

**Report of the Committee of Visitors
Deep Earth Section
NSF Division of Earth Sciences
2008-2010**

Submitted January 17, 2012

Introduction

The 2011 Committee of Visitors (COV) to the Deep Earth Processes (DEP) Section, Division of Earth Sciences, met on 7-9 November, 2011, at National Science Foundation (NSF) Headquarters in Arlington, Virginia. The purpose of the meeting was to conduct an external review of the five research programs that make up this Section, which include Geophysics, Petrology and Geochemistry, Tectonics, EarthScope, and Continental Dynamics. The report of this review, carried out under the auspices of the Advisory Committee for Geosciences, is hereby transmitted to the NSF Directorate for Geosciences, for internal use and for preparation of the annual NSF report produced in compliance with the Government Performance and Results Act (GPRA).

The members of the 2011 COV were: Donald DePaolo, Chair (University of California, Berkeley), Wendy Bohrson (Central Washington University), Catherine Constable (University of California, San Diego), James Evans (Utah State University), Milton Garces (Hawaii Institute of Geophysics and Planetology), Elizabeth Hearn (University of British Columbia), Guust Nolet (University of Nice), Sarah Roeske (University of California, Davis), Sheila Seaman (University of Massachusetts, Amherst) and Rebecca Lange (University of Michigan).

The charge to the COV was to review the actions taken by the five research programs during the previous three fiscal years (2008-2010) and to evaluate the products and contributions supported and overseen by the programs over that period. For the review of program actions, the COV was asked to examine the integrity and efficiency of the processes used to solicit, review, recommend, and document proposal evaluations, including the effectiveness of the program's use of NSF's two merit review criteria, and the relationship between decisions and program goals. The Committee was provided with a template meant to organize and specify the types of questions the Committee consider as it reviewed the programs. The template included requests to comment on management of the programs, including responsiveness of the program to emerging research and education opportunities, the planning and prioritization process that guided the development of the program research portfolio, and the responsiveness of the program to previous COV comments and recommendations. The Committee was also invited to make additional comments on broader issues such as areas in need of improvement or gaps within program areas, agency-wide issues that should be addressed to help improve program performance, and ways to improve the COV review process, format and report template.

The COV formed subcommittees to evaluate each program in detail, and a chair was named for each subcommittee. The subcommittees were:

Geophysics: Nolet (chair), Bohrson, Constable, Garces, and Lange

Tectonics: Evans (chair), DePaolo, Hearn, Roeske, and Seaman

Petrology and Geochemistry: Bohrson (chair), DePaolo, Garces, Lange, and Seaman

EarthScope: Constable (chair), Evans, Hearn, Nolet, and Roeske

Continental Dynamics: Hearn (chair), with the entire committee except for DePaolo who was judged to have a COI

Prior to the review, the COV was sent statistical and background information on proposals, mail and panel reviews, outcomes for the five programs over the three most recently completed fiscal years under evaluation (2008-2010), a copy of the previous (2008) COV report chaired by Sean Solomon, and the NSF response to the previous COV report. At our meeting, Program Officers (POs) presented highlights of each program to the full committee and fielded questions. The Tectonics and Geophysics programs were reviewed the first day. Both overview presentations were given in the morning, and then the committee split into the two subcommittees and spent the remainder of the day reviewing proposal eJackets online. The committee was given access to the proposal jackets for one review cycle for each program; the specific review cycles reviewed by the committee were chosen to be representative, but also to minimize COIs with the COV members. On the second day, a similar process was used for the Petrology and Geochemistry and EarthScope programs. The third morning was devoted to review of the Continental Dynamics program. For the CD program, the committee was given access to all proposal jackets for the 2008-2010 period. This program has only one review cycle per year and handles a smaller number of proposals, although those proposals are longer and more complicated as a result of their multi-disciplinary and multi-institutional nature. The COV is grateful to the NSF staff for their considerable efforts at assembling the information needed for the committee to complete its charge.

