



**National Science Foundation**  
Directorate for Engineering  
Division of Engineering Education and Centers (EEC)

**Committee of Visitors**  
**Review of the Engineering Education and Centers Programs**  
COV Meeting Date: February 18 – 19, 2010

**COV Recommendations and EEC Response**  
Original Response: Jan. 25, 2011  
Updated Response:<sup>1</sup> August 22, 2011

Upon completion of their evaluation of the Engineering Education and Centers (EEC) Division on February 18-19, 2010, the Committee of Visitors (COV) issued a final report, dated March 15, 2010, with several comments and recommendations. The evaluation period was for fiscal years 2007, 2008, and 2009. This report offers a division response to the COV report. It is divided into 5 sections:

1. Overall COV Comments and Recommendations
2. Engineering Centers Sub-Team
3. Human Resources Sub-Team
4. Engineering Education Sub-Team
5. COV Process

Section 1 highlights responses to the overall priority comments and recommendations that transcend the three sub-divisions (Sec. 2 – 4) within EEC or that are significantly important to warrant targeted attention. Sections 2-4 focus more on responses to specific matters of the respective sub-divisions. Section 5 highlights matters related to the COV process itself.

Text that is italicized within this report is taken verbatim from the COV final report and the Executive Summary. Some wording is inserted (not italicized) in places within the COV recommendations and comments for clarification and flow.

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<sup>1</sup> The new EEC Division Director (DD) arrived on January 3, 2011. The original EEC response (i.e., 2010 response) to the COV report was not finalized by that time. Thus, in this response the new DD is integrating her comments with the original responses of the previous DD.

## 1. Overall COV Comments and Recommendations

- [Engineering education] *The COV strongly encourages the Foundation, the Engineering Directorate, and the EEC Division to **elevate engineering education alongside the core engineering science disciplines** given its strategic importance in maintaining the United States' pre-eminence in the world.* (Boldface emphasis in the COV report)

EEC is working diligently at this time under new leadership to bring focus to the critical research objectives for engineering education research. The division recognizes this rapidly growing scholarly field of research, and it is in the process of realigning its programs to meet the needs of this community for greater impact. It is also in the process of defining implementation and assessment strategies for maximum impact with limited resources. EEC is working with partners such as the ASEE, NAE, Engineering Directorate Advisory Committee as well as other divisions in the Engineering (ENG) and Education and Human Resources (EHR) Directorates.

- [Engineering education] *The Engineering Education Program is severely underfunded, as suggested in the previous (i.e., 2007) COV report. To increase the impact of the program, NSF must increase the funding. EEC is the only program that funds engineering education research. This positions EEC in a critical national role. This program can address major needs for workforce preparation.*

As is well-known, the NSF budget as a whole is facing challenges. In the short term, EEC program directors are working diligently to leverage its education research budget by partnering with EHR, CISE, and other directorates as strategically appropriate. For the long term, the division will keep in constant dialogue with ENG leadership (AD, DAD, and Division Directors) to advance this research agenda in the best ways possible.

- [Engineering Research Centers ERC] *NSF should consider adopting the ERC (3-yr. / 6-yr. review versus 5-yr. renewal review) review process as a best practice for all large centers such as NSECs and STCs. (That is,) the critical review cycle for the ERCs of three years and six years is particularly effective and should be considered as a best practice for large programs throughout the National Science Foundation.*

EEC agrees that the rigorous post-review process of the ERC program has had a tremendous impact on the research, education, outreach, and knowledge transfer outcomes that it seeks. EEC program directors also co-lead some of the NSECs, STCs, and other centers. However, ERCs are specific primarily to ENG and are closely tied to industry, while the other major center programs are NSF-wide and not as closely aligned with industry. Nevertheless, the 3-yr / 6-yr critical review cycle approach to post-award management is proven as effective in ensuring that center goals are kept on track; are realigned as necessary; and are eventually met. Having this approach adopted NSF-wide would require consensus across NSF major programs.

