

EEC Update to COV Comments October, 2008

(A) Overall EEC Strategy/Operations

- (1) COV Finding: The National Science Foundation outcome of Discovery is not fully reflected in the Division Plan.

2007 Response: The Division Plan will be modified to better incorporate EEC objectives related to our responsibilities for Discovery. With our role in supporting interdisciplinary centers involved with sensing and imaging, synthetic biology, quality of life, engineered biomaterials, many important discoveries have been made and many more await the future. The upcoming Division Retreat will consider this as one of our main topics to address.

2008 Update: We have held two retreats this year and identified three additional discovery goals: a) Foster fundamental advances from interdisciplinary research and transformational systems through Engineering Research Centers and Nanoscale Science and Engineering Centers; b) Support innovative educational processes and discovery of how people learn through the CAREER and engineering education programs; c) Develop new technology and educational materials through Engineering Research Centers, the Research Experiences for Undergraduates program and the Nanoscience Undergraduate Education program.

- (2) COV Finding: Data provided to the COV (mainly from the Enterprise Information System--EIS) was quite variable and lacking in uniformity and comprehensiveness. A significantly more robust database is needed for current and future operations. As for diversity statistics within EIS, NSF should provide reviewers with a rationale for providing the demographic information which might encourage more reviewers to do so.

2007 Response: The COV was provided statistics from the following sources:

<u>EISMAIN, Trends</u>	<u>COV module reports</u>
1) Type of Review	2) Reviewers by State
3) Dwell Time	4) Reviewers by Institution Type
5) GPRA	6) Reviewers by Minority Status
7) Award Size Duration	8) Reviewers by Disability Status
9) Funding Rate	10) Proposals by State
	11) Proposals by Institution Type
	12) Reviewers by Gender

Some of the confusion arose from the fact that actions are linked/related differently in the multiple NSF data tables from which EIS (Enterprise Information System) draws information. Several examples illustrate this inconsistency.

- a) The number of proposals reported in the “Dwell Time” report does not include actions such as interagency agreements, contracts, pre-proposals, or proposals that have been withdrawn or returned without review whereas the “Type of Review” report does count those actions. Thus the number of “proposals received” reported is different depending on which source the COV member views so it appears as if there is an inconsistency in data between sources.
- b) The “Funding Rate” report picks up individual awards (eg. all awards within a collaborative are counted) whereas “Award Size Duration” only counts the awards to lead institutions. So the count of number of awards for a given program in a given year will be different depending on which report the COV member consults.
- c) Post award oversight site visitors are not counted in any of the COV module reviewer demographic reports; only reviewers associated with a panel or ad hoc proposal review are counted. The Centers program uses a significant number of site visitors for post-award oversight.
- d) The “Award Size Duration” report does not count continuing increments as funding during the fiscal year that the increment is issued. Rather it counts the funding during the fiscal year in which the original cooperative agreement is established. This makes the average Center award appear in some years to be less than \$500,000. This is a noticeable discrepancy because the typical Center budget is \$3M to \$4M per year.
- e) The “Reviewers by Minority Status” report draws from a data table that is not consistently linked to the data table where all of the information resides. EEC staff members have initiated discussions with the personnel who maintain the EIS report system to fix this programming language.

EEC has initiated meetings with NSF budget and finance personnel (who maintain the EIS report system) to better understand the caveats associated with each of the reports and to provide feedback to them about the places where the statistics don’t accurately reflect the program (in particular for the Centers programs). As for diversity reporting, EEC Program Directors (PDs) will inform their reviewers about the importance and the use of the demographic statistics and encourage them to complete them.

2008 Update: We have added a Science Assistant to our staff who is skilled in data analysis and understands the NSF database systems. She has met with NSF budget and finance personnel and discussed the variances in the different reports. On an annual basis, she will prepare reports based on the appropriate EIS and BEP (budget) data that will more consistently convey the information the COV needs to review the Division’s programs.

- (3) COV Finding: A continuing plan for EEC program leadership succession and transitioning is needed.

2007 Response: EEC agrees with this assessment. Succession planning needs to be part of an overall strategy for workload assignment, which is currently done on an ad hoc basis, often driven by pressing emergency. EEC will work to improve this by doing the following things: the ERC Program Leader has distributed the leadership of sub-components of the program to specific ERC PDs and staff to broaden the familiarity of the staff with leading and improving program components. This will enable the program to function if there were a sudden change in leadership of the ERC Program. In that scenario, a new leader would likely be sought through an open competition. A permanent federal employee is a likely avenue because leadership continuity within the program is important. Under a planned retirement scenario, the ERC Program Leader recruitment could include a six-month period to search for a replacement while the current leader is still on board and a one-year training period during which the leader could be brought back to NSF as needed to train the new person.

