Update to the 2004 Committee of Visitors Report

NSF Division of Engineering Education and Centers

MEMORANDUM

As noted below, the following are observations, recommendations, and responses contained in the 2004 COV Report for the Division of Engineering Education and Centers (EEC), and the 2004 Response, the 2005 Update, and the 2006 Update to that COV report.

1. **COV Finding/Recommendation:** The COV notes that, while most merit review procedures were found to be effective, a wide variance in the overall quality and level of detail of the reviews was observed. The report supports the continued use of the review templates that are currently used in EEC programs and suggests that these templates should be further improved to increase their effectiveness.

   2004 NSF Response: EEC wholeheartedly endorses this recommendation and notes that review quality has improved significantly since program-specific review templates were instituted division-wide at the urging of the FY 2001 COV. We will implement the specific recommendations to appoint a chair for each review panel and to insert language in each template urging the panelists to submit their reviews before the panel meeting. We will also provide a reference to the NSF document that provides guidance for and examples of activities that address the broader impact criterion (http://www.nsf.gov/pubs/2002/nsf022/bicexamples.pdf).

   2005 NSF Response: We have continued to implement the recommendations outlined in our 2004 response, continuing review templates, appointing a chair for each review panel, and providing information on NSF guidelines for review criteria. While some variance in review quality likely will always exist, we believe that these steps are improving the overall quality of the reviews we are receiving in our panels.

   2006 NSF Response: The three specific actions indicated in the 2004 EEC Response have been continued. With these actions and the continued use of program-specific review templates, the review community has been continually educated as to what comprises a high quality review, with a commensurate increase in average review quality and decrease in the variance of that quality.

2. **COV Finding/Recommendation:** The COV suggests that the diversity of the reviewer pool should be increased and, while recognizing that current policies make the collection of comprehensive demographic data difficult, indicates its frustration with the poor quality of the demographic information provided to evaluate the diversity of the pool. In addition, the COV urges EEC to set diversity goals for all programs that are aggressive, but realistic.

   2004 NSF Response: Although there is room for improvement, EEC review panels currently include a significant number of women, underrepresented minorities, and industrial reviewers. Regarding data availability, there is talk of expanding to all of ENG a successful pilot in SBIR and CMS of a system that prompts reviewers until they self-identify their demographic information. EEC will participate enthusiastically in such a system.

2005 NSF Response: EEC review panels have continued to be diverse, with significant numbers of women, underrepresented minorities, and industrial reviewers participating in panel reviews. A Directorate-wide reviewer database, however is not available as of this writing, but an effort is underway to complete its development. In the meantime, we are working to maintain better records on reviewer demographic information for future COV evaluations.

2006 NSF Response: EEC is always striving to improve diversity and its review panels reflect among the highest, and probably the highest, level of diversity within the Engineering Directorate. As pointed out in the recommendation, if reviewers choose not to self-identify their ethnic or racial characteristics, NSF staff are not allowed to assess them. The hoped for rollout of the Directorate-wide reviewer database has not yet occurred.

3. **COV Finding/Recommendation:** The COV found that the EEC portfolio of awards is consistent with program guidelines and reviewer recommendations. While praising the ERC program for its innovative awards, integration of research and education, and identification and support of new investigators, the COV recommends that smaller, interdisciplinary teams be funded in preference to increasing the size of individual ERC awards.

2004 NSF Response: Developing a viable mechanism for funding "small, interdisciplinary groups" in ENG has been under discussion for at least 10 years. The establishment of the Nanoscale Science and Engineering Initiative enabled the funding of a significant number of Nanoscale Interdisciplinary Research Teams (NIRT), but did not address the broader issue of how to foster efforts in other disciplines of a scale between individual investigator awards and ERCs. In the current budget environment, even keeping ERC funding flat will only allow very limited funding for such efforts. This may be a good time to begin a planning process for the time when budgets begin to increase again.