On the second day the Committee requested a minor reschedule so that each subcommittee could meet with the corresponding program officers for 30 to 45 minutes to discuss program management. This change was intended to help the committee respond more knowledgeably to the questions posed in the review template on this issue. We recommend that this meeting time between POs and corresponding subcommittees be considered for adoption as standard procedure for future COV's.

For each program we selected up to 20 proposals from a specific review cycle to examine in some detail. We generally chose a few that were highly rated and resulted in awards, the lowest-ranked proposals that resulted in awards, the highest-ranked proposals that were declined, and proposals for which the mail rankings were either substantially higher or substantially lower than the panel rankings. For some programs we looked at proposals selected essentially at random from the "Must fund," "Fund if possible," and "Do not fund" categories. We examined several proposals for which there was a sufficient panel conflict of interest that the decision was based entirely on mail reviews and program officer evaluation. For the Continental Dynamics Program, the three-year perspective gave us an

opportunity to assess how proposed project scope and program decisions evolved, because many of the proposals were resubmitted and hence reviewed in more than one cycle.

General Findings

In the majority of individual proposal cases reviewed, the proposal evaluation process is sound, and carefully and meticulously administered by the Program Officers. *Ad hoc* mail reviews are solicited from scientists with appropriate expertise, and there is ~60% review return rate in all of the programs, slightly higher or slightly lower depending on the cycle and program. All of the programs use a merit review process involving three parts – *ad hoc* mail reviews, panel review, discussions and ranking, and program officer discretion and resourcefulness in dealing with proposals that fall near the “water line.” This COV, in agreement with the previous COV, is strongly supportive of this three-part review process and unanimously recommends that it be retained. The committee notes that the panel process alone would be less effective without *ad hoc* reviews, and that the panel process serves multiple purposes, not the least of which is to provide to a steady stream of members of the research community an opportunity to see first hand how the merit review and decision making process works in the Foundation. The panel process provides a valuable form of transparency and education that benefits the Foundation and the community.

All of the DEP program officers have an unusually thorough knowledge of their research community and can provide valuable and necessary guidance to their panels, as well as make good independent decisions where necessary. There is abundant evidence that each PO expends serious effort and is adept at finding opportunities for co-funding of proposals from allied programs within and external to the Division that can extend the ability of their program to fund important and worthy research, and hence provide a great benefit to their research community. This part of the DEP programs is exceptionally well managed.

Program management

Although the primary focus of the COV is intended to be a review and evaluation of the merit review process, the template provided to the committee also includes questions about program management, including issues such as responsiveness of the program to emerging research and education opportunities, and the planning and prioritization process that guided the development of the program research portfolio. These questions resonated with many members of the committee and were seen to be an integral part of the committee charge. Specifically, the committee members were in agreement that the specification, development, and evolution of a program’s portfolio is an implicit means for ensuring that the best and most potentially-transformational research ideas are submitted as proposals to the program. The highest quality research ideas could, in theory, be viewed as incompatible with the program scope if the program officers are not adequately articulating the scope of the program, updating the solicitation, and communicating the evolving objectives of the program to the community.

Current DEP program structure has been in existence for about 12 years, with the exception of the addition of the EarthScope program in 2003. Some programs have remained unchanged for over 20 years. Although the current organization seems to work well in many ways, due partly to the resourcefulness and dexterity of the program officers, there is at least the appearance of a stasis that does not in fact reflect the dynamism of the research fields. The committee believes that the Section Head and the program officers need to be thinking regularly about how best to organize the programs, and to have a systematic and transparent process for updating the solicitations. There is a notable lack of clarity on the origins of the program solicitation language, and the process by which solicitations are developed and allowed to evolve with the changing nature and emphasis of the fields. The committee is well aware that each of the programs invests in supporting topical workshops on a regular basis, but it is less clear how the results of those workshops help shape the program objectives or affect the solicitations. A more transparent and systematic process for developing program solicitations could also serve to improve transparency and documentation of the metrics and procedures used in the evaluation and implementation of program priorities.

