NSF can best contribute to achieve effective partnerships for advancing fundamental/basic knowledge. It may be in leadership roles, but often in collaborations with its partners, i.e., NOAA, and across disciplines in NSF itself.
* Mr. Strang asked Dr. Marrett for her perspective on the relationship between Department of Education and the science agencies, specifically NSF, as to responsibility for leadership in science education? Additionally, within NSF, should science education be solely within EHR or spread throughout the research directorates?

Dr. Marrett responded that internally all parts of NSF must be involved. Externally, in addition to the Department of Education and NSF, a third actor is the National Institutes of Health. A working team from all three agencies has been established to advise how best to divide responsibilities. She invited input from the Committee as well.

The Chair emphasized the interest of the AC on this topic, noting that the Committee’s next step is to provide input to the NRC study on science education standards. Dr. Marrett acknowledged the importance of such input to aid in understanding and developing the standards which will reflect the fundamental things that everybody needs to know.

* Dr. Kellogg requested the Acting Director’s thoughts on the NSB’s ongoing merit review process. Dr. Marrett responded there is presently no firm agenda and the Board is still seeking input and ideas on the two criteria: intellectual merit and broadening participation. Dr. Killeen added it is currently an outbound investigation with focus groups, survey instruments, and culling information from COV and PI reports.
* In response to Dr. Shepson’s question regarding what advice Dr. Marrett would offer the new Director, she responded by stating she would emphasize the importance of interacting with advisory committees as well as the broader external community. She also noted it would be important to first get a handle internally on what the agency can and cannot do, to obtain input from parties, such as the Advisory Committee, who understand the culture and the history of NSF.
* Hope was expressed that the new Director would be encouraged to continue Dr. Marrett’s practice of having direct contact with program directors. Dr. Marrett noted the new Director has expressed interest in meeting with all program directors.

After the discussion, Dr. Kellogg thanked Dr. Marrett for her appearance before the Committee and for answering the members’ questions and listening to their advice.

**Wrap Up**

Members made some general comments including:

* Interest in hearing more about the GEO management survey
* Observation of inherent tension that exists as NSF is both a science agency and a government agency. It’s part of the culture. Can lessons be learned from academia as universities have grappled with similar tensions?
* Recognition that as interdisciplinarity and partnerships have become more important and more common, collaboration, particularly international collaboration with attendant cultural differences, may increase stress levels on the workforce.
* Getting “small things” done may create negative stress, i.e., dealing with travel arrangements and logistics for small meeting. Need for solid administrative staff support.
* Administrative staff frustrations/stresses need to be considered as well
* Acknowledgment of inherent stressors in all big organizations
* Request to hear outcome of GEO retreat discussions on workforce issues
* Importance of sustaining support for the four internal teams (Education and Diversity, Facilities, International Activities, and Data and Informatics).
* Recognition by Advisory Committee of staff’s work in above areas would be valued and appreciated

There being no further discussion, the Advisory Committee meeting was recessed at 5:26 p.m., to reconvene at 8:30 a.m., Thursday, October 7, 2010.

**Thursday, October 7, 2010**

Day two of the Advisory Committee activities began with individual Division Subcommittee meetings. Upon conclusion of the subcommittee meetings, at 10:59 a.m., the Advisory Committee reconvened as a Committee of the Whole, to consider the remaining agenda items.

**Division Subcommittee Meeting Reports**

**Atmospheric and Geospace Sciences**

Dr. Gombosi noted the AGS Subcommittee had a full agenda. Topics included:

* Dr. Morgan discussed proposed strategic planning exercise which will address both workload and other challenges, as well as science opportunities and priorities
* Only one AGS presenter at UCAR Board of Trustees meeting because AC and NCAR meetings held at the same time.
* Information briefing on Wyoming Supercomputer Facility. No issues; physical construction underway; completion expected December 2011 with start-up operations planned for summer 2012
* Budget briefing. AGS expects increase, significant portion of which is committed to NCAR. Core programs almost flat.
* CRI (Climate Research Initiative) is $60 million initiative, funding split among GEO, other directorates, USDA and Department of Energy. Solicited proposals are of two types: (1) capacity/community building; and (2) ambitious multidisciplinary ideas. Awards will be announced next month
* Briefing on UCAR/NCAR review, which comprises both science and management. NCAR is largest AGS center and thus has large impact. Accomplishments and future plans will be assessed. Should management contract be renewed or recompeted? In early 2012, review will be completed and recommendation made.
* Discussion of balance issues and agreement that this needs to be addressed by strategic planning
* Discussion of facility life cycles. Community needs to see numbers to understand tradeoffs. AGS leadership should discuss how best to involve the community.
* Discussion of GEO survey. Ideas to consider in the upcoming GEO management retreat could be: role of program directors, which has become more constrained over the years; recognition that engaged/empowered directors are essential to healthy science community; GEO leadership and increased budget that have resulted in more visionary opportunities have not always translated into day-to-day activities.