2005 NSF Response: As noted in our 2004 response, developing a viable mechanism for funding small, interdisciplinary groups would require an improved budget environment than we are current facing. As part of the ENG strategic planning process, new ideas for funding future ERC programs are being explored that could include a provision for funding of smaller groups pursuing higher risk research. However, no decisions have been made as of this writing.

2006 NSF Response: The Directorate for Engineering will be reorganized in FY 2007, to include an Office for Emerging Frontiers in Research and Innovation (EFRI). EFRI will recommend, prioritize, and fund interdisciplinary initiatives at the emerging frontier of engineering research and education. These investments will represent transformative opportunities, potentially leading to new research areas for NSF, ENG, and other agencies, and the inception of new industries providing opportunities for US leadership in, and/or significant progress on recognized national needs. Per project funding of up to $500,000 per year for up to 4 years should be sufficient to fund the types of small, interdisciplinary teams suggested by the COV.

4. **COV Finding/Recommendation:** The COV observes that EEC programs have been highly successful in meeting the PEOPLE goal and that its programs have had a dramatic impact on diversity, curricula, and pre-college outreach. Further, EEC

programs have provided the impetus for entirely new degree programs, produced breakthrough results that are redefining performance limits in critical technology areas, and are making significant contributions to economic development.

> **2004 NSF Response:** We agree.

> **2005 NSF Response:** EEC continues to actively support the NSF PEOPLE strategic goal.

> **2006 NSF Response:** This is still the case. We're particularly proud of the 2006 Class of Engineering Research Centers (ERC).

5. **COV Finding/Recommendation:** The COV observes that the overwhelming majority of EEC awards are to research-intensive institutions and that more capacity needs to be built at other institutions.

> **2004 NSF Response:** There is a bit of a "chicken and egg" issue here, in that many smaller engineering institutions don't have the infrastructure to generate competitive proposals in our mainline programs. We are encouraging partnering and have asked ERCs to reach out to non-research-intensive institutions. We have also asked REU sites to recruit from smaller schools and have provided a number of Department-Level Reform planning grants to small departments and an implementation award in FY 2003 to Sweet Briar College to set up a new engineering program.

> **2005 NSF Response:** The size of ERC awards still demands that a competitive proposal show that a significant research infrastructure is available to support the research. While this still favors the research-intensive schools, we are beginning to see ERC proposals from new schools that would not be classified as of this writing as research intensive. They are not yet competitive, but we believe that the proposal experience could help them in understanding how to become more competitive in these large programs. The ERC program continues to require that Centers develop partnerships with non-research intensive schools, and these have provided an excellent means of involving faculty and students in cutting edge research. In other EEC programs, particularly the I/UCRC program and the engineering education programs, there is a broad range of institutions being supported.

> **2006 NSF Response:** The steps outlined above are beginning to show progress. The ERC for Reconfigurable Manufacturing Systems at the University of Michigan has recruited Morgan State University, an HBCU, as a core partner and is working with Morgan State to upgrade their manufacturing programs. Several ERCs are establishing 4+1 programs to recruit students from predominantly undergraduate institutions to pursue masters degrees, with the hope that many will continue to doctoral studies. Interestingly, the Sweet Briar College engineering program was studied as a possible model for a proposed new engineering degree program (that would be the first 4-year engineering degree program at a Tribal College) at Salish Kootenai College, in Montana.

6. **COV Finding/Recommendation:** The COV recommends that EEC undertake a comprehensive study to answer the following questions: What will ERCs look like in 5-10 years? What are the overarching goals of the EEC Educations and Human Resource Development Programs?

2004 NSF Response: EEC is intensifying its efforts to address these issues and the appropriate metrics for evaluating progress as part of the ENG-wide strategic planning process that is currently underway.