- [Human resources] *Given the successful track record of the REU and RET programs, additional funding must be provided to these programs for greater impact. There is a sense of urgency in this matter as expressed by the NSB report.<sup>2</sup> With concerns over the STEM pipeline, REU and RET are established models to address these concerns. (Furthermore), NSF leadership should adopt the RET program as a Foundation-wide program by charging other directorates to develop and fund similar, but collaborative, programs.*

Each year the REU and RET programs experience a significant increase in proposal submissions with many high quality proposals in the mix. However, the REU and RET budgets have remained flat over the past decade, thus negatively impacting success rates. In addition, the federal government is currently questioning the possible duplication of programs, and the impact of RET, in particular, is under discussion and in question. This last point suggests that the tremendous impact of the RET program is not widely known or understood.

Thus, lack of suitable funding levels and lack of effective communication about impact provide new opportunities. In the near term, the RET program manager has already succeeded in establishing a partnership with the CISE Directorate, which has committed \$1.2M per year to the program starting in FY11. The REU program manager continues to nurture external formal partnerships with DOD/AFSOR (ASSURE program) and DOE (Geothermal program).

Moving forward, EEC is now in a position to reexamine these programs and ensure that they are updated as strategically necessary for maximum impact. An REU/RET workshop is scheduled for Fall 2011 to study the current situation and the future of these programs. More external partnerships for both programs will be explored, such as with Homeland Security, to leverage the tight budgets and to meet national needs at the same time. The EEC DD and RET program manager will continue to seek partnerships within NSF. EEC will continue to champion these programs with the hope that funding increases may come in the future.

- [Proposal review] *The NSF procedures for mail-in versus panel reviews (education program) were not documented in the materials that the COV received. (Also,) in order for ad hoc (mail) reviewers to be effective, it is recommended that the reviewers have experience with center proposals or that they have multiple proposals to review to provide a basis for comparison (centers program).*

EEC will ensure that the appropriate type and number of reviewers are engaged in the evaluation of all EEC proposals. The Nano-ERC competition is ongoing, and this review process will provide the opportunity for EEC to establish best practices in its procedures.

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<sup>2</sup> The referenced NSB report is, "A National Action Plan for Addressing the Critical Needs of the U.S. Science, Technology, Engineering, and Mathematics Education System," NSB-07-114, Oct. 30, 2007. Also, see "Preparing the Next Generation of STEM Innovators: Identifying and Developing Our Nation's Human Capital," NSB-10-33, May 5, 2010. The latter report was published after the COV meeting but highlights how important this issue still is today.

- [Proposal review] *In general, there is the need for continued emphasis to reviewers on the expectations for reviews. NSF should provide **templates for the reviews (e.g., add strengths and weaknesses sections)**. The recommendation made by the 2007 COV review to provide example reviews from the past to panelists in advance of the meeting (as an effective mechanism to obtain good reviews) should be standard for all panels.* (Boldface emphasis in the COV report)

As standard practice, EEC program directors routinely solicit both first-time and experienced reviewers to serve as their ad hoc and panel reviewers. This approach provides an opportunity for mentoring new faculty and non-faculty (e.g., industry, etc.) reviewers in the NSF review process. However, as noted by the COV, inconsistencies in reviewer briefings have occurred.

Since the COV meeting the REU and RET program managers have prepared detailed guidelines that are provided to its reviewers in advance. These guidelines include a discussion of the two NSF review criteria on intellectual merit and broader impacts and instructions on evaluating proposals with respect to the REU- and RET-specific review criteria. They are currently updating these guidelines further with FAQs and providing examples of past individual reviews and panel summaries to reviewers.

For all of its programs, EEC will develop general templates for individual reviews and panel summaries that will emphasize strengths and weaknesses in the intellectual merit and broader impacts as well as program-specific review criteria. Although the EEC program directors (more often than not) provide advance guidance to the reviewers, inconsistencies are still noted across the EEC programs. The suggestion to provide example reviews from the past to panelists in advance will be implemented as appropriate.