As an example, given the evolution of the general topic of tectonics and its overlap with Geophysics, Petrology and Geochemistry, EarthScope, earth surface dynamics, and Continental Dynamics, it might be beneficial for all the programs to further define what the objectives of each program are, and how investigators might best find a home for their research. The current program solicitations are useful from an individual program standpoint because they are fairly general and do not serve to unnecessarily restrict the scope of the program, but they are less useful in helping an investigator to understand the differences between programs. This is especially important for new PI's and those who are not well connected or at R1 research institutions.

An important part of managing and sustaining a healthy research community is in bringing new PI's into the program, and each program showed evidence that new PI's were brought into the program at the rate of about 5% of funded proposals per year. This rate appears acceptable although it implies an average PI turnover time of about 20 years, which is somewhat shorter than the typical career length of academics.

Responses to previous COV recommendations

The general recommendations of the previous COV that are not already addressed above were:

- increase the number of CAREER proposals
- preserve a healthy fraction of awards to individual-PI projects
- take steps to communicate to the constituent communities the means by which proposers can satisfy the Broader Impacts criterion
- stress the importance of substantive commentary as a critically needed component of all mail reviews; pay particular attention to the most expert mail reviewers

- inform potential multi-investigator proposers that the thoughtful development of a management plan would not only improve their chances for an award but would also improve the expected outcomes of their project if funded

As is noted in the individual program write-ups provided below, the Division has increased the number of CAREER proposals and awards by a substantial number since the last COV. The programs have also preserved a substantial fraction of single-PI projects, and in fact many of the multiple-PI projects involve only a small number (2 or 3) PIs.

The definition and importance of the Broader Impacts (BI) component of the proposal Project Description and Summary are works in progress. Different proposals vary widely in their approach to BI, ad hoc reviewers vary widely in their critiques of BI, and it remains unclear how much emphasis panel and PO place on BI for funding decisions. This is clearly not an ideal situation, and it has improved only slightly over the past three years. This COV would therefore echo the recommendation of the previous COV that the POs continue to communicate to their communities the means by which proposers can satisfy the BI criteria for their program or for the DEP section overall.

This COV also agrees with the previous one in pointing out the importance of substantive commentary as a critically needed component of all mail reviews, as opposed to relying mainly on the scores represented by the checked boxes (P, F, G, V, E). We also concur that it is appropriate to pay particular attention to the most expert mail reviewers, even if their reviews and scores differ from those of the remainder of the reviewers. Our investigations of proposal jackets from the full suite of programs suggest that the panels and the POs do this routinely and we commend them for doing so. Of course, it is important to document this reasoning in the panel summary and we found that this is also a regular occurrence.

Although the importance of management plans within proposals was not addressed specifically by the PO presentations we heard, it is our impression that this is becoming a more standard requirement across the NSF (and indeed across the federal government) and is taken seriously by the reviewers, panels, and POs. This message has also been passed on to the research community over the past three years.

EAR/DEP Program Review Process

The COV appreciated the considerable effort expended by NSF in producing an agenda that allowed it to complete the entire review on site. However, many of us felt that the process could be strengthened if more time were available for interactions with POs, and for COV discussion of the template questions to achieve consensus for draft parts of the report on each program. This might be accomplished by enabling committee review of some subset of eJackets ahead of time.

As noted above and in some of the Program reports below, a subsidiary concern of the COV was the issue of program scope and evolution, how this is determined, how it is reflected in the program solicitations, and how it is communicated to the scientific community. Although we provide some suggestions about how these issues might be addressed, we also

make the general recommendation that NSF/EAR consider holding periodic reviews of the overall DEP (or EAR) organization and program structure. Something like a decadal timescale would likely be an appropriate frequency for such a review.

Geophysics program (PH)

The geophysics program covers theoretical, observational as well as experimental geophysical science at a range of scales. Co-funding from other programs or initiatives within the Geosciences directorate is at a high level, notably with EAR, ICER (Integrative and Collaborative Education and Research in the Geosciences), Marine Geology and Geophysics (OCE and AGS) and Mathematical Geosciences, but also from PetaApps and Climate and Large Scale Dynamics. Continued involvement with existing community initiatives such as CSEDI (Cooperative Studies for the Deep Interior), COMPRESS (Consortium for Materials Properties Research in Earth Sciences), CIG (Computational Infrastructure for Geodynamics) and CIDER (Center for Interdisciplinary Deep Earth Research), as well as new ones (EarthCube), and coordination with IRIS (Incorporated Research Institutions for Seismology), UNAVCO and EarthScope characterize the broad diversity and high level of activity and outreach of this program.