2008 Update: The ERC Program Leader continues to broaden the familiarity of the EEC PDs with the overall program operations. In addition, a cross-Directorate working group, with one representative from each division, has been created to become part of the ERC program management function. The working group reviews the solicitation before it is issued and makes ERC selection recommendations, using panel review and site visit results, to the Engineering Directorate leadership team. In addition, eight Program Directors from outside EEC are now serving as an ERC Program Officer for a specific center. This also broadens the pool of individuals with an understanding of ERC operations.

- (4) COV Finding: Overall, the COV found that access to EEC results, technologies and innovations could be improved. More specifically, the COV would like to see the Centers' program promoted within NSF and with other agencies to achieve recognition for the "best practices" that have been developed. ERCs are one of the few examples of a successful systems-level tie to industry. In the Education area, the COV recommends that EEC coordinate with the Division of Undergraduate Education (DUE) to establish a repository of education innovations and products. Finally, the COV recommends that better dissemination of instructional materials developed in the Research Experiences for Teachers (RET) and Bioengineering and Bioinformatics Summer Institutes (BBSI) programs be encouraged.

2007 Response: With the addition of a Science Assistant in June 2007, the Division now has a staff member who can devote the necessary time to collecting, analyzing and promoting the Division's programs and best practices through written and electronic venues. A 10-year retrospective paper on engineering education is being drafted that will feature exemplary ERCs, Research Experiences for Undergraduates (REUs), RETs and Engineering Education programs; and the Division website has already undergone initial renovations, with future efforts aimed at promoting each of its programs on a recurring basis.

For the BBSI program, the major focus is on the didactic training and research experience of the participating undergraduate and early stage graduate students. No instructional materials have been developed at this time. Currently, an RET program website is being developed which will list and provide weblinks to all the ongoing ENG supported RET Site programs. The participating teachers and community college faculty will be given the opportunity to post curriculum and instructional materials that they have developed on this site.

EEC has co--funded the National Science and Engineering Digital Library program for several years including a collection of engineering related undergraduate and pre-college instructional materials. Recently these two collections merged into the "Engineering Pathways" digital library. We are considering whether to require our new grantees to place their results into this digital library as a means of archiving them and making them available more easily to others. See <http://www.engineeringpathway.com/ep/> to enter the digital library.

2008 Update: The 10-year retrospective paper on engineering education was completed and posted on the EEC website. We have redesigned portions of the EEC website to more clearly promote our accomplishments and our mission, including publishing the highlights of our PIs on the website and announcements of lectures and awards and honors received by Program Officers. We have placed emphasis on encouraging PIs to submit highlights and as a result, have increased our collection of them by more than two-fold.

(B) Engineering Centers

- (5) COV Finding: The COV strongly advises NSF to rescind the reduction in the number of ERCs to 15 and to increase the number of ERCs to 25 (along with an appropriate increase in program staff). This is because ERCs are a high visibility American Competitiveness Initiative opportunity and provide a proven significant and positive impact on their participants and industry. In addition, the COV strongly endorses the broadening of the impact of the ERC program through the potential expansion to EPSCoR States through mini ERCs.

2007 Response: While EEC agrees with the COV assessment concerning the visibility and effectiveness of the ERC program, it will be challenging in the short term to increase the total number of centers beyond the current and the original level of 15. The Engineering Directorate continues to experience very low funding rates (16% in FY 2007) and lags behind the NSF average by 5% to 7% annually. In addition, other center-type programs have been supported by NSF and ENG since the origination of the ERC program. Nonetheless, opportunities to more broadly support the ERC program will be explored. In

addition, EEC will continue to explore the potential for an initiative with the NSF EPSCoR office to support smaller scale ERCs in EPSCoR states.

2008 Update: The ERC program is exploring the idea of developing smaller scale ERCs aimed at developing academic institutions that have not traditionally been considered ones with a strong research orientation. These would be available for any state and would be initiated with the aim to develop the overall research capability of the country by developing stronger research programs at more institutions. In addition, the ERC program is considering developing a solicitation for a targeted technology area that could be co-funded by other entities with similar interests.

- (6) COV Finding: The COV endorses the Gen-3 New Features but warns that funding for these centers needs to be increased beyond that projected so these new features do not become unfunded mandates. The COV is also concerned that the elimination of cost sharing from academia and industry for ERCs will have a negative impact on the Centers' ability to develop both institutional and external (industry) commitment at the highest levels. NSF should return to a 20% cost sharing requirement for universities and mandated support from industry.