- [Broader impacts review criterion] *There is a wide variation in how well broader impacts were addressed by reviewers (some reviewers just summarized the proposed activities without evaluative comments).*

The EEC program directors recognize this matter. EEC will address this issue in the upcoming division retreat in Sept. 2011.

- [Review panel summaries] *The 2007 COV review committee brought up the concern of panels repeating individual review statements (in panel summaries). Panel review summaries should document the panel discussion and the findings/discussion of the panel and not summarize the proposal itself. There is an indication in some cases (that) the panel summary is used to restate individual reviews.*

EEC program directors are already briefing the review panels more carefully about this matter. They will continue to monitor the quality of the panel summaries to ensure that they capture the valuable discussions that take place.

- [Reviewer profile] *More industry reviewers are needed – especially for ERC proposals. Efforts should be made to collect demographic data from review panels. The information provided reflects a significant percentage of unreported data – thus, it is of little value.*

Agreed. EEC program directors will utilize their network of contacts in industry, at non-profits, among venture capitalists, and at professional societies to establish a more robust reviewer database. Collecting demographic data of the reviewers, on the other hand, continues to be a challenge, because it depends solely on individuals volunteering to provide this information. Some individuals choose not to provide it. Nevertheless, the complex nature of EEC programs – i.e., the fact that they require the integration of research, education, people development, and knowledge transfer – necessitates the need for a broad-base community of reviewers which also covers the technical depth that is required for high-quality evaluations of proposals. EEC will strive to address this COV recommendation.

- [External leveraging opportunities] *Partnerships with other funding agencies (e.g., DOE, NIH) are a plus and should be pursued.*

Agreed. As noted above, EEC already has engaged in such partnerships. The MOUs with DOE to jointly support new energy ERCs were signed in 2010. Subsequently, DOE program managers participated in the ERC competition by attending site visits and the Blue Ribbon Panel meeting. In spite of the current federal budget cuts, DOE has committed to its intended 50% funding of two ERCs for five years with the possibility for renewal. In addition to the DOE/ENG MOU by the EEC Centers team, the EEC HR team has been resourceful in identifying funding sources and funding streams from DOD (AFOSR) and DOE (Geothermal) to leverage their budgets. Efforts will be explored to expand the scope of the formal MOU between the ERC program and DOE for HR-related programs. In addition, partnerships with other agencies (e.g., Homeland Security) will be explored.

- [Internal leveraging opportunities] *HRD<sup>3</sup> (EHR) and EEC are running programs independently of each other in the STEM fields. More collaboration should be encouraged to leverage funds. For example, ADVANCE (HRD) and BRIGE (EEC) both address underrepresented groups in the faculty. IEECI (EEC) and CCLI (HRD) both address curriculum issues. There is an opportunity to leverage efforts with the well-funded Robert C. Noyce and MSP programs (DUE<sup>4</sup>).*

There are two main points in this comment by the COV: 1) duplication of and 2) leveraging of EHR and EEC programs. In the examples cited in the comment, there is evidence of the lack of clarity by NSF in promoting its programs such as ADVANCE and BRIGE. The goal of ADVANCE is to develop strategies for advancing *all women faculty* careers in STEM and *not* to focus on the STEM pipeline. BRIGE, on the other hand, supports *junior faculty* without previous NSF funding to become mentor-scholars of students from underrepresented groups in the STEM pipeline. Thus, the programs are not duplicative, but there is opportunity to leverage strategies. Both the IEECI and CCLI programs funded projects to develop curricula, and there was some duplication. IEECI was terminated after the FY10 competition.

