Directorate for Geosciences (GEO)
Office of the Assistant Director (OAD)

Response to the 2010 Committee of Visitors Report: Geosciences Education and Diversity (GEO E&D) Programs

Date of the COV: May 24 – 26, 2010

The Directorate for Geosciences (GEO) appreciates the 2010 Committee of Visitors (COV) for their time and efforts to review the Fiscal Year 2007 to 2009 activities of the following programs in the Geosciences Education and Diversity (GEO E&D) portfolio: Geoscience Education (GeoEd), Opportunities for Enhancing Diversity in the Geosciences (OEDG), Global Learning and Observations to Benefit the Environment (GLOBE), Geoscience Teacher Training (GEO-Teach), and the Division of Earth Sciences Education and Human Resources (EAR E&HR) program. GEO commends the COV for the excellent guidance provided in the report resulting from the May 24-26, 2010 meeting, and takes advantage of this opportunity to acknowledge the large amount of work involved in evaluating the complex portfolio of separate programs which comprise the GEO E&D efforts. GEO also acknowledges the many valuable comments offered by the COV members in Section 3.4 of the COV report that will improve execution of the COV review process the next time. In particular, the suggestion to hold a pre-COV webinar to explain some of the mechanics of the review and decision process, and where to locate specific types of information in E-jacket, is a very useful recommendation.

GEO is delighted to receive the committee's highly complimentary assessment of the integrity and efficiency of the merit review process and appreciates their comments that management of the GEO E&D programs is exemplary. We are especially pleased with the committee's overall finding that the GEO E&D portfolio is innovative and making important contributions to improve geoscience education and develop a diverse and skilled geoscience workforce. It is gratifying to learn that the committee had a very favorable response to the changes that have been made in program management since the last COV met and viewed the new strategic framework as important progress toward making the program more cohesive. The committee's suggestions regarding future directions of the GLOBE and GEO-Teach programs, and how those programs might evolve to serve key components of the new strategic plan, are of particular value.

This Response addresses the specific concerns expressed in the COV Report, gathered under two main headings: (1) issues of concern which were common across all of the programs reviewed; and, (2) program-specific issues identified in the template. COV Report comments are generally indicated in italics, followed by GEO's response. Specific sections where comments arose in the COV Report are indicated in parentheses.

Section 1: Common Issues of Concern

Outputs and Outcomes (Section 2.2)

The committee acknowledged that progress had been made since the last COV in getting more engagement of tribal colleges and minority-serving institutions in GEO's education and diversity programs, but felt that more effort was still needed in this area, particularly with regard to getting two-year college faculty and students engaged in the geosciences and over the barriers that make it hard for them to succeed in the competitive NSF process.

GEO's response: GEO has continued its outreach to minority PIs, minority-serving institutions, and tribal colleges (see comments in the GEO Directorate Issues section below) and has begun to take concrete steps toward engaging 2-year and community college faculty. At the end of FY 2009, GEO provided funding to support the travel of community college faculty members (20) and students (7) so that they could attend the 2009 annual Geological Society of America (GSA) meeting in Portland, which was holding a special session on issues in geoscience education in such institutions. In conjunction with this meeting, a special listening session/networking dinner was convened at Portland Community College and attended by J. Karsten. In FY 2010, GEO funded an OEDG Planning Grant to convene a workshop on 2-year college geoscience education programs, which was held at Northern Virginia Community College on June 24-27, 2010. Information about this workshop, which was attended by 36 participants (including L. Patino) and 4 conveners, is available at: http://serc.carleton.edu/geo2yc/index.html. The final recommendations from this workshop are pending, but the associated web site continues to operate as a virtual networking site. GEO anticipates providing additional travel support this year to enable community college faculty to attend the 2010 GSA meeting in Denver. GEO program staff members attending GSA also are planning to hold a mini grant-writing tutorial for these participants. Collectively, these workshops and symposia are being used to help GEO conduct a needs assessment for the students and faculty in these types of institutions, so that future solicitations and program funding decisions can be more strategic in addressing those needs.

Priority Recommendations

a) GEO E&D Goals and Strategies (Section 3.1)

The committee suggested that the program map the GEO E&D portfolio to the new GEO Education and Diversity Strategic Framework by explaining its goals and objectives in program solicitations, requiring PIs to describe how their projects would achieve those goals, asking reviewers to consider how well those goals are served during the review process, and documenting in Review Analyses how well an award project is tied to these strategic priorities.

