

Division of Engineering Education and Centers (EEC) Response to the 2016 Committee of Visitors (COV) Report

Introduction

The Committee of Visitors (COV) met July 19-20, 2016 to review programs in the Division of Engineering Education and Centers (EEC) in the Directorate for Engineering (ENG). The COV covered EEC operations for fiscal years (FYs) 2013, 2014, and 2015. The Committee was co-chaired by Drs. Deba Dutta, a member of the Engineering Directorate Advisory Committee (AdCom), and Galip Ulsoy. They presented the COV report to the ENG Advisory Committee on October 19, 2016. The Advisory Committee unanimously approved the report at the meeting.

EEC wishes to thank the members of the 2016 EEC COV for their time and effort in carefully reviewing the activities of the Division. EEC is especially grateful to Co-Chairs Deba Dutta and Galip Ulsoy for their leadership during the COV process. The final report consists of a thorough review with many clear and actionable recommendations.

The COV evaluated 175 randomly selected proposal actions spanning the fiscal years mentioned above. The COV report addressed five topic areas: I. Merit Review Process; II. Selection of Reviewers; III. Management of the Program; IV. Portfolio of Awards; and V. Other Topics. Our response to each of these areas is listed below.

I. Merit Review Process

1. *Recommendation/Observation: The COV expressed concerns with the variability of the merit review process and the resulting feedback to Principal Investigators (PIs) regarding funding decisions. More consistent documentation would benefit the community. [I.3, I.6, I.7]*

Response: In the summer of 2015, EEC developed Panel Summary templates that improve consistency in both the review process and help to better inform the PIs as to the full nature of the panel discussion. The revised templates include a section that describes the rationale for the panel's recommendation. These changes are being implemented to properly communicate, especially when there are significant discrepancies between individual reviews, how the panel ultimately arrived at its final proposal categorization and ranking. In addition, in cases where the program officer feels that the panel summary and individual reviews do not provide sufficient detail, a communication from the cognizant program officer ("PO Comment") is added to the jacket. Since supplements and EAGERS are not subject to external review, there are no reviews to provide to PIs. Feedback is provided to the PI through PO Comments, especially for cases in which the proposal is declined. The panel summaries and the review analyses in FY2016 were reviewed by the Division

Director (DD) and/or the Deputy Division Director (DDD) during the DD concur process. A number of jackets were returned to PDs for further clarification.

The COV is correct that there is a difference in review associated with the RFE and RIEF reviews, due to the nature of the programs. RIEF is an initiation grant program for researchers with little to no experience in engineering education research. Thus, the proposals may not be as strong as those submitted to RFE. Common reviewers are instructed that they may be more lenient in rating RIEF proposals than they would be for RFE proposals. Goals of the RIEF program are to support training and mentorship to initiation grant proposers, and further encourage them to establish a research agenda in engineering education.

II. Selection of Reviewers

1. *Recommendation/Observation: The COV noted a lack of clear documentation on reviewers' qualifications. [II.1]*

Response: To address this, beginning in FY17, EEC established a new process for collecting the CVs from the reviewers that are associated with the division's review panels. This documentation will be provided to future COV participants to enable them to assess the qualifications of the reviewers who are involved with each panel.

2. *Recommendation/Observation: The COV observed that reviewers had an inconsistent geographical diversity. [II.3]*

Response: In organizing panels, EEC PDs strive for balanced and diverse demographics while also being cognizant of not over-taxing reviewers from distant locations or underrepresented groups. Reviewers that need to travel long distances are less likely to accept invitations to participate in panels at NSF. Therefore, PDs will also strive for appropriate use of both in-person and virtual or hybrid panels to ensure that panels have the expertise needed for reviewing the proposals while being mindful of creating opportunities for reviewers to participate virtually when they are unable to travel to NSF to participate in person.