The COV considers that the quality of the management of the geophysics program sets a very high standard for the other programs. Two permanent program officers, Robin Reichlin since 1995 and Eva Zanzierka since 2004, were assisted by three rotators: Derek Schutt in 2008, Ben Phillips from 2009-2011 and Steve Harlan in 2009-2010. The review process is well defined and includes both mail and panel reviews. The goal of 4-5 reviews per proposal was usually met in the round we considered (Fall 2010, 105 proposals, of which 16 had only 3 reviews). The COV was impressed by the quality of many of the mail reviews, which often show a level of detail that attests to a good choice of reviewers. The large number of proposals forces the panel to go 'with the mail review' for about 25% of proposals, most of them near the bottom of the ranking list. The wide range of disciplines covered by the program implies a strong reliance on the expertise of reviewers, and this was a concern expressed by the previous COV, but we believe the evaluation process has in general worked very well during the period we analyzed. The program processed between 265 and 283 new proposals per year and managed a total of 570 active awards. The program also provided panel review for postdoc proposals.

In the period considered, 13 CAREER awards were made (31 submitted), a significant advance with respect to the previous period (8 awards/17 submissions). 14 SGER, RAPID and EAGER projects were supported. The POs do not set the agenda for portfolio balance in terms of science themes, which often emerge very rapidly or unpredictably. Instead, the program officers keep active contact with the community to develop priorities, goals, infrastructure, and other critical needs, exemplified by the fact that no less than 35 workshops were funded. This aspect of the program is judged to be a very impressive characteristic of the geophysics program; in the past it has led to the establishment of centers such as SCEC (Southern California Earthquake Center) and CIDER (Center for Interdisciplinary Deep Earth Research) and facilities such as CIG (Computational

Infrastructure for Geodynamics). A current concern is the somewhat fragmented nature of the rock mechanics community.

The last COV expressed some concern that the peer-review process discriminates against high-risk proposals under the fierce competition for available funds. Aside from funding such proposals through SGER/EAGERs, the POs now highlight HR/HR or transformative projects in panel review and address the issue explicitly in panel summaries if appropriate. For the (rather small) selection of proposals we were able to inspect during the visit this seemed not to be an issue. The overall success rate of proposals hovers around 40%, up from about 30% in the period reviewed by the last COV. The success rate for early career scientists is above this average.

The POs are very responsive to agency-wide initiatives such as FESD (Frontiers in Earth System Dynamics), CMG (Collaboration in the Mathematical Geosciences), CDI (Cyber-enabled Discovery and Innovation) and other cyber-infrastructure initiatives. Although this has probably contributed significantly to the increase in funding rate and is highly applauded, the COV expresses some concern that these initiatives represent essentially unfunded mandates to the staff and may in the long run hurt the successful management of the core programs, which have already seen their proposal volume doubled in the last decade.

Tectonics Program (TE)

The Tectonics Program (TE) supports field, laboratory, and some numerical modeling studies of lithosphere evolution and deformation. The program portfolio includes single PI projects, small-group projects, and interdisciplinary projects that integrate structural geology, petrology, geochronology, geomorphology, and geophysics, among a range of topics, and that focus on long-term and active tectonic processes. The program also works across EAR and NSF to fund cross-disciplinary research and pursue unique scientific opportunities. Its stated core mission, as published in the 2011 proposal call, appears little changed since the 2008 COV.