**Earth Sciences**

Dr. Mora, Chair of the subcommittee, reported on the Earth Sciences Subcommittee discussion, noting that, in general, the news is positive; EAR is in good shape. Key points of the discussion included:

* EAR has been extremely busy. Five new hires and one more anticipated. Appropriate training critical for the newly hired
* Significant growth in core budgets
* In addition to core programs, EAR making large and strategic investments in programs aligned with GEO priorities, such as Critical Zone Observatories
* Received briefings on Rapid Response proposals and awards addressing EAR/geologic events this year
* Heard report on new WSC (Water Sustainability and Climate) program
* Recommends EAR consider follow-up and data gathering on young investigators involved in cross-disciplinary and integrated proposals
* EAR sponsoring update of BROES (Basic Research Opportunities in Earth Science). Report expected in 2011 and should be significant contribution to guide community
* Briefed on CZOs. Stimulus funds used to add new observatories to network
* NSF more effective overall in aligning its efforts with parallel efforts in Europe.
* Received reports on two MREFCs, San Andreas Fault Observatory and DUSEL (Deep Underground Science and Engineering Lab). AC-GEO review of both investments was requested and provided. Sense of inclusiveness in decision-making derives from that. Important given magnitude of investments.
* Acknowledgment of very effective and dedicated performance by the EAR team, project managers and program directors, resulting in delivery of exciting new opportunities for the community
* Dr. Watson, as a member rotating off the AC, noted this has been a time of amazing visionary new initiatives for EAR, and leadership at all levels has been outstanding.

**Ocean Sciences**

Dr. Beardsley, Chair of Ocean Sciences Subcommittee, began his presentation noting that the committee schedule had been full and the discussion was lively and informative. Highlights of the discussion include:

* Dr. David Conover, the new Division Director, stated four stress points:
  + Infrastructure and research balance. Infrastructure budget creeping up.
  + New initiatives (i.e., four in CRI) versus core programs.
  + Review processes and different budget cycles for new initiatives
  + Portfolio management of initiatives
* Dr. Kileen noted there is an NSF integration team with responsibility for management of entire SEES portfolio
* Important that program managers continue to have voice as the portfolio goes forward
* Rapid Responses to events were very well done. Long-term outcome will be the resultant peer-reviewed science
* OCE undergoing strategic planning effort
* Broader participation of OCE in new activities, particularly National Ocean Council and Ocean Research Priorities Plan, is another indicator of exciting times for this science
* Broadening participation in all levels
  + Continue to support plan for targeted postdocs and early career facilitation awards for women and underrepresented
* Mr. Strang stated importance of continued support for COSEE (Centers for Ocean Science Excellence), which has helped to build a foundation to influence direction of common core science standards, as well as broaden access to K-12 students
  + Dr. Killeen requested that the Subcommittee provide a memo outlining COSEE attributes and outcomes, including elements of evaluation that document outcomes
  + Dr. Killeen noted the issue exists of coordinating education outreach activities and the role of education in directorates other than EHR. Question of how to demonstrate the value added re vitality of education, diversity, and public outreach activities within the science directorates
  + Dr. Karsten added another dimension to EHR versus research directorates supporting education outreach activities is the role of Department of Education. She also requested Committee input to help the Directorate articulate its unique and essential role in education programs. She emphasized the increasing pressure for more accountability and the importance of helping PI communities understand the right evaluation strategies, and the need for help in developing some of these resources.
  + Dr. Robinson suggests putting together a portfolio of great things that are being done by all the “amateur” science educators who are scientists.
* Dr. Delaney noted the decline in funded requests for ship time and overall concern of fleet management and renewal and requested this issue be an agenda item for the next meeting.
  + Both Dr. Killeen and Dr. Conover agreed that very critical decisions will need to be made related to this issue and requested AC input.

Upon conclusion of the discussion, Dr. Beardsley stated his appreciation for the opportunity to serve on the Advisory Committee as the Committee has matured and become more active and participatory. He reiterated that this is an exciting time for this science, and a great team is in place to manage and move forward and “keep going.”

The Chair thanked Dr. Beardsley for his presentation.

**Meeting Wrap-Up – Part I**

Since some members have to leave before the scheduled time for adjournment, Dr. Kellogg proceeded to some wrap-up activities before the COV report presentations. Dr. Killeen presented certificates of appreciation to those members rotating off the Advisory Committee, including Dr. Beardsley, Dr. Mora, Dr. Gombosi, Dr. Watson, Dr. Foufoula-Georgiou, Dr. Shepson, and Mr. Strang. Both Dr. Killeen and the Chair thanked the members for their service and the many contributions they have made to the Committee, in particular their work on the GEO Vision document. Dr. Kellogg then read a statement by Dr. Grubisic, another member who will be rotating off, which expressed her thoughts and appreciation for the opportunity to serve on the Committee. The Chair stated the challenge will be to find new members who will make the same good contributions.