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<sup>3</sup> HRD: Human Resource Development Division, Directorate for Education and Human Resources (EHR)

<sup>4</sup> DUE: Division for Undergraduate Education, EHR

As for leveraging programs, EEC has partnered with many of the directorates and offices (e.g., SBE, CISE, OCI, GEO, EHR) as well as programs (e.g., IGERT, ATE, CAREER, and HBCU-UP). A recent example is the joint solicitation between EHR/DUE and ENG/EEC, NSF 10-569, for the STEM Talent Expansion Program (STEP) Center for Innovation and Entrepreneurship. A \$10M/5-year award was made recently to Stanford to develop a national center on education in innovation and entrepreneurship. Another example is the Network for Computational Nanotechnology (NCN). Although OCI<sup>5</sup> is not a formal partner in the cooperative agreement, it has made significant investments (>\$1.5M) to the NCN program for cyber infrastructure and middleware development.

Finally, since the COV meeting, EEC has established an informal monthly brown bag lunch session at which EHR and ENG program officers, science assistants, AAAS Fellows, and Einstein Fellows gather to share ideas and identify opportunities for collaboration. Another useful development is the Broadening Participation seminar series which is organized by HRD and includes all of NSF. The forum is held twice a month for presentation of ideas, best practices, research results, etc., which pertain to broadening participation in STEM research and education. In addition, the EEC program directors have jointly managed review panels for several programs. However, there is certainly opportunity to organize and expand these collaborative roles.

- [NSF outcome goal for research infrastructure] *Research tools (i.e., instrumentation, facilities, cyberinfrastructure, etc.) are without question critically important to advance basic knowledge and innovation. Human resources are also critical components of research infrastructure and, thus, should be given serious attention in terms of funding levels and integration into the research infrastructure fabric.*

As noted in the comment, research infrastructure is typically viewed as hardware, software, and facilities. However, EEC agrees that people are an integral part of the research infrastructure. The EEC program directors understand this view, and they manage their programs in a manner to ensure impact on people development through research training, formal education, and internships.

- [Public understanding of engineering] *The Division and Directorate is (are) encouraged to give priority to the NSB suggestion to develop programs to capitalize on the NAE effort to improve the public's image of engineering using the themes that have been identified to be effective and to unify the programs' message to increase the national impact.*

The ENG Directorate had a working group to explore the public understanding of engineering, and it issued a white paper with recommendations in FY10. Also, the NAE released the report, "Changing the Conversation: Messages for Improving the Public Understanding of Engineering," in 2008. The NAE is attempting to facilitate agencies, industry, and professional societies to leverage their efforts. NSF and EEC are working directly with the NAE in this regard. ASEE will be pulled into this discussion, too. The new ASEE Executive Director,

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<sup>5</sup> Office of Cyber Infrastructure, Office of the Director.

Dr. Norman Fortenberry, came from the NAE, and the EEC leadership has worked with him for many years.

## 2. Centers Sub-Team

- [Adequate number of reviewers] *It is not clear how many reviewers per proposal are appropriate. For center preliminary proposals and center full proposals, the numbers ranged from 3 – 6. ERC proposal reviews were more thorough than regular panels, but there are still some cases where only one or two reviews are substantive (mostly in the pre-proposal stage).*

For the Nano-ERC competition (NSF 11-537) EEC is implementing new processes that address these issues. The ERC team will ensure that each proposal has at least six reviews to address the range of requirements called for in the solicitation. They also will guide the reviewers to provide thorough evaluative comments. Before being approved as a reviewer, s/he will be asked if they have the time to commit to providing thorough reviews. A review template and guidance will be provided.

- [Consistency of review criteria during the competition] *There was one example provided to the COV, where there was a change in emphasis on certain critical issues as the process moved from pre- to full to site visit.... The COV realizes that variation in viewpoints during the process naturally occurs; however, some consistency is needed in the weighting of criteria throughout the process.*

The ERC team will ensure that the review criteria are clear and that their weighting is executed consistently between proposals throughout the competition. The ERC team will have to brief the reviewers repeatedly with the same message throughout the competition to ensure consistency.