2005 NSF Response: As part of the ENG-wide strategic planning process, EEC has been actively addressing these two questions. The ERC program is being examined in light of 20 years of success, and proposals for new ways of continuing the program for the next 10 years are being explored. As of this writing, these plans are still in development but we expect to have any changes in the program implemented before the next round of ERC proposal preparation. Overarching goals for both the engineering education and human resource development programs have been developed and are included as part of the EEC and ENG strategic plans.

2006 NSF Response: The first phase of the ENG-wide strategic planning process is complete and has resulted in a major reorganization of the Directorate for Engineering, effective October 1, 2006. EEC was an active participant in the planning process. Among the changes for EEC is the inception of a "Third Generation" of the ERC Program in the FY 2006 solicitation. The new generation will focus on transformational research and education, innovation, partnership with small business, and international collaboration. In addition, EEC's education programs have increased their emphasis on the fundamental study of how engineers learn engineering and deemphasized the development of engineering curricula without the benefit of such understanding.

7. **COV Finding/Recommendation:** The COV requests that increased attention be paid to planning and assessment of the education and human resource assessment programs, including cross-project evaluation.

2004 NSF Response: We are well on our way to realizing this suggestion, having funded a formal evaluation study of the department-level reform program from its inception in 2002, initiated an evaluation of the RET program in 2003, and completed a study of the PFI program in 2004.

2005 NSF Response: The initial study of the RET program has been completed and a more expanded study will begin in FY06. The other studies are still underway. In addition, we are beginning the planning for an evaluation study of the REU sites program.

2006 NSF Response:

EEC co-funded the National Academy of Engineering studies, *The Engineer of 2020: Visions of Engineering in the New Century*, published in 2004, Educating the Engineer of 2020: *Adapting Engineering Education to the New Century*, published in 2005, and *Enhancing the Community College Pathway to Engineering Careers*, published in 2005. In addition, the SRI International studies, *The Impact of Industry Interaction with ERCs* and *Evaluation of the Research Experiences for Teachers (RET) Program: 2001-2005* were completed in 2004 and 2006, respectively, and the study of the planning awards for the Department-level Reform and Bridges for Engineering Education programs, *Educational Innovation Through Interdisciplinary Collaboration: A Study of NSF Planning Grants, 2002-2003*, was completed in 2006. Evaluations of the Bioengineering and Bioinformatics Summer Internship (BBSI)

Program, the Research Experiences for Undergraduates (REU) Site Program, and on the economic impacts of the 3 Engineering Research Centers that graduated in 2006 were initiated in 2006.

8. **COV Finding/Recommendation:** Finally, the COV made recommendations with regard to the COV process. They requested that their instructions be modified to better specify the expectations of the NSF with respect to the deliverables from the COV process, that they be provided with easy electronic access to jackets, and that a method be developed for the random selection of an adequate number of jackets to provide a valid sample across all programs.

> **2004 NSF Response:** The COV instructions are modified every year and seem to be improving. This recommendation should assist that process. The jacket selection process is more difficult. For the FY 2001 COV, we selected every 10th jacket by jacket number, which should give a random sample, and in FY 2004, the chair of the COV selected the jackets for examination to assure broad program coverage. Both methods were found to be inadequate by the respective committees. As the FY 2004 COV observes, EEC programs are so diverse that it may be impossible for the COV to examine enough jackets during their time at NSF to make them feel comfortable that they haven't missed something. The answer may be to give COV members easy remote access to all of the jackets before the COV. We attempted this in the FY 2004 COV with mixed success, since we were the first to try it and we encountered a number of bugs. Nonetheless, the COV members took full advantage of the access they got and strongly recommended that NSF make the necessary modifications to the e-Jacket system to make early electronic access possible for future COVs.

> **2005 NSF Response:** Access for the COV to eJacket is available now. Using what we have learned in the past two COVs, we will attempt a better sampling strategy for the next COV.

> **2006 NSF Response:** We are pleased that the granting of electronic access to COV members prior to their meeting is now the standard procedure at the NSF and believe that the pioneering experiment of the 2004 EEC COV had some influence on the development of this capability.