3. *Recommendation/Observation: The COV noted that it might be helpful to have more reviewers from industry, national laboratories, and other non-academic backgrounds for proposals, including those outside of the ERC program. [II.3, V.2]*

Response: EEC acknowledges that such reviewers can offer key insights and provide a more comprehensive perspective in the review process. EEC continues to emphasize to PDs the value of including individuals from industry and the national labs on panels, where possible. PDs have significantly increased their effort to enlist reviewers at key engineering society (e.g., IEEE, ASME, etc.) meetings, workshops, and conferences. In addition, EEC has further reached out to its Centers to include

ERC representatives from industry, national laboratories, and other non-academic environments in review panels for the Engineering Education, Workforce Development and Broadening Participation clusters - *in addition to review panels that are related to the Centers programs.*

III. Management of the Program

Many of the COV comments in this section were addressed in other sections of the Division's response. Unique comments from section III.1 are addressed below.

1. *Recommendation/Observation: The COV noted that it might be helpful to use goals, metrics, and evaluations, for example, a "Gap Analysis," to help make programmatic decisions. [III.1, III.2, III.3, IV.10, V.1]*

Response: We agree with this recommendation. EEC is pursuing multiple methods of evaluating and assessing its portfolio in order to inform programmatic decisions and further the integration of its centers, engineering education, workforce development, and broadening participation programs. One such evaluation is a division portfolio analysis that is a combination of quantitative high-level measures such as budget, proposal and award, review, and panel overview numbers and a more qualitative overview of the evolution of research topics and the emerging topic areas for each of the clusters. This EEC portfolio is a part of a larger ENG directorate-wide effort to improve the data analytics, metrics, and efficiency of the entire ENG directorate. EEC has engaged our Science Analyst, AAAS Fellows, and program officers to garner the background data/insights needed to develop goals and metrics that can help guide the division's programs. We will also perform a follow-up study that builds on the analysis conducted by a former EEC AAAS S&T Policy Fellow. The analysis used a rubric that allows for organizing proposals based on strategic thrusts, public-values mapping, engineering grand challenges, and outcomes. The division plans to additionally leverage the valuable insights and reports that are produced from NAE studies (e.g., ERC, Engagement of Professional Societies), along with the results from EEC-funded workshops that will be conducted in FY17.

Recommendation/Observation: The percent funding rate has risen between 2013 and 2015, which can be primarily attributed to a reduction in the number of competitive proposals, the numbers having dropped between 2013 and 2015. However, the number of new PI proposals decreased from 2013 to 2015. It is unclear what processes were used to promote a healthy level of new PI proposals. [COV Report, p. 12]

Response: In response to a reduction in the number of competitive proposals, EEC program officers have increased their outreach efforts in FY16. In particular, those leading the Engineering Education and Broadening Participation clusters have targeted numerous conferences, meetings and workshops (e.g., ASEE Sectional conferences, ASME, AIChE, IEEE, NSBE, SHPE) to present and discuss EEC funding

opportunities, while also conducting one-on-one meetings with prospective PIs (at a booth that was staffed by EEC program officers). EEC program officers also devoted more attention to smaller regional conferences in FY2016, conducting special workshops and smaller sessions with potential PIs. EEC representatives additionally participated in a number of “NSF Day” trips, presenting funding opportunities and meeting with new faculty to help respond to questions regarding specific proposal ideas and the overall submission/review processes. EEC is cognizant of the impact that long dwell times can have on pre-tenure faculty and will do its best to ensure that the reviews are conducted in a timely fashion.

IV. Resulting Portfolio of Awards

1. *Recommendation/Observation: The COV said that it thought it would be helpful to have information on sub-awards in order to better understand the involvement of community colleges and 4-yr colleges. [IV.6]*

Response: There is no designated area in FastLane/eJacket to capture specific information of sub-awardee involvement in proposed efforts, other than the budgetary elements. The sub-awardee involvement is typically integrated by the proposers in the project description, which is made available to the COV committee.

V. Other Topics

1. *Recommendation/Observation: ERCs should maintain a hybrid process of selecting PI-identified and directed topics. For example, EEC could use the NAE grand challenges as a directed set of topics. Given the emphasis on innovation, is there a strong link between the ERCs and the I-Corps program? For example, the number of spinoffs is a quantifiable measure of the impact. It would be helpful to analyze this further and develop a list of lessons learned and guidelines for future ERCs.*

Response: The ERC program has used a hybrid process of selecting PI-identified and directed topics in the past. This will be considered in conjunction with the insights provided in the report that will produce by the current NAE/NRC “The Future of Center-Based, Multidisciplinary Engineering Research” study.