- [Diffuse requirements and unfunded mandates] *Caution should be exercised to avoid underfunding new initiatives (unfunded mandates). Caution should be exercised to avoid diluting funding of core engineering and science efforts as Gen-3 initiatives are introduced.*

The budgets for Gen-3 ERCs were increased by \$250,000 over the budgets for Gen-2 ERCs to account for the costs of new features. In addition, supplements are given to Gen-2 and Gen-3 ERCs to carry out translational research in collaboration with small firms. Annually, the total support level has been \$2,000,000 from the ERC Program and another \$2,000,000 from the SBIR program. Budgets permitting, this support would continue in the future. The ERC program directors will monitor budget stress and its impact on productivity of the centers. Gen-3 ERCs are still nascent, and the ERC team will examine their implementation and impact.

- [Basic research/entrepreneurship balance] *Care needs to be taken that Discovery is preserved as ERC's move towards Entrepreneurship.*

Because ERC research programs are guided by the 3-plane strategic planning construct, there is always a balance of fundamental research, prototype/process development, and technology demonstration, i.e., from discovery through to systems testbeds. The new Gen-3 dimension is to move the ERCs into the innovation space through support for translational research. This

innovation and entrepreneurship key feature extends but does not replace fundamental research. Each ERC supports an Industry Liaison Officer (an ERC staff person), whose role is broadened to expand the center activities into the innovation space and to ensure that the researchers are not distracted from the fundamental scholarly work needed to advance the center vision. However, EEC will continue to take a careful look at the actual budget stress and its impact on fundamental research conducted in the Centers.

- [Open-theme center competitions] *There exists a need to maintain a number of open themes as the centerpiece of ERC competitions. This also applies to NSECs. There does not appear to be a need for a separate competition unless there is specific designation by Congress. Continuing to solicit proposals, which are not limited to targeted themes, will allow unanticipated emerging areas to be addressed (want creative and innovative efforts.)*

The general philosophy of the ERC program is to maintain the open-topic standard. Typically, if Congress or the White House has emphasized an area of interest, the PIs would respond independently to that interest through the open-topic ERC solicitation.

However, the FY10 competition embraced an opportunity for partnership with DOE that was of mutual interest given the broad range of grand challenges around energy. To DOE, the ERC program had a well-established review process, and its post-award management offered rigorous ongoing review of the centers. Thus, the ERC framework was of benefit to DOE to meet its agency objectives. New monies were not added to the ERC program internally. Instead, DOE offered to co-fund centers at the 50% level. They participated in the review process, and they will participate in the post-award management of co-funded centers.

The FY11 Nano-ERC competition is an anomaly. The NSEC program is gradually coming to a close, and three ENG-managed NSECs graduated in FY11. At the same time there is a great interest in advancing nanotechnology to nanosystems. Thus, the ERC program adopted the nanosystems topical area and launched the Nano-ERC competition. The competition is on an aggressive timeline so as not to lose the NSEC funding in FY12.

Unfortunately, federal budget constraints have impacted the timing for the next general-topic ERC competition. It is now delayed to FY13 rather than the anticipated FY12. Nevertheless, the competition will be run as usual. EEC expects the open-topic competitions to remain the norm.

- [Federal initiatives and ERC] *As new emphasis areas of discipline research (e.g., Nano, Energy) are defined (e.g., by Congress or partner funding agencies), new Centers should be competed through the ERC process, rather than as a stand-alone process that does not take advantage of the best practices developed over the history of the ERC program. For example, nanotechnology-focused centers (e.g., NSEC) should be integrated into the ERC program.*

Agreed. For example, the Nano-ERC competition is being run separately from a regular open-topic ERC competition due to funding timelines. However, all the elements and rigor of a regular ERC competition are being implemented, with the exception of the pre-proposal phase being excluded. The ERC process will be followed for any future initiatives (involving centers) that may arise from Congress or other agencies, if they are to be led by Engineering.