“The COV was impressed by the management of the review process by David Fountain, the permanent TE Program Officer, and James Dunlap, a rotator in the program during the CoV period. Dunlap has since been replaced by Stephen Harlan, who became a permanent program officer in 2010. David Fountain has done an excellent job with limited resources (the COV perceived this program to be understaffed). The program maintains a transparent, well-defined and well-documented process for thorough and thoughtful evaluation of proposals based on both ad hoc mail review and panel discussion, and gives thorough feedback to investigators on their proposals. The TE program handled 502 new full proposals during the three-year period considered by the COV (2008-2010). This amounted to 65-105 proposals (40-65-projects) per panel cycle. The program maintains a portfolio of approximately 350 funded awards. It funded four workshops and participates in an impressive range of NSF-wide activities. TE also supports cross-program projects, including NAVDAT, UNAVCO, and GeoEarthScope, and seeks co-review and co-funding with the petrology, geophysics, land-use dynamics, EHR, international programs and EPSCoR

programs. The program also currently supports 5 CAREER grants, and eight RAPID, EAGER, and SGER projects.

We focused our detailed programmatic evaluation of the review process on the Spring 2010 panel cycle, which included 77 submitted proposals. The subcommittee examined 18 proposals in detail. These included 5 supported projects and 13 that were declined. We selected proposals from across the full spectrum of rankings: highly ranked proposals, proposals that were at the “water line”, and several poorly ranked proposals. We evaluated proposals from established and young investigators, and, to the extent possible, from underrepresented investigators. The majority of proposals reviewed (12) were from the gray area around the “water line”, as these were thought to present the most difficult funding decisions.

The COV subcommittee noted that both ad hoc (mail) reviews and panel review are needed to maintain the high quality and fairness of the decision process. The combined panel and ad hoc method provide a well-balanced pool of reviewers in terms of scientific expertise, gender, and geographic distribution. A wide variation in the quality of the ad hoc reviews continues to be a problem, with a number of perfunctory written evaluations, but the number of quality reviews was almost always sufficient to augment and balance the panel review. As with all programs, the program receives more high-quality proposals than it can fund. The review analyses of the program officers in TE clearly outline the rationale behind each funding decision. We also noted the broad reach of their understanding of the nature of the proposals. Their efforts at identifying multiple funding resources early in the process are noteworthy and beneficial. We noted that the program has increased the number of CAREER grants over the last COV period.

The COV charge, section III, asks questions regarding responsiveness and portfolio management, and other issues regarding a broader perspective of program management. Based on our discussions with the POs, they see themselves as responsive to the needs of the research community. The COV recommends that the POs go a step further and work with the tectonics community to identify important new research trends and methods; this might be done by encouraging workshops and increasing communication with the community. The program managers did provide financial support for several structure and tectonic-themed workshops during the review period and graduate student intensive summer schools, but apparently little communication occurred between the organizers and the program managers on what important themes and research trends emerged from these events. Our subcommittee recognizes this is a two-way street and the research community needs to step forward, but more communication from the program managers to provide feedback would help. Increased understanding of the objectives and processes within the tectonics and other DEP programs among the research community would result in increasing opportunities for researchers, and increasing the exposure of the program to a broader range of investigators (including younger PIs). The subcommittee anticipates that the Tectonics program will be at the nexus of one of the themes in this COV report: the issue of the organization of Deep Earth Processes.

Petrology and Geochemistry (CH)

The Petrology and Geochemistry (CH) Program supports research that focuses on the formation and chemical composition of Earth, including the crust, mantle and core. Included in this scope is basic research in the areas of petrology and geochemistry of igneous and metamorphic rocks and ore deposits, volcanology, mineralogy and mineral physics, relevant experimental work, and the development of new analytical techniques in support of these research areas.

The program is managed by two full-time program officers Sonia Esperança and Bill Leeman, and a shared Senior Program Specialist V. Yasmin Adawi. During some of the COV period, Stephen Harlan served as a part-time program officer. After the COV period, Jennifer Wade joined the program as a program officer. In addition to managing Petrology and Geochemistry, staff members manage or assist with other programs, including Margins, CSEDI, CAREER, and ADVANCE. Involvement in other programs strengthens Petrology and Geochemistry, and the staff is commended for the effort these activities require. The Program has been fortunate to have consistent, high quality leadership for many years. In particular, the effective and longstanding role that Sonia Esperança has played as PO is noted. POs know the Petrology and Geochemistry community well, and this cognizance is considered a tremendous asset for the program.