GEO's response: Since the COV met, GEO has begun to include a section in Review Analyses for awards that articulates which goals and objectives of the Strategic Framework are being addressed through the project. This began with the Review Analyses for awards from the FY 2010 GeoEd competition, and will be extended to the OEDG, GLOBE, and GEO-Teach program awards when those competitions have been completed. In addition, the newly revised OEDG

program solicitation [NSF 10-599] now specifically identifies the main goals and objectives of the Strategic Framework and asks PIs to describe which goals/objectives they will be working toward. When the OEDG review panel meets this winter, GEO will advise them to consider how well the proposal addresses the Strategic Framework in making their assessment. The next versions of the GLOBE and GEO-Teach solicitations, currently under revision, will also incorporate specific information about the Strategic Framework and which portions of it are intended to be emphasized by that specific program. The current GeoEd solicitation, which is valid through FY 2012, already includes some general comments about GEO's strategic goals; the program will edit this solicitation as time allows so that it more explicitly describes the specific Strategic Framework priorities.

The committee also recommended that a thorough workforce study be conducted to properly inform activities to be undertaken in addressing the Strategic Framework's second goal related to "Preparing the Geoscience Workforce".

GEO's response: GEO notes that the American Geological Institute (AGI) released just such a compilation in its 2009 report "Status of the Geoscience Workforce: Report Summary" [http://www.agiweb.org/workforce/reports/2009-StatusReportSummary.pdf]. This extensive report provides a summary of major needs and trends within specific sectors that employ persons with geoscience training, as well as data on the educational pipeline. In the next year, GEO will evaluate whether the GEO E&D Strategic Framework needs to be further modified to better reflect the trends revealed in that report. It will also consider to what extent this report may not fully capture the full workforce needs across the broad spectrum of geoscience fields, given the highly interdisciplinary and evolving skill sets required in the marine and climate science sub-fields, in particular. The GEO E&D program lead (J. Karsten) is a member of the AGI Workforce Committee and is thus in a position to engage with private sector representatives and monitor developments regarding the geoscience workforce and make sure the GEO E&D programs are properly aligned with emerging trends.

b) Geoscience Teacher Training (GEO-Teach) (Section 3.2)

The committee felt that the two current GEO-Teach projects had made valuable contributions toward improving geoscience teacher preparation at the regional/local level, but that they had not fully achieved the desired goal of having national impact. The committee felt that the goals of the GEO-Teach program, informed by the new Strategic Framework, needed significant clarification before release of another solicitation. Further, the committee made specific recommendations to: support smaller projects; incorporate the various Earth System Science literacy frameworks now available; encourage partnerships with national/regional professional societies, accrediting organizations, and/or state/regional policy makers; explore regionalization of teacher professional development; and explore the use of GLOBE approaches in some GEO-Teach projects.

GEO's response: GEO appreciates the insightful guidance offered by the committee regarding the need to better articulate the goals of the GEO-Teach program before issuing another solicitation and making sure that those goals are aligned with the GEO E&D Strategic Framework and the GEO Vision Report. GEO will consult with both the AC-GEO at its October

2010 meeting and the GEO Education Team, as it prepares to revise the GEO-Teach solicitation for FY 2011, and explore further the merits of the committee's recommendations regarding a two-track approach, partnerships with professional organizations to help achieve national scale impact, regionalization/customization of professional development programs, and capitalizing on potential synergies with the GLOBE program.

c) GLOBE (Section 3.3)

The committee feels strongly that GEO should continue its support for the GLOBE program and, in particular, its support for projects that encourage students to collect and use data in ways that inform the community, to carry out an action project, to work with local scientists, and to contribute to high quality global databases. The committee offered a potential model approach that engages local scientists, science-based agencies, teachers, companies, and community colleges in a collaborative process to define locally-significant, place-based research projects of merit that can be addressed using GLOBE protocols and resources. The committee also recommends tracking of GLOBE students to estimate how many of them enter into science (and especially geoscience) fields at higher education and career levels, as well as their demographics.