2007 Response: The ERC program will closely monitor the performance and financial strength of the Class of 2008 to determine if there are sufficient funds to fulfill the goals of the Gen-3 ERCs, as they are more complex and include more partners than Gen-2 ERCs. An additional threat to their financial stability is the prohibition against cost sharing implemented by the NSB, which precludes NSF from requiring academic, state, and industrial funds. We will monitor the total annual support levels for these ERCs closely to see if the ERCs have sufficient funds to carry out their visions. This monitoring will begin in FY 2009 and will continue through their third-year renewal reviews when it will be determined if funding is sufficient. If not, possible options include allowing some of the new Gen-3 features to be optional rather than required or removal of some of the new features altogether. The ERC Program is in agreement with the COV assertion that the elimination of cost sharing will have a negative impact on centers and their ability to build interested and committed partnerships with their institutions and industrial members. The NSB office is currently carrying out a study to determine the impact of this policy on the centers, and, if the policy is revised, EEC will discuss requiring cost-sharing for subsequent years with the Office of General Counsel.

2008 Update: The National Science Board (NSB) Task Force on Cost Sharing is currently engaged in an examination of the NSF cost sharing policy. Prompted by a 2007 Congressional directive in the America COMPETES Act, the Board issued a report in February 2008 on the impacts of a 2004 change to NSF cost sharing policy that eliminated NSF program-specific mandatory cost sharing requirements. This report contained several recommendations regarding

mandatory cost sharing policy at NSF and is available electronically at (http://www.nsf.gov/nsb/publications/2008/rprt_congress_cs_policy.pdf). One of the recommendations contained in the Board's report was re-imposition of cost sharing for the ERC, I/UCRC and EPSCoR programs.

The Cost Sharing Task Force held two Roundtable meetings on cost sharing in July, 2008, where the perspectives of several stakeholders were considered. The ERC Program Leader presented at this meeting. The ERC program is preparing the next solicitation for the ERC program and is working closely with NSF's Office of Budget, Finance & Award Management to develop appropriate cost sharing language for inclusion in the new solicitation that will call for cost sharing from academic institutions and membership fees from industry. It should be noted that 98 percent of the Gen-3ERC proposals submitted to NSF 07-521 included academic support even though it was not required or expected.

- (7) COV Finding: The COV recommends that the lead institution of each Center take responsibility to manage the diversity strategic plan for the Center as a whole; delegation of this responsibility solely to the Minority Serving Institution is discouraged.

2007 Response: Delegating the diversity strategic plan to a minority serving outreach school is not the intent, nor the case at most ERCs. The Centers are required to have a diversity plan developed in partnership with the Chairs of departments contributing ERC faculty in place and it is evaluated annually by the site visit team. Diversity statistics and trends are reported in the Centers' Annual Reports and tracked by the Leader of the ERC Program. In most ERCs, the Education Director is a faculty member from the lead university and is responsible for the overall diversity plan of the Center as a whole. In others, a senior faculty member from the lead institution has been responsible for the plan and its execution.

2008 Update: The ERC Program continues to require that the diversity strategic plan of Centers be implemented throughout their partnership with expectations that each partner institution's team members be diverse, not just those coming from the minority serving partner institution(s). A Partnership Effectiveness Survey is being sent to the Centers this fall that will explore the effectiveness of the partnership between all the ERC institutions. One of the objectives of the survey is to determine if there is an issue with how the diversity plan is being implemented. The data will be presented at the annual ERC meeting in December, 2008 and action will be taken to correct issues identified.

- (8) COV Finding: The COV found the Centers program to be "severely understaffed."

2007 Response: EEC leadership will monitor the increasing need for staffing increases, however optimal staffing continues to be a problem across the Engineering Directorate, and the Foundation, as a whole.

2008 Update: Three new Full Time Equivalent (FTE) positions were added to the three discipline specific divisions (CMMI, ECCS and CBET) within the Engineering Directorate over the past year. The intent of these three positions is to provide a broader base of discipline expertise for the ERC program. The corresponding division directors have each agreed to provide a lead program director for up to 3 ERCs within their respective divisions. As a result, there are currently 8 program directors outside of EEC providing oversight of 8 of the 15 active ERCs. This is expected to reduce the workload on the ERC program directors who reside in EEC and broaden the participation of the other ENG divisions in the ERC Program.

(C) Engineering Education

- (9) COV Finding: The COV had several comments in the context of portfolio content and management within the engineering education program. In the area of portfolio content they felt that EEC should consider developing engineering education programs that would promote the following features:
- a) faculty who are scholars in the broadest sense, both excellent educators and excellent discipline specific researchers;
 - b) mini-grants to fund faculty travel to education-oriented conferences;
 - c) multi-PI, multi-institutional major grants with commensurate funding that does not come from or undermine other initiatives; and
 - d) leveraged funding for initiatives of mutual interest to other agencies.