During the review period, 660 proposals were considered, with 520 proposals reviewed by the panel, including 112 co-reviewed by other programs, primarily Geophysics (PH). Two hundred and fifty five (255) new awards were made during the review period, and more than 400 active awards were managed. The total budget, including ARRA funding, was ~\$45 million dispersed for Petrology and Geochemistry projects and ~\$7 million for co-funded projects.

Program Officers make considerable effort to interact with community members and provide feedback that informs PIs about the proposal process. This effort is reflected in the diversity of PIs, including impressive involvement of new PIs and women. Five CAREER awards were funded during the review period, and most of these have support from other programs. Involvement of minorities cannot be accurately evaluated, as the declaration of the relevant demographic data is voluntary; therefore, reported statistics under represent actual demographics.

Subcommittee members found that the proposal review process is very well managed. The number of ad-hoc reviews received is typically high, and the level of detail in the reviews indicates that experts are being engaged in the review process. The panel evaluates a large proportion of the submitted proposals, and panel summaries were typically representative of the range of ad-hoc reviews. The subcommittee particularly wants to note that use of both ad-hoc and panel reviews is essential to maintain the integrity of the review process. Program officer documentation in support of awards and explaining declines is outstanding.

The proportion of proposals submitted and supported in various disciplines of petrology and geochemistry is influenced primarily by the community and has changed over the last 6 years. Flexible portfolio management by the program officers affords them the ability to respond to emerging needs, including those that appear over short timeframes, such as those triggered by volcanic crises.

Recommendations:

The depth and breadth of projects in this program is impressive and reflects the high-impact research that is supported. Proposal submission statistics clearly indicate that interest in Petrology and Geochemistry remains high, as it has for over a decade. This proposal pressure creates workload issues for program personnel, and relatively constant levels of funding over the last decade also create challenges for maintaining quality as research costs escalate. It is essential that the critical role that the Petrology and Geochemistry Program plays in the Deep Earth Section is recognized and fully appreciated by section, division and directorate administrators; addressing the workload issues and funding challenges should be a top priority. Thus, we recommend that

- Division and section administrators engage directly with the program officers to strategize about funding levels and the future of the program;
- Program officers and administrators develop a succession plan that will allow at least one new full time program officer to be mentored for a significant period of time to gain knowledge of the community. While this shorter-term knowledge transfer is imperative, it is also critical that an operational style in which program officers keep fully involved with the community be maintained in the future.

One of the critical aspects of successful program management for Petrology and Geochemistry, as mentioned above, is the depth of leadership experience and the knowledge of the community that the program officers have. Subcommittee members feel the time is propitious for this wealth of experience to be used to reflect on the mission and goals of the program and potentially update both. Such an effort would be strengthened by interaction with the community. Thus, we recommend that

- The program officers engage the community in various ways to provide input on future directions and goals of the program, including the name and boundaries of the program (i.e., “branding”). For example, the current name of Geochemistry and Petrology is tool oriented and does not obviously include physical volcanology, a growing area of research within this program. One possible alternative is to have the unifying theme of the program (i.e., the name) be less focused on “tools used” and more on “questions addressed” (e.g., origin and evolution of Earth’s crust, mantle and core from a geochemical perspective). It is not an easy task to find an appropriate and concise new name, as geophysics also addresses evolution of Earth’s crust, mantle and core, but from a geophysical perspective. Nonetheless, subcommittee members feel that the current name and overall description of the programs need to be re-evaluated.

This effort will more likely be successful if most or all Deep Earth Section (or all EAR) programs engage in substantive program updates.

The program officers and selected community members might for example produce a white paper or equivalent on these discussions and make recommendations to the section and division regarding the future of the program. The white paper should be made public and be widely circulated.