GEO's response: GEO welcomes the focused comments regarding possible next steps in NSF's participation in the GLOBE program. The proposed grassroots model for developing GLOBE student-researchers and recommendation to build stronger linkages to local communities, local employers, and community colleges are very useful suggestions. As described in the COV background presentations, NOAA has recently rejoined as a co-sponsor of the GLOBE program and OSTP has recommended creation of an Executive Management Board (EMB) to provide strategic oversight of the program. J. Karsten will be attending a site visit at the GLOBE Program Office (GPO) in Boulder the first week of September 2010, where discussions will focus on implementation of the EMB process, a detailed program evaluation that is just getting underway, progress on the new technology systems that will enhance the ability to conduct student research currently being developed, and what each of the funding agencies sees as their main contributions to the GLOBE program. There is a specific agenda item related to the next NSF GLOBE solicitation and lessons learned from the FY 2006 competition from the perspective of the GPO staff. In addition, GEO has recently been involved in discussions with EHR regarding an EHR-GEO collaboration on the next GLOBE competition that could lead to additional financial resources being available for GLOBE-related activities. EHR already receives many GLOBE-related proposals in its core programs on an ad-hoc basis and feels that co-sponsoring the next GLOBE solicitation would allow them to give the PI community more specific guidance regarding the types of GLOBE activities they would like to support. EHR seems particularly interested in proposals to test, evaluate, and scale-up the emerging GLOBE models for student research and models for professional development of GLOBE (and other K-12) educators who oversee the student research projects. A revised GLOBE solicitation will also seek to engage scientists involved with some of the GEO and NSF research priority areas in global climate change and sustainability being supported through the new Science, Engineering, and Education for Sustainability (SEES) portfolio. GEO expects that a draft GLOBE solicitation that reflects inputs from the COV, GPO, and EHR will be available for discussion at the October 2010 AC-GEO meeting, with release in very early 2011. The committee's recommendation to

better track the demographics and fate of students participating in GLOBE is an important goal, but is more of a responsibility of NASA (and now NOAA). It is likely that much of this information will be collected as part of the GLOBE program-wide evaluation activity currently under development.

d) EAR E&HR (Template Section A.4.2)

In response to GEO's request, the committee suggested possible options for re-deployment of the funds in this program that previously supported ad-hoc projects. The committee recommended that consideration be given to funding access to EAR research by high school interns, K-12 teachers and students, informal science education institutions, and free choice learners from the general public.

GEO's response: GEO agrees with the committee that any future solicitation(s) should focus on reaching audiences that are not currently being served by existing programs. Elementary and secondary school students and teachers and the general public are not primary target audiences in the EAR E&HR programs, and they are only supported by supplements or co-funding opportunities with awards made by the research programs. Solicitations from the EHR Directorate do target these groups; thus, any new solicitation in EAR should be mindful of not overlapping with existing ones. In addition, it is important to consider whether new solicitations should be only within the purview of EAR or should encourage a more systematic approach and include other Divisions within GEO. The GEO Education Team, which includes program staff from both GEO and EHR, will continue to evaluate how best to serve this audience and the proper role for EAR E&HR funding within that equation.

GEO Directorate Issues (Section 4.0)

The committee recommends that GEO continue its efforts to attract proposals from across the geosciences community and enhance participation of underrepresented groups and Minority-Serving Institutions (MSIs) in the GEO E&D programs, as well as expand its efforts to encourage proposal submissions (and success rates) from community colleges.

GEO's response: As noted above, GEO is already taking steps to help identify some of the unique needs and barriers that exist within the community colleges, raise awareness of funding opportunities within minority-serving institutions, and identify strategies for encouraging more proposal submissions and greater success rates by PIs from these types of institutions. Subsequent to the COV meeting, GEO was a co-sponsor of the 2010 Joint Annual Meeting of Principal Investigators (JAM PI), supported by programs within EHR's Division of Human Resources Development (HRD). Many of these PIs are minority STEM faculty or faculty from MSIs. GEO sponsored one of the lunchtime keynote presentations (heard by >1000 attendees), hosted an exhibit booth about GEO's funding programs (overseen by J. Karsten and L. Patino), and participated in a panel discussion about funding opportunities at NSF. This type of outreach to minority and minority-serving scientists will continue through GEO E&D program staff attendance at the annual Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) and National Association of Black Geologists and Geophysicists (NABGG) annual meetings and upcoming dedicated symposia related to broadening participation in the

geosciences. Among these special outreach events this year are an "AfricaArray Forum on Diversity in the Geosciences" (September 29, 2010; Houston, TX), a planning meeting being organized by WGBH at the National Museum of the American Indian (NMAI) (September 16, 2010; Washington, DC), and a special 1-day faculty symposium on inclusion at Penn State University (Invited presentation by J. Karsten, November 10, 2010).