The Committee took a short break before a working lunch session.

**Working Lunch: COV Reports**

Dr. Kellogg reconvened the meeting at 12:22 p.m., for the presentation of the three Committee of Visitor (COV) reports:

**EAR: Instrumentation and Facilities presented by Dr. Foufoula-Georgiou**

Highlights included:

* Committee met July 26-28 at the NSF
* Portfolio includes support for meritorious requests for infrastructure that promotes research and education and funds projects in four categories
  + Equipment acquisition
  + Instrument development
  + Mutiuser facilities. This area represents largest portion of budget.
  + Early career
* Charge to COV to review process, outcomes and impact on community
* 2007-2010 activities summarized
  + 551 proposals submitted; 214 funded; 3,000 external reviewers participated
  + Committee selected random sample of 85 proposals. Average award size is $185,000 for 2 years
  + No age or gender bias findings. No large MRI facilities headed by females, which helps explain lower award size to females.
  + Healthy level of interagency and intra-agency collaboration, although absence of co-funding found with AGS
  + High incidence of international partnerships in proposals
* Recommendations included:
  + Broader impacts criteria should not be given separate ranking score as it appears well integrated. Program officers have discretion
  + Disallowance of cost-sharing has created problems. Program officers should propose to reinstate. Dr. Killeen responded this may not be actionable; NSB has recent cost-sharing policy
  + Gap existing in funding mid-size infrastructure should be addressed
  + Communicate to PIs who are not funded why their proposals are not competitive
  + Rotator position in IF program should be made permanent
  + Organize workshop/forum to facilitate discussion of best management practices for facilities

Upon completion of the report, the Chair requested and received a motion and second to accept the COV. Report was unanimously accepted.

**AGS: Atmosphere Section presented by Dr. Gombosi**

Dr. Gombosi stated that AGS programs in geospace and atmospheric science are well balanced and in good shape and development of the strategic plan will take place next year. Dr. Morgan responded that some of the concerns raised in the COV would be addressed in that strategic planning. Dr. Gombosi then recommended acceptance of this COV report. The Chair requested and received a motion and second to accept. The Committee voted unanimously to accept the report.

**Education and Diversity: Geosciences Education presented by Dr. Snow**

Highlights included:

* Committee met May 24-26 and produced lengthy report reflective of many activities that are ongoing
* Essential to align GEO Education and Diversity strategy with GEO Vision document
* Reviewed GEO’s management of the GLOBE program and agreed the right approach is a focus on students and local scientists where best learning occurs. “Think globally; act locally.”
* Minority serving institutions and community colleges deserve more attention
* Assess human resources/staffing needs to deal with expected STEM education growth
* Continue to look at education expenditures in all areas including COSEE program
* Committee satisfied that the preliminary response from Directorate indicates things moving in right direction.

Following Dr. Snow’s report, the Chair requested and received both a motion and second to accept the report. It was unanimously accepted.

**Meeting Wrap-Up - Part II**

The Committee engaged in general discussion regarding the appointment of new members to fill the vacancies that will occur as a number of members rotate off this year. Dr. Killeen reviewed the process and noted it’s important to obtain representation on the Advisory Committee that reflects strong expertise in all core and cross-cutting programs and that can provide provocative input to the Directorate and the Foundation.

In addition to offering specific names to be considered, members suggested that balance is critical and recommended that age, gender, and minority status, as well as an understanding of individual PIs versus big program participation are all important.

Dr. Robinson asked how best to help the community develop the capacity to write strong proposals for SEES and CRI. Dr. Killeen agreed there is need to build communities to do this new type of work, and stated although it’s early in this five-year activity, lessons are beginning to emerge, including emphasis on postdocs and early career faculty, and seeding positions in universities.

Dr. Erwin requested that information be given at the next meeting on activities related to the historical components of earth science as opposed to just the process-oriented components.

**Action Items**

* Advisory Committee will respond to questions posed by the staff working groups. Chair will draft a proposed letter from the Committee to help inform the NRC report
* DUSEL and SAFO subcommittees will give status report at next AC meeting
* Dates of AC-GEO 2011 meetings are April 13-14 and October 12-13. Effort will be made to communicate these dates to UCAR to avoid potential meeting conflicts

Dr. Kellogg concluded the meeting by thanking Division Directors and their staffs for their hard work in support of the Committee and also thanked Dr. Killeen, Dr. Cavanaugh and Ms. Lane for their support in helping to make the meeting run so smoothly. Finally, Dr. Killeen thanked the Chair for her leadership and the Committee for its input to the Foundation.

There being no further business, the AC-GEO meeting was adjourned at 1:30 p.m.