EarthScope (ES)

The EarthScope Program supports broad integrated research on the structure, evolution, and dynamics of the North American continent and the underlying reaches of the deep Earth as well as on the physical processes responsible for earthquakes and volcanic eruptions. Research proposed to this program is expected to make use of EarthScope facilities and/or further the scientific or educational goals articulated in the 2010-2020 science plan *Unlocking the Secrets of the North American Continent*. EarthScope has the following observing systems: (1) the Plate Boundary Observatory (PBO), consisting of GPS and borehole strain and seismic stations; (2) the USArray of seismic and magnetotelluric stations (now being augmented with infrasound sensors); and (3) the San Andreas Fault Observatory at Depth (SAFOD), a 3.1-km-deep instrumented borehole into the San Andreas Fault; (4) LiDAR, INSAR, and geochronology resources.

During the 2008-2010 period reviewed by this COV, ES has seen considerable growth, and significant turnover in program officers. Program Officer Kaye Shedlock (FY08-09) and rotator Linda Warren (FY08-10) were initially in charge with assistance from Steve Harlan (FY08-10). Greg Anderson (since FY09) and Chuck Estabrook (FY11) are the program officers at the time of our review.

Progress on Issues Raised by the 2008 COV.

In 2008 the COV laid out 3 main recommendations:

- (1) expand the pool and expertise of PIs involved in ES;
- (2) broaden the scope to include other geophysical, geochronological, and geological studies relevant to EarthScope goals;
- (3) clarify the kind of proposals suitable for submission under the program announcement.

The program has now addressed all three of these issues through the development of the 2010-2020 community science plan, annual community workshops, and development of a new program solicitation. The EarthScope National Office also plays an important role in connecting to both researchers and the community at large. The program managers appear to have done an excellent job of facilitating the new plan. Significant research results on episodic tremor and slip from Cascadia, and structure beneath the Western US attest to the high impact of ES projects within the science plan.

Assessment of the ES Program (2008-2010): Reviews and Funding.

The ES program has grown significantly as increasing data streams have come on line and a broader group of PIs seek to use them in integrative projects. During the review period ES handled 292 proposals (148 projects) with an average success rate of 31%. The overall management of the program has been sound, with thorough, effective, and transparent review procedures, and results clearly transmitted to the PIs. Suitable procedures are in place to handle conflict of interest. Despite significant growth in number of submitted proposals the panel continues to discuss 95% of them. The committee noted that several areas do need continued attention.

The return rate for ad hoc reviews is somewhat low, and increased effort is necessary to consistently acquire well-argued, high quality reviews spanning the necessary breadth of expertise, especially for complex interdisciplinary proposals.

Increasing numbers and breadth of proposals is a sign of a healthy program, but competition for a limited budget leads to lower success rates (or lower award levels) and the potential for large proposals to dominate a panel round. To reduce the burden on reviewers and panelists we suggest exploring the possibility of a 2-track submission with a pre-proposal process for expensive projects so that PIs can be encouraged to develop clear goals and management plans for multi-investigator proposals.

The COV noted some overlap in goals of the PH, TE, CD, and ES programs. Communication among program managers in the Deep Earth Section is good as indicated by a number of jointly funded projects. If co-funding is anticipated it could be important for program officers to recommend that proposal submissions are coordinated among the programs to ensure that proposals are not lost in the cracks. Finally the program needs to pay continued attention to junior researchers, encouraging them to develop suitable CAREER proposals, and ensuring that unsuccessful PIs consistently receive appropriate mentoring.

Continental Dynamics (CD)

The Continental Dynamics (CD) program funds large-scale, multi-disciplinary investigations of the continental lithosphere that integrate seismology, geophysics, geomorphology, isotope geochemistry, petrology, tectonics, and/or drilling projects. The CD projects are collaborative, each involving PI's from several institutions, and awards are typically about 1.5 to 4.5 million dollars over two to five years. During the 2008-2010 time period, fourteen to fifteen new project proposals were received per year and of these, three to five were funded.

Progress on Issues Raised by the 2008 COV.

The 2008 COV reported that the CD Program mortgaged funds at a rate significantly higher than the NSF goal (60-65%). Efforts were clearly made to decrease the mortgage rate and to fund more new projects each year. During 2009 and 2010 (the last two years of the COV time period) the mortgage rates were 50 and 56%, respectively.