- [ERC management] *There are some processes in place to train other PDs, but if Lynn Preston were to retire now, the succession of a new director and maintaining program momentum would be difficult.*

The continuity of the ERC program management is a valid concern, given the shortage of program directors at this time. However, Lynn Preston hired a new permanent ERC Program Director who started at the end of August 2011. At the same time, she continues to leverage program director expertise in other divisions as needed. The two current permanent ERC program directors are well-trained by Ms. Preston, and either could assume the ERC leadership role on an interim or permanent basis.

- [ERC staffing] *The ERC program staff needs to be increased, given the workload. It is important to have permanent staff (rather than IPAs) to ensure a continuing high level of quality and efficiency in the management of these long-term investments.*

As mentioned above, a new ERC PD has been identified and hired after a formal search process. There is a slight possibility of bringing in another new person on a detail assignment from another NSF division. The heavy workload continues to be leveraged by PDs outside of EEC who have the appropriate technical expertise.

- [Junior faculty participation in ERCs] *New tenure-track faculty should be brought into ERC's to help them get started, get connected, and receive mentoring.*

Each ERC includes junior faculty based on needed expertise, but not as add-ons just for mentoring purposes or not in leadership roles. Their expertise must add value to the center. That said, the ERCs do provide a collaborative environment that could be a vehicle for mentoring. The idea of engaging junior faculty into an ERC is a good one, and the ERC PDs will encourage those opportunities.

- [Underrepresented groups in ERCs] *Greater participation of underrepresented groups in the research leadership of centers remains a challenge.*

The EEC DD and ERC team will monitor this situation. Broadening participation will have more rigorous oversight in the future than is currently taking place.

### 3. Human Resources Sub-Team

- [Non-Research I and community college institutions] *The 2007 COV report presented a recommendation to increase the participation of community colleges in the REU and RET programs. However, not much increase is noted in the new awards. To enhance the participation of community colleges and non-research intensive universities, consideration should be given to include specific language in the respective program solicitations that detail expectations for including the participation of representatives from these groups in site proposals. This would expand their participation beyond individual awards made to these groups (including awards to Minority-Serving Institutions MSIs).* (The last sentence is a combination of two sentences from the COV report but is still quoted text.)

The current REU Sites and Supplements Program Solicitation, NSF 09-598, contains in Section II (Program Description) the following paragraph:

“So that the REU program can succeed in attracting students into science and engineering who might not otherwise consider those majors and careers, projects are also encouraged, when appropriate, to involve students at earlier stages in their college experience. For example, some REU projects effectively engage first-year and second-year undergraduates by developing partnerships with community colleges.”

Similarly, the current Research Experience for Teachers in Engineering and Computer Science Program Solicitation (NSF 11-509) contains language encouraging the participation of community college faculty in the program. Below is just one example from NSF 11-509, in the Program Synopsis, of the emphasis placed on community college participation.

“The ... Research Experiences for Teachers (RET) in Engineering and Computer Science program supports the active involvement of K-12 ... (STEM) teachers and community college faculty in engineering and computer science ... research in order to bring knowledge of engineering, computer science, and technological innovation into their classrooms. The goal is to help build long-term collaborative partnerships between K-12 STEM teachers, community college faculty, and the NSF university research community by involving the teachers in engineering and computer science research and helping them translate their research experiences and new knowledge of engineering into classroom activities.”

EEC will continue to encourage community colleges to be involved in its programs more broadly. For example, EEC co-funded (\$350,000 award) and participated in the June 2011 NSF Summit on Community Colleges, which was organized by the National Academy of Engineering and the American Association of Community Colleges. The purpose was to better understand the role of community colleges in engineering education as well as to build more extensive partnerships among community colleges and the research directorates of NSF. Many representatives from community colleges were in attendance. This forum was also used to further broadcast NSF programs that may be of benefit to them.