EEC recognized the potential value in linking the ERC and I-Corps programs and, as a result, the ERC program supported the participation of the Industrial Liaison Officers (ILOs) from a number of ERCs in the I-Corps “Train-the-trainer” program (in FY15/FY16). We will continue to encourage such engagement in the future. In addition, the ERCs that were launched in FY15 engaged in a joint “kick-off” workshop held at NSF in October 2015. A significant portion of the workshop was conducted by Dr. Curtis Carlson (former president and CEO of SRI), to provide insight and guidance on improving innovative performance and creating value for the ERC. The “NABC”

innovation methodology that he created at SRI was presented in a series of interactive sessions that helped the ERCs to identify the Needs, Approach, Benefits, and Competition (NABC) associated with the value proposition of their efforts. He has continued to work with ERCs in follow-up FY16/FY17 workshops and is planned to conduct a similar workshop with the new ERCs that will be awarded in FY17. EEC will also continually strive to further engage industrial involvement in all of its programs while exploring new ways to increase opportunities for ERCs to “*enhance the nation’s innovation capacity*” by further leveraging their participation in the centers.

To help guide future proposers and center management efforts, the ERC Program has produced a “Best Practices Manual” that is routinely updated with centers’ insights and experience (which is available at http://erc-assoc.org/best_practices/best-practices-manual). In addition to this document, the program plans to provide a webinar/workshop that is targeted for those who might be interested in developing an ERC in the next competition – in advance of the solicitation deadline. The efforts will provide a comprehensive description of all dimensions of what is required for an ERC to be successful, emphasizing and providing a deeper understanding of all aspects (e.g., workforce development/education, diversity/culture of inclusion, and innovation) of the criteria that will be used in the merit review process.

Recommendation/Observation: “The COV believes it is important for the engineering education research programs to continue to encourage the translation of research to practice. EEC should explore ways to catalyze this phase. The committee suggests that the impact of the engineering education research, directly on students and practices, be assessed. Elements of NSF Advance Programs should be considered as a potential model for institutional transformation in the integration and practice of engineering education. RED is potentially a good catalyst and efforts should be made to assess its impact on the specific institution and, more broadly, the discipline.”

Response: We agree with this recommendation. The translation of education research into education practice is a long-standing problem. The Professional Formation of Engineers (PFE) initiative includes programs that span the research-to-practice continuum (e.g., the Research in the Formation of Engineers (RFE) and the **Revolutionizing Engineering and Computer Science Departments (RED)** programs). PFE is stimulated by the recognition that the engineering profession must be responsive to workforce needs, national priorities, and grand challenges. In FY17/FY18, EEC plans to increase the investment in K-12 and graduate levels, while also placing an increased emphasis on supporting and/or leveraging research on the translation of fundamental research to practice and building communities of practice. The relative lack of knowledge regarding effective strategies for propagating and scaling pedagogical reforms stems in part from the complex nature of the higher education ecosystem. For example, needs, resources, and cultures vary greatly between disciplines, departments, and institutions, making the transfer of

innovations to new settings challenging. Although some research suggests that change can be facilitated by developing “reflective teachers” and “shared vision”, additional research is needed to clarify which practices/approaches work best in different contexts. We will also explore new ways to further leverage and expand the impact of the RED program.

Recommendation/Observation: “It is time to include the LGBTQ community in this vision and definition of inclusion. Research is emerging that shows LGBTQ individuals have unequal access to opportunities in STEM fields, and engineering, in particular, owing to the hetero-normative, male-dominated demographic and culture of these fields.”

