National Science Foundation
Directorate for Engineering
4201 Wilson Boulevard
Suite 505
Arlington, VA 22230

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Arun Majumdar
Almy and Agnes Maynard Chair
Department of Mechanical Engineering
University of California at Berkeley
Berkeley, California 94720-1740

Dear Dr. Majumdar:

The Engineering Education and Centers (EEC) COV Report was previously transmitted by Dr. Phillips. We thank you and the COV members for their support of the NSF EEC programs.

I have attached a response to the recommendations in the EEC COV report that was prepared by Dr. Allen Soyster, the Director of the Division of Engineering Education and Centers. I concur with this document and adopt it as the official response of the Directorate for Engineering.

I wish to express my appreciation to the individuals who participated in the COV review. This process is critical to the management of the Directorate, and will help to guide our future decision-making.

Sincerely,

Richard O. Buckius
Assistant Director
Directorate for Engineering

EEC COV Comments and Response 3-10-08

(A) Overall EEC Strategy/Operations

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

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.

(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.

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

EISMAIN, Trends
- Type of Review
- Dwell Time
- GPRA
- Award Size Duration
- Funding Rate

COV module reports
- Reviewers by State
- Reviewers by Institution Type
- Reviewers by Minority Status
- Reviewers by Disability Status
- Proposals by State
- Proposals by Institution Type
- 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.

(3) <u>COV Finding: A continuing plan for EEC program leadership succession and transitioning is needed.</u>

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.

(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.

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.

(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.

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.

(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 industry and mandated support from industry.

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.

(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.

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.

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

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.

(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.

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

(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.

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.

(D) Human Resources

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

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.

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

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

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

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.

(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.

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.

(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.

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.

(E) Partnerships for Innovation (PFI)

(16) COV Finding: Low success rates continue to be a major concern in some programs.

Response: In FY 2007, a decision was made and approved by the Office of the Director to fund a second cohort of the Highly Recommended proposals from

the most recent PFI Solicitation NSF 06-550 using FY 2008 funds. In the near term, this action was a reasonable way to increase the PFI success rates.

(17) COV Finding: Approaches such as requiring Letters of Intent that explain the proposed partnerships in advance would facilitate selection of appropriate reviewers.

Response: The submission of a mandatory Letter of Intent (LOI) will be a requirement under the next solicitation.

(18) COV Finding: Implement data collection procedures to measure the impact of the program on the engineering workforce and literacy of all citizens.

Response: Data collection procedures will be improved to highlight the full impact of this program on female and underrepresented groups. Data collection procedures will highlight the number and the success (based on quantifiable metrics) of programs performed by the individual grantees targeted to underrepresented groups. The data will be patterned after the ERC data collection but has been adapted to capture data relevant to highlighting the full impact of this program on female and underrepresented groups.

A Grantees Workshop will be held in the spring of 2008 to provide a forum for a comprehensive gathering of NSF-sponsored researchers on both active and graduated awards supported by the PFI Program. This important inaugural event will provide an opportunity for the PFI community to: (a) share ideas and results that have out of the PFI awards; (b) discuss strategies and achievements with respect to the sustainability of innovation and (c) provide input for the design and anatomy of future partnership projects.

(19) COV Finding: The COV is concerned that the PFI funding line responsibility is through the Office of Integrated Affairs (OIA), while the program management is through the Engineering Directorate (ENG). The COV recommends that the budget should be moved into the Office of Industrial and Innovation Partnerships (IIP) within ENG.

Response: The Office of Industrial and Innovation Partnerships and the Engineering Directorate will continue to examine the strategy for the optimal management and implementation of the PFI Program.

(F) Industry/University Cooperative Research Centers (I/UCRC)

(20) COV Finding: The program offers a low base of support for grantees in the program and more money should be given in the awards.

Response: The I/UCRC Program Directors are working to increase the size of the awards. In 2007 for example, the new announcement increased the size of the award by paying for the NSF evaluator. Previously, payment for the NSF evaluator was paid for by the grantee. In 2008, we will again look at increasing the award size.

(21) COV Finding: An international component should be included in the program.

Response: We agree with the comment. The I/UCRC program has been actively supporting international collaborations. For example, in 2007, we funded the following seven international projects:

- The *Water Quality Center* has international collaborations with Northern Ireland, which takes advantage of Northern Ireland's expertise in a "lab on chip" technology for monitoring water supplies in real time.
- The *Children Injury Prevention Center* is conducting a study in China on the use of booster seats to reduce children injuries
- The *Membrane Center* has a project targeting brackish water in the Middle East. This project brings together experts in Israel, Jordon and USA to solve water quality problems in the region.
- The *Center for Experiment Research in Computing* is working with the Brazilian Ministry of Health to develop a new computer system that will help monitoring the out break of diseases like AIDS and Malaria in rural area.
- The *Center for Computational Material Design* is working with Singapore's High Speed Computing Center on collaborations to develop new tools in functional materials that require Singapore's high-speed computational expertise.
- The I/UCRC Program funded an international workshop at Purdue University through our Cooling Technology Center I/UCRC.
- The Program funded Precision Forming I/UCRC at Virginia Commonwealth to visit China, Korean and Japan to study Micro manufacturing and Manufacturing of Lightweight Structures.

(22) COV Finding: Participation by women in the I/UCRC program is low.

Response: The importance of diversity is fully recognized. In 2007, the program has increased its number of female site directors from seven to eleven.

(23) COV Finding: The program should collect data highlighting of under represented groups in the program.

Response: Data on diversity and underrepresented groups is being collected. This data will be available for the next COV.

(24) COV Finding: The Fundamental Research Supplement should continue and grow.

Response: The program has initiated a fundamental research supplemental effort in response to an earlier COV recommendation. The program has offered this supplemental funding opportunity every year since 2005 and the number of awards has grown in number from six supplemental awards in 2005 to eleven in 2007.

(25) COV Finding: The COV was concerned about continuity of leadership in the program.

Response: The program has two Program Directors assigned to the program, Dr. Rathindra DasGupta and Mr. Glenn Larsen. Dr. DasGupta has industrial experience and is particularly cognizant of small business partnerships and innovation. Mr. Larsen is not new to the I/UCRC program having worked part-time on the program since 2006. Mr. Larson has been full time starting in 2007 and brings to the program 25 years of experience working at NSF. He will be working closely with Dr. DasGupta learning the program management of the I/UCRC's. In addition, Dr. Donald Senich will be coordinating the I/UCRC program activities with the rest of the Division's Programs. He was previously responsible for implementation of the I/UCRC Program.