- [Future of REU/RET] *Strategic planning should include plans to increase the funding to REU and RET programs as well as ideas to build upon the current successes and program impacts made over previous years.*

EEC will engage in a comprehensive strategic planning retreat in Sept. 2011. A joint mini-retreat for the Education Research and the Human Resources teams was already held in preparation for the division retreat. As REU and RET are tremendously successful based on their original objectives, the discussion of the future of these programs will be an important part of the retreat. The scope of their objectives will be revisited and refined in the context of building a framework for developing future engineers. Based on these discussions, funding needs will be determined more strategically.

- [K-12] *Investigate ideas/programs to impact pre-service K-12 STEM teachers.*

The RET in Engineering and Computer Science Program targets both pre-service and in-service teachers. In addition to the RET sites, programs that directly or indirectly impact K-12 STEM teachers are a core feature of the ERCs. The centers have been engaged in working with K-12 teachers for many years. Furthermore, the Engineering Education program also encourages PIs to develop formal programs involving K-12 teachers. In fact, one EEC CAREER awardee focuses her research-based education activities at the K-12 levels.

#### **4. Engineering Education Sub-Team**

- [“Must” recommendations] ***NSF is encouraged to address all the recommendations; however, the COV believes that the following three must be addressed:*** (Boldface emphasis in the COV report)

*- Given EEC’s unique role in engineering education research, the division must continue to drive the community to increase research rigor, similar to discipline research, including potential for transformative results, sound assessment and evaluation methods, concise review of the literature, and knowledge transfer and dissemination.*

In Fall 2010, EEC issued a new program description (PD 10-1340) for Research in Engineering Education (REE), which focuses on research rigor, similar to core engineering disciplinary research. The new language is very direct, as seen in the excerpt:

“This program discourages proposals that seek to simply implement and/or evaluate pedagogical innovations that have been previously shown to be effective for engineering students; such projects may be considered in the TUES<sup>6</sup> program of DUE.

An ideal engineering education research project addresses the iterative cycle in which research questions that advance understanding are informed by practice and the results of research are, in turn, translated into practice. In discussing how the planned work advances understanding, competitive proposals will ground the proposed work

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<sup>6</sup> TUES: Transforming Undergraduate Education in Science, Technology, Engineering, and Mathematics

both in a theoretical framework and relevant prior work, describe how the research advances knowledge of how engineering students learn, and discuss how the research results are broadly generalizable and transferable. In discussing how research can be translated to practice, competitive proposals take the point of view of a potential user of the educational innovation, describing how the research results can affect the practice or process of educating engineers, improve the infrastructure for engineering education, or build networks and capacity for engineering education research for example. Competitive proposals also contain a strong evaluation plan to inform the research effort and allow assessment of the project's impact and effectiveness.”

*- Sustained programs in engineering education are needed to establish and implement best practices, including programs that specifically address recruitment, retention, and advancement of women and URMs.*

The COV makes an important point regarding the sustainability of engineering education programs for suitable duration, such that best practices can be identified, established, and implemented. After the Education Coalitions era of the 1990s, the Engineering Education programs changed irregularly, such that monitoring their effectiveness was difficult.

The new REE program description mentioned above offers two one-month submission windows per year and allows the flexibility for PIs to propose ideas for their research with budgets that can be negotiated with the cognizant program director. The scope of the project dictates the time duration PIs would need to be successful in conducting the research. Thus, the intent of the EEC Engineering Education program is to use REE as a sustainable, flexible approach, rather than prescriptive, to achieve research outcomes that can be measured and adopted for major impact.

EEC program directors are very sensitive to the issues regarding the integral participation of women, URMs, and persons with disabilities in STEM. The PDs are, in fact, looking at defining alternative pathways for all students, both traditional and non-traditional students, to earn an engineering degree. Non-traditional students may include first-generation college (who may have to work full- or part-time) and Veterans returning from service (who can benefit from the GI Bill). These populations have a significant percentage of students from underrepresented groups who could potentially study engineering.