The committee also recommended creation of a single document that looks across all of the education and diversity elements being made by GEO (both within and outside the GEO E&D portfolio) and identifies what expenditures are being made toward specific goals.

GEO's response: Some of this information (e.g., GEO's IGERT funding) was provided in the background materials for the COV, but GEO agrees that having all of this information compiled in one place would be helpful when making future funding decisions and revising solicitations. The committee has already acknowledged the difficulty of trying to document the budgetary obligations associated with education and diversity activities being supported as broader impacts activities of the GEO-funded research projects. An effort will be made to document some of the major educational investments being made through the larger GEO Science and Technology Centers and facilities that have dedicated education staff and programs. The GEO Education Team will compile this information for the AC-GEO in the coming year.

The committee raised concerns about whether the partitioning of some GEO education and diversity activities (most notably, the OCE education program, which is not included in the GEO E&D COV review) might lead to less cohesive efforts across the Directorate. The committee asked GEO to consider the rationale for how these activities are placed within the various Divisions and inform future COV's about this rationale, should the status quo remain.

GEO's response: The GEO Education Team will work with the GEO Management Team in responding to this recommendation.

The committee noted the growing importance of professional master's degree programs as a valuable credential in the applied sciences and recommended that GEO consider whether it should support some targeted professional master's degree programs that fit within the strategic directions outlined for GEO.

GEO's response: GEO notes that a new NSF-wide Science Master's Program (SMP) was offered in FY 2009 (mandated as part of the American Recovery and Reinvestment Act funding) and managed by EHR. J. Karsten was GEO's representative on the NSF-wide working group that managed the SMP competition. There is a great deal of interest at NSF in continuing this program in FY 2011 should funds be available when the final FY 2011 budget is appropriated. Should the NSF-wide effort be continued, GEO feels it would be most practical to use the SMP program as the funding vehicle for addressing the COV's recommendation. The GEO Education Team will continue to explore this issue and whether there is a need for GEO to establish a separate funding mechanism going forward.

The committee recommended that GEO consider undertaking a longitudinal study of the long-term effectiveness of its full portfolio of E&D programs, particularly those focused on broadening participation.

GEO's response: As part of its contract for OEDG program evaluation, the American Institutes for Research undertook a study exploring the feasibility of carrying out a longitudinal survey of OEDG impacts. There are many requirements related to systematic data collection that must be met for a meaningful longitudinal assessment; without this consistency, significant bias can enter the analysis. The AIR feasibility study (issued June 29, 2009) found that few of the OEDG projects had the necessary baseline data on which to build a meaningful longitudinal study for the OEDG program, and the situation was most problematic for those working at the K-16 grade level populations (which is the bulk of the OEDG projects) because of the lag times involved. The report suggested that a purposive follow-up to collect case studies for OEDG projects working with undergraduate and graduate students might yield valuable insights into effective strategies, but could not provide information on overall impacts of OEDG investments. The GEO Education Team will continue to work with AIR to determine whether following up with such case studies provides insights that cannot be obtained through other means and whether there is potential for a broader portfolio evaluation.

Section 2: Program-Specific Comments

This section identifies specific issues that were commented on within the COV Template itself and GEO's responses to them.

Inconsistencies in addressing broader impacts in individual reviews and panel summaries; short review comments in individual reviews that lack substance.

GEO's response: GEO will continue to educate its reviewer community about the importance of addressing both NSF review criteria explicitly and separately, and to provide constructive feedback to PIs. The program will implement more consistent use of Panel Summary templates that have separate review criteria headings.

Lack of information about reviewer backgrounds; confusion about when panelists are also reviewers.