2007 Response: The division has released a new announcement for engineering education programs in FY08 that includes several of these recommendations.

2008 Update:

a) Our CAREER awards require both excellent educators and excellent discipline specific researchers. Our portfolio includes two CAREER awards for 2007 and one for 2008. In the IEECI announcements for 2008 and 2009 proposals for expansion projects in Innovations in Teaching and Learning require that the research team include tenured successful engineering faculty.

b) EEC sponsored workshops that included travel support for faculty participants, and EEC will continue to support travel as part of research grants and to support faculty travel as part of workshop proposals. For example, EEC funded a workshop on motivating interest in science, mathematics, and engineering in K-12 students, a symposium to consider issues related to establishing academic programs in engineering education, and a PI conference. In addition, EEC co-funded a workshop to define the emerging bioengineering curriculum and a series of workshops to explore the emergence of design as an engineering discipline.

However, while EEC appreciates the need for funding for faculty to travel to education-oriented conferences, the relatively high overhead cost of processing a large number of small travel grants for individual faculty to attend individual conferences would reduce the cost effectiveness of our program.

c) The FY08 Innovations in Engineering Education, Curriculum, and Infrastructure (IEECI) included exploratory grants that could be funded at a 50% higher level if two or more institutions were included.

d) EEC has co-funded a number of grants with other divisions within NSF but has not yet co-funded with other agencies. This is an area for further exploration.

- (10) COV Finding: In the area of engineering education portfolio management and balance, the COV thought that EEC is perhaps too responsive to emerging research/education opportunities that some might consider in vogue. They recommended a balance between core issues and new frontiers. They also found that sustained programs in education are needed to establish and implement best practices and expressed a concern about how decisions are made to initiate or terminate education programs. They noted that the engineering education program is inadequately funded and they encourage the participation of more IPAs in the program.

2007 Response: A new IPA has been hired who joined Engineering Education and Centers (EEC) in January of 2008. We agree with the concern about the process of initiating and terminating programs. New programs should be carefully reviewed by EEC staff as well as the overall Engineering Directorate.

2008 Update: In addition to the deputy division director, Sue Kemnitzer, EEC has two program officers who work primarily on education programs: the IPA who was hired in January, 2008, and a visiting AAAS Science and Technology Policy Fellow.

(D) Human Resources

- (11) COV Finding: REU and RET programs have a huge impact on pipeline issues. EEC should explore opportunities for scalability.

2007 Response: All anecdotal signs point to the REU program as having tremendous impact on attracting students to graduate school and careers in engineering. A longitudinal study by SRI, Inc. is currently underway on the REU program with the initial report due to NSF in the spring of 2008. EEC will use the results of this evaluation study to document the impact of REU on student career and graduate study choices. A similar study was conducted on the RET program covering the period 2001-2006 and the report, "*Evaluation of the Research Experiences for Teachers (RET) Program: 2001-2006,*" was submitted to NSF in July, 2007. The recommendations of the report are currently under consideration by EEC to improve the RET program. ENG is the

only Directorate that holds an annual RET Site competition through a formal program solicitation. Many of the RET Sites are cross-disciplinary so there is a good opportunity for cross Directorate financial collaboration. EEC will meet with appropriate staff in other NSF Directorates about their possible participation in the ENG RET Site Program competition.

2008 Update: The SRI report on the evaluation of the REU program was received August 2008. The comprehensive survey results of REU participants are under review by EEC but appear to bear out the anecdotal evidence that the REU program is effective in attracting undergraduate students, particularly underrepresented ones, to graduate school. The recommendations from the July, 2007 study: “*Evaluation of the Research Experiences for Teachers (RET) Program: 2001-2006*” will be incorporated into the next solicitation revision in 2009. Also as the solicitation is revised for 2009, EEC will to meet with appropriate staff in other Directorates to discuss their possible participation in the program. Results of these studies can be found on the website: <http://www.sri.com/policy/csted/reports/university/index.html#ret2006>

(12) COV Finding: EEC should address the declining number of women in undergraduate engineering programs.