*- There is a need for a major program (collaborative, multi-PI, multi-university) effort to allow faculty to try high-risk ideas with the potential for high national impact.*

The new Research in Engineering Education (REE) program offers an opportunity for PIs to propose high risk ideas to two annual submission windows. In addition, EEC has posted FAQs that further encourage high risk/high pay off proposals. To stimulate larger projects, the new REE program invites proposals without dollar limits and with special encouragement of multidisciplinary teams.

Also, the new \$10M STEP national center on innovation was awarded to Stanford University in July 2011. EEC is contributing 50% of the budget at \$1M per year for five years. This center

requires an extensive partnership network comprised of other universities, industry, non-profits, and venture capitalists.

- [Unsolicited proposals] *The division should return to the practice of accepting unsolicited proposals to better encourage innovative research and collaboration. The target date for these unsolicited proposals needs to be on a perennial predictable schedule.*

As mentioned previously, the new REE program description was issued in Fall 2010 that invites unsolicited proposals with two specified windows for submission (January and August). This will be a perennial offering to invite proposals.

- [Project duration] *The impact of the research may have been reduced as (a) result of the short 2-year duration. Additional tracks are recommended that have, for example, single PI (e.g., \$300K for a min. of 3 years), small group PIs (\$750K for a min. of 3 years), and multi-PI/institutions (>\$2M/yr) up to 5 – 10 years.*

The new REE program description enables all of these tracks to be possible. Some proposals already have been submitted in FY11 that include small and multi-PI/institution teams. The new STEP center on innovation is an example of a multi-PI/multi-institution five-year \$10M award.

- [NUE evaluation] *NUE has run 8 years and should be evaluated for continuation.*

Funding from the NSF NNI<sup>7</sup> (Dr. Mike Roco) has been committed to proceed with a formal evaluation of the NUE program starting in FY12. NUE continues to serve the education mission of the NNI.

## **5. COV Process**

- [Awards portfolio] *To help the next COV, it is recommended that the geographic distribution data be normalized by the number of engineering faculty in each state and the population of each state. (Also,) Including a table that summarizes award size, number of investigators, and other appropriate characteristics would have been helpful to the COV.*

EEC will develop best practices for reporting demographics that will ensure that sufficient information is provided to future COVs. The requested information, and any other anticipated information, will be provided to the next COV.

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<sup>7</sup> NNI: National Nanotechnology Initiative

- [eJacket documentation] *The COV recommends that there be a comparative summary of the evaluations and awards provided to the COV.*

EEC will explore developing such a table. This type of table should be produced for each panel/competition and should identify how awards fit into the context of the pool of submissions.

- [ERC review advance preparation] *Two Centers teleconferences would have been helpful [to prepare the COV centers sub-team]. One earlier (two months before) to orient the group to the COV process, eJacket, etc. and a second one a couple of weeks before the COV to discuss observations after reading some of the jackets. Getting the matrix assignments earlier would have been helpful.*

Agreed. The Centers program is large and complex, and an additional teleconference will be included in future COV planning.

- [Program highlights] *Highlights could have been organized by subgroup.*

Agreed. EEC used a wholly web-based system for its COV for the first time. There were several lessons learned from this experience, some of which could be classified as “growing pains,” and EEC will work to prevent them in future COVs and to employ best practices from this experience.

This specific suggestion by the COV regarding highlights was presented in the context of improving the COV process for the Centers program. EEC will provide project highlights by subgroup for the next COV for the Centers as well as for Engineering Education and Human Resource Development.

- [Demographics of ERC reviewers] (For centers) *reviewers tend to be concentrated from the east coast - ... - especially the southeast.*

The ERC team will take a careful look at selecting panelists for the Nano-ERC and future competitions. In fact, this point on geographic diversity of the reviewers is an important one for all programs in EEC. An EEC reviewer database is being created, and gaps in all types of diversity (geographic distribution, university types, underrepresented groups, etc.) will be assessed and corrected as much as possible.