Response: EEC’s programs have been developed to help foster a culture of inclusion and broaden the participation of all groups in engineering. The Broadening Participation in Engineering (BPE) Program is a Directorate-wide initiative dedicated to supporting the development of a diverse and well-prepared engineering workforce. In particular, the division specifically funded two LGBTQ related projects in FY15 and another in FY16. In addition, NSF launched the “Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science” (NSF INCLUDES) program in FY16. This is a comprehensive initiative to enhance U.S. leadership in science and engineering discovery and innovation by proactively seeking and effectively developing STEM talent from all sectors and groups in our society. EHR serves the coordinating directorate for the program and has dedicated a program officer (Jolene Jesse) to serve as the program lead. The EHR/HRD DD (Sylvia James) & ENG/EEC DD (Mario Rotea) co-chaired the initial kick-off of the program. Sylvia James and Don Millard (EEC’s Acting Division Director/Deputy Division Director) have since been designated as co-chairs of the new INCLUDES Big Ideas Design Team, whose charge is to develop a vision document, white papers that address key components, a ten-year roadmap and a portfolio analysis for the program.

Recommendation/Observation: “The COV should also review the post-award processes, metrics, and management of the impact of the ERCs.”

Response: The post-award processes are fully documented in eJacket. The Volumes I&II of the annual reports could be provided for review during the next COV. We can also provide the metrics and data that is collected annually by the ERC’s contractor.

Recommendation/Observation: (COV Report, p. 11): “Based on the information given in the COV Data Book, Section II, the following comments can be made: ... 2) The report shows the demographic distribution of EEC Reviewers for all reviewers who self-identify. It would be informative to know the percentage of reviewers who did not self-identify.”

Response: This data is available and was provided to the COV in response to their request. It will be provided to the next COV as part of the background materials.

Recommendation/Observation: "The COV process should contain information used to ensure that the sample of proposals is a representative sample and unbiased, i.e., more information on the stratified random sampling."

Response: As stated at the start of the COV report Jackets were randomly selected to include the desired distribution of awards, declinations, and returned without review proposals within each program within each cluster across the three fiscal years under review. The Centers subcommittee also received invited (INVT) and not invited (NIVT) pre-proposals.

Each COV member in the Workforce Development/Broadening Participation in Engineering (WD/BPE) and Engineering Education subcommittees received 15 jackets and each COV member in the Centers subcommittee received 5 jackets due to the size and nature of Centers proposals versus other proposals. The number of proposals for each program was chosen to best reflect the overall portfolio while ensuring that the COV received proposals from across all programs.

Recommendation/Observation: "The issue of geographic diversity of reviewers is a significant challenge agency-wide and perhaps EEC could be a model for how to diversify the proposal review process."

Response: We recognize the challenge and appreciate the suggestions offered by the COV. We will consider the recommendations for improvement and explore new opportunities that allow us to augment the geographic diversity in our review process. There is also a foundation-wide effort underway to address this issue. We will do our best to employ the best practices that are developed.

Appendix: Diversity and COI Report

I. Committee Membership

The Committee of Visitors (COV) met on July 19 and 20, 2016 to review programs in the Division of Engineering Education and Centers (EEC) in the Directorate for Engineering. The COV Committee was composed of 17 members from the scientific and engineering community chosen for their breadth of expertise and experience in fields associated with EEC. The 17 COV members composed a diverse committee with respect to geography, type of institution, gender, ethnicity, age, sector, and scientific representation. The specific composition of the COV Committee membership was as follows:

Geographic and Demographic Representation

Geographic Region:

- Northeast (5)
- Southeast (4)
- Southwest (2)
- West (2)
- Midwest (3)
- Northwest (1)

Institution Types:

- 1 Private Educational Institutions
- 15 Public Educational Institutions
- 1 Industry

Demographics: 29% (5/17) female, 71% (12/16) male. COV members represented diversity in age and background.

Programmatic Representation

All members currently conduct or have conducted research in those disciplines, fields, or activities that are affected by EEC awards/outcomes and are extremely knowledgeable in the areas of EEC programs under review.

II. Conflict of Interest Report

A Conflict of Interest (COI) briefing was provided to all members prior to conducting COV-related activities. A COI briefing was also conducted at the start of the COV meeting by a certified NSF (ENG) COI Officer. All COV members completed the NSF COI form (NSF 1230P). All members of the COV were barred from seeing proposals from their home institution. None of the COV members was involved in the review of a program in which he or she had a pending proposal. The ENG COI officer was available at all times during the

COV meeting to answer questions and/or resolve issues regarding conflicts of interest. No real or apparent conflicts arose during the course of the COV review of EEC programs.