2007 Response: This issue will be addressed in the recently released Engineering Education Announcement.

2008 Update: The 2008 IEECI announcement included an exploratory area focused on increasing the number of students in the pipeline. A number of proposals explicitly included efforts to increase interest and retention among female students. These included the following awards: “The Role of Service-Learning: Improving Engineering Education; Attracting Women into Engineering,” “IEECI Exploratory Project: Why Women Stay: An Investigation of Two Successful Programs,” and “Communication of What Mechanical Engineers Do: A Strategy for Recruiting Women.” The draft 2009 IEECI announcement has an exploratory project area on sustainability, which may attract more female students and an exploratory area on cyber-learning to improve learning and improve retention. In addition, several 2007 DLR awards went to proposed efforts to increase interest and retention among female engineering students and we funded a WEPAN proposal for a knowledge Center for Best Practices. Also, in January, 2008, EEC co-funded a workshop entitled “Women Engineers in Advanced Academic Positions (WEAAP): Effecting Change in Higher Education.”

(13) COV Finding: EEC should make a concerted effort to increase the participation of students and faculty from community colleges.

2007 Response: Historically, the vast majority of REU participants have been junior-or-senior-level undergraduate students who have typically already

committed to a major in science or engineering. So that the REU program can succeed in attracting students into science and engineering who might not otherwise consider those majors and careers, Principal Investigators are also encouraged, when appropriate, to involve students at earlier stages in their college experience. EEC strongly encourages REU projects to reach broadly into the student talent pool of our nation. Principal Investigators will continue to be encouraged to extend their recruitment efforts to community colleges.

In FY 2003 the ENG RET Program was further expanded to include and encourage the participation of community college faculty in on going research and education activities funded by ENG. Not only is the ENG Directorate the only NSF Directorate that holds an annual program competition based on a formal program solicitation, it is the only Directorate that actively encourages and seeks the involvement of community college faculty in both its RET Supplements and Sites programs.

2008 Update: EEC continued to encourage PIs to extend their recruitment efforts to community colleges. The topic was discussed at the EEC Grantees September, 2007 conference and with all potential applicants to the REU program.

- (14) COV Finding: The REU program is a good example of collaborative research funding with DoD. The COV recommends that opportunities for leveraged funding be explored with other federal agencies.

2007 Response: The REU program will pursue a possibility with NASA for joint funding and will pursue more co-funding with other NSF divisions. The REU program will continue the positive collaboration already in place with DOD. The RET Program Director will talk with the appropriate DoD program officials about the possibility of forming a partnership similar to the one in place between NSF and DoD to support REU sites (the ASSURE program) to determine whether RET sites in DoD relevant research areas could be co-funded. Also, the RET and REU Program Directors will pursue further discussions between NSF and NASA Education Programs regarding their potential participation in REU and RET site programs through a Memorandum of Understanding (MOU). In FY 2007 a draft MOU was prepared by the REU Program Coordinator in the Directorate for Education and Human Resources with input from EEC.

2008 Update: The REU program director drafted a Memorandum of Understanding (MOU) for co-funding between the Directorate for Education and Human Resources and the Directorate for Engineering (both NSF) and NASA. The NASA Education Director was not interested in participating at that time because the person was new to the job and the organization was undergoing changes. A connection with NASA will continue to be pursued.

Co-Funding for Engineering REU Program FY05-FY07

Program	FY 2005	FY 2006	FY 2007
DoD	\$1,429,597	\$1,011,139	\$924,468
EPSCoR	\$272,122	\$291,465	\$330,000
OISE	\$100,000		\$80,000
Totals	\$1,801,719	\$1,302,604	\$1,334,468

- (15) COV Finding: International education and research opportunities should be explored to develop programs that will sustain the long-term health of U.S. Competitiveness.

2007 Response: EEC will build on recent efforts in IREE, ERC, REU, RET and Engineering Education Programs to support current grantees the opportunities to work with partners in foreign countries. Through the IREE Program, current grantees in ERC, RET, RET and Engineering Education have provided funding to enable current grantees to travel abroad to engage in collaborative research and education. In the future, we will explore the possibility of establishing in EEC a permanent home for the IREE Program in order to give it more visibility and line-item budgetary support. Such an effort will require financial cooperation from not only ENG but other NSF entities.

2008 Update: EEC hosted a 2007 IREE Grantee Conf. in October 2007, which facilitated sharing of experiences of the 2006 cohort of IREE awardees. The conference was attended by 175 early-career faculty and students; the proceedings were published in spring 2008 and distributed at the ASEE conference held in June 2008, with very positive feedback. The 2008 IREE Grantee Conf. in May 2008 facilitated the sharing of experiences of the 2007 cohort. It was attended by 200 students and early-career faculty; the proceedings are being prepared. A total of 45 countries were visited by the 2006 and 2007 cohorts, the top 10 choices being Germany, UK, France, China, Japan, Switzerland, India, Australia, Netherlands, and Spain, in that order.