In the CD Program, a typical proposal – even after passing through the pre-proposal process – may be submitted two or more times. This requires that information such as reviews and ranking statistics be saved through multiple annual decision cycles. The 2008 COV requested that ranking statistics be recorded for each decision cycle, and this information is now available.

The 2008 COV also pointed out that science planning for the CD program has been guided since its inception by the Chandler community workshop held in March, 1989. That panel recommended that another geosciences community workshop be held for the purpose of reviewing and perhaps realigning the priorities of the CD Program. The same recommendation had already been made by the 2005 COV. A geosciences community workshop to review and re-assess the priorities of the CD program is long overdue, given changes in the organization of the NSF (including the addition of new programs) and advances in science. The overlap in types of projects funded by EarthScope and Continental Dynamics in North America has led to confusion in the community about where to best submit proposals. Moreover, many techniques relied upon by the tectonics and lithosphere geodynamics communities simply did not exist 25 years ago. A community workshop should be a priority even if a transition to a new “Integrative Earth Systems” program is under discussion - perhaps the workshop could aid in this transition by helping to define the goals and scope of the new program.

Assessment of the CD Program (2008-2010): Reviews and Funding.

CD proposals typically involve two stages; (1) ten-page pre-proposals are reviewed by a panel, and then (2) 36-page proposals are reviewed by ad-hoc mail reviewers and by a panel. The PO (Leonard Johnson) generally sends out ten review requests and receives five to eight reviews. Relative to mail reviews provided to other NSF EAR DEP programs, most of these reviews are detailed and thorough. Both the mail and panel reviews of the intellectual merit of Continental Dynamics proposals appear to be comprehensive. The COV felt strongly that the current review system, with both mail reviews and panel meetings, is ideal. Given the complexity and sophistication of the projects, as well as the high cost and small number of supported projects, having many careful reviews checked against each other in an open and transparent process is absolutely crucial to the CD program. The PO is successful at obtaining sufficient (and sufficiently detailed) reviews for these heavy-duty proposals - clearly a challenge, but additionally challenging because of the potential for conflicts of interest.

The COV had two concerns about the review process and funding decisions for the CD program. One concern is that there was no overlap among the mail reviewers from one annual review cycle to the next for some proposals that were initially rejected and resubmitted. Most CD proposals are not funded on the first try, and having some reviewers see the same proposal in successive years is important (so they can note whether concerns from the prior submission were addressed adequately). The PO informed the COV committee that he strives to achieve some degree of reviewer continuity through multiple decision cycles.

A more significant concern was an apparent inconsistency between panel and mail reviewers' ratings and funding outcomes for a significant fraction of the proposals we examined. We evaluated seven jackets, choosing proposals with a range of outcomes: some were funded on the first try, some were rejected one or more times before being funded, and others were not funded during the three-year period we considered. Of the seven proposals we evaluated, in three cases the proposal was either (1) highly rated by the reviewers and the panel and not funded; or (2) not strongly supported by the reviewers or the panel, yet funded. Somewhat troubling was the fact (related to us by the PO) that post-panel conversations with principal investigators, sometimes by happenstance, had entered into the decision in all three of the cases noted. The PO emphasized that the final decision was his responsibility, and involves factors not covered by the reviews. We don't question the PO's prerogative to make decisions of this sort, but it is our understanding that in cases where there could appear to be inconsistencies in the review process, and especially when there are substantive interactions with PIs outside of the normal review process, a record should be entered via the "Diary Notes" feature in eJacket (as resolved by NSF following the June 2008 COV). The PO acknowledged that he did not deposit a formal note of these conversations into the jackets.

Assessment of the CD Program (2008-2010): Program direction.

The PO demonstrated in his presentation that projects funded during 2008-2010 were geographically broadly distributed. The program has been effective at advertising the scientific discoveries made by its researchers. CD research was featured in several press releases and high-profile publications, and three film projects documenting scientific work were made (though it was unclear how the filmmaker was selected). Eight workshops were held, including two on geoscience work in the Himalayas. The COV would like to emphasize here the importance of holding a community workshop to help define the future foci of the CD program or its likely successor(s).