GEO's response: Getting information about reviewer backgrounds other than institution and geography continues to be problematic, given that the information is self-reported and often not provided by the reviewers. For future COVs, the program will take steps to clarify which reviews were contributed by panelists and which were contributed by ad-hoc reviewers. Given present workloads, it would be very difficult for GEO program staff to prepare a short biographical sketch of the reviewers to append to the review, as suggested by the committee, but GEO will examine what other strategies might be useful for providing such information to the committee in the future.

Potential negative bias in having proposals that have been submitted by community college PIs reviewed by 4-year/university college faculty.

GEO's response: As a policy, the GEO E&D program has always made sure that proposals submitted by community colleges are reviewed by a panelist from an equivalent institution, so that this perspective is brought to the discussion, so we think this is not a major concern. But, GEO will consider whether additional strategies might be needed to prevent bias in the review process and to level the playing field for community college-based proposals. GEO will also consider steps for helping community college faculty be more effective in their NSF proposals, as discussed elsewhere in this response.

It is difficult to determine the specific impacts or range of impacts resulting from projects funded by the GeoEd program.

GEO's response: GEO notes that previous GeoEd solicitations were very broadly written, leading to a very diverse portfolio of funded projects and making it very hard to conduct any type of portfolio analysis of impacts. In the most recent version of the GeoEd solicitation (NSF 10-512), the goals of the solicitation have been narrowed into four topic areas, and there is greater clarification of when proposal topics should be submitted to EHR and not GEO. The GEO Education Team will examine whether it is possible to aggregate information regarding impacts for each of these four program emphasis areas in the future.

The committee recommended that GEO may want to more specifically address the use of research to inform educative aspects or researching the effectiveness of particular educational activities in projects supported by the GeoEd program.

GEO's response: The revised GeoEd solicitation (NSF 10-512) is much more explicit about the requirement for evaluation and assessment activities for all GeoEd projects. Reviews and panel comments from the FY 2010 competition indicate that the most successful proposals did incorporate significant scholarly foundations from education research in the Project Description, as requested in the revised solicitation. Although GEO feels that the FY 2010 GeoEd projects selected for awards have a much stronger foundation in these areas, it will continue to monitor the situation and see if additional steps are needed to address the committee's concerns.

The committee was concerned about the small Track 1 GeoEd funding levels and whether they were adequate. They also felt there was a need for better monitoring of whether the Track 1 pilot projects succeed in getting additional funding through GeoEd Track 2 or other NSF programs, in order to gauge overall impact of these small awards.

GEO's response: GEO did not change the award size for Track 1 or Track 2 projects in the revised NSF 10-512 solicitation, due to very limited resources available for this program ($1.5 M per year for Track 1 and Track 2 combined). Philosophically, GEO feels that incubating many small projects that may be able to demonstrate enough potential to garner additional funding elsewhere is a valuable strategy rather than investing in a few, larger projects. Other programs are available within EHR to support mid-sized and larger efforts. GEO agrees that it should do a

better job in tracking how many of these Track 1 projects are able to garner additional funding, and will try to establish more effective strategies for doing so in the future.

The committee suggested that high-risk, potentially high-return projects might benefit from having more post-award monitoring, depending on the availability of program officer time.

GEO's response: GEO will consider this issue further in the next year, but there are significant staff workload issues that will likely prevent this.

The committee recommends that GEO conduct training sessions (or equivalent) to help specific underrepresented institution types (MSIs, community colleges) be more successful in pursuing NSF/GEO funding.

GEO's response: GEO agrees that it needs to do a better job in deploying web-based resources as a tool for educating prospective PIs about how to prepare a competitive proposal to the GEO E&D programs and will work toward having such resources available by the October 2011 AC-GEO meeting and GeoEd deadline.

The committee felt there were missed opportunities for encouraging greater industry involvement and private sector commitments that could help with sustainability of NSF-initiated geoscience education and diversity projects.

GEO's response: GEO will continue to engage with industry representatives through its networks to seek stronger partnerships in this area and work on developing collaborative activities that may formalize their participation in GEO E&D-funded activities.

The committee feels that, with the expanding workload, the GEO E&D program does not have sufficient staff resources and recommends addition of at least one more program officer to the team.

GEO's response: GEO recognizes the importance of ensuring high quality and timeliness in the merit review process as well as the accomplishments of the current staff. We will continue to evaluate the staffing needs for the portfolio and the distribution of available resources.