



MEMORANDUM

DATE: March 12, 2009

TO: Thomas W. Peterson, AD/ENG

FROM: Lawrence S. Goldberg, Acting DD/ECCS

SUBJECT: Division Response to Report of the Committee of Visitors for the Electrical, Communications and Cyber Systems Division, June 16-18, 2008

I wish to express my thanks to the members of the ECCS Committee of Visitors (COV) for their thoughtful and detailed review of the Division's programs and for the timely completion of their report. I also wish to commend the ECCS staff for their dedicated efforts and spirit of teamwork exhibited in assembling the large volume of material and information for this review.

I am pleased that in its summary observations the COV judged the ECCS Division to be highly successful in all aspects of performance, and that the portfolio of awards managed by the Division is effective in addressing Directorate, Foundation, and National priorities as well as furthering the NSF goals of advancing discovery, learning, and research infrastructure. I want here to recognize the COV's commendation of then Division Director Dr. Usha Varshney for her skillful management and leadership of the Division.

The COV noted that the program areas covered by ECCS have become even more important to the Foundation and the Nation over the past few years. All of NSF's targeted challenges – Science and Engineering beyond Moore's Law, Dynamics of Water Processes in the Environment, Adaptive Systems Technology, Cyber-Enabled Discovery and Innovation, and National Nanotechnology Initiative – will require groundbreaking technological developments in electronics, photonics, controls, adaptive networks, power, and complex systems. ECCS not only funds basic research in these areas, but has been the origin of many novel interdisciplinary efforts that have laid the groundwork for addressing these challenges. In the COV's view, ECCS-funded research will play a similar instrumental role in addressing many of the Grand Challenges identified by the National Academy of Engineering.

However, the COV also identified in its summary observations several areas of concern it believes are beginning to undermine the effectiveness of the research areas for which ECCS is responsible. The COV recommends that vigorous action is needed by ENG and NSF to improve the funding level for ECCS. The COV's concerns (paraphrased in *italics*) are: (i) *Limited funding means the ECCS programs are not very deep in their coverage of topics;* (ii) *The average award size lags behind ENG and NSF in providing for research costs;* (iii) *Most proposal budgets are, as a result, renegotiated downward prior to funding;* and (iv) *Without increased funding, ECCS should take prompt action and choose to decrease its success rate in order to increase the average award size.*

I believe the COV has raised a critical issue for ENG consideration regarding the funding level for ECCS in order to sustain the effectiveness of ECCS programs (See extended COV comments on this issue later in Section C.4). The issue of average award size versus success rate is one for which ECCS has striven to find the right balance. Following the recommendation of the previous 2005 COV, ECCS has consciously raised its average award size for individual investigator awards from \$210,000 in FY2004 to \$300,000 in FY2008, with the intent of reaching a more enabling average award size of \$350,000. ECCS also intends to provide a higher average award size for small groups of up to \$450,000 as appropriate. We are aware though that Director Bement has expressed the view that maintaining success rate is important for the Foundation. ECCS intends to continue its emphasis of maintaining a high success rate for CAREER awards, which we view as our most important investment for the future. We will continue to monitor progress in these areas.

It should also be noted that the above award size statistics focus on individual investigators only. The comparable award size data for all ECCS research awards has been raised from \$303,000 in FY 2004 to \$336,000 in FY 2008.

The COV provided extensive specific commentary in addressing Parts A, B, and C of the Template. Selections of these comments are *paraphrased in italics* below and are followed, as appropriate, by an ECCS response in normal text.

Part A: Integrity and Efficiency of the Program's Processes and Management:

A.1: Quality and Effectiveness of Merit Review Process

A.1.1-3: The panel process seems appropriate and well-managed, panels are well organized, proposals are reviewed by 3 or 4 independent reviewers and then discussed by a larger review panel, almost all reviews address both merit review criteria, and the independent written review evaluations of a proposal appear reasonably consistent in their ratings.

A.1.4: In cases where the panel consensus differed significantly from the individual reviewers' ratings, the panel summaries need to provide a clearer rationale for the decisions.

ECCS program directors are giving increased attention in each panel they moderate to assuring that the panel summaries clearly reflect the consensus of the panel's discussion and recommendation for all proposals considered. Panel summaries are read by all panelists and the Program Director for their content and consistency with the panel's recommendation before final approval is given at the end of the panel meeting. We will continue to monitor progress in this area.

A.1.7: ECCS was exemplary in achieving an average dwell time for proposals of just 4.78 months, setting an NSF record of time-to-decision of under 6 months for 98% of all proposals in FY2006 and ranking second NSF-wide in FY 2007.

This recognition goes deservedly to efforts of all ECCS Program Directors under the direction of Dr. Varshney.

A.1.8: The broader impacts criterion is not adequately addressed in many individual reviews, especially with regard to educational impacts, pointing out that most discussion is on intellectual merit.

ECCS Program Directors place strong emphasis on the need that balanced discussion be given to both review criteria when they invite and send formal written guidelines to potential

panel reviewers. The Program Directors also emphasize that the panel's discussion of each proposal should address what the proposal itself has identified as its broader impacts, including educational aspects. ECCS will continue to monitor progress in this area.

There are several suggestions to improve the Panel Summary: clear feedback should be given to PIs in the case when their proposal is not recommended due to serious failings so that it not be resubmitted; the panel summary should be drafted by a panelist who has not provided an individual review to assure that the overall panel discussion is more evenly captured; and the Division should standardize on consistent use of three recommendation categories - highly recommend, recommend, and not recommend.

The ECCS Division is now uniformly using the three recommendation categories in all of its panels. As a matter of standard procedures, we assign panelists who have not provided written reviews to be panel scribes and also to read the proposals, although on occasion when conflicts arise during the panel, other panelists must be assigned as scribes and sometimes they are also reviewers. We also seek to have the panel summary provide guidance to the PI on whether the proposal could be improved and possibly resubmitted or not.

There were instances where program officers overrode a panel's recommendation without clearly laying out the rationale for their decision in e-jacket.

The Division Director requires all ECCS Program Directors to provide a clear rationale in their own words for all funding recommendations, including those that may differ with the recommendation of the review process. This process has been in place and will continue to be emphasized by the Division Director before an award recommendation is concurred.

A.2: Selection of Reviewers

A.2.1,2,4: Reviewers selected by ECCS typically had appropriate expertise and qualifications, and recognized in a positive sense that there was increasing participation by reviewers from industry, government agencies and laboratories. The number of first-time panelists has been increasing, reaching almost 40%, which serves an important part of educating future PIs. More geographic, ethnic, and gender diversity is needed. However, the EIS summary statistics did not provide them useful demographics of reviewers.

ECCS Program Directors are very conscious in organizing panels that they need to bring in new reviewers to the system and have consideration of demographic and geographic diversity, including from industry. This remains a continuing challenge in providing appropriate expertise and background to enable a fair and balanced review process, but we are achieving progress in a steady way as noted by the COV. In order to keep track of the demographics for each of our panels, we have developed a table (in aggregate numbers, not identifying specific individuals) listing all categories of interest such as gender, ethnicity, industry or government, first time ECCS or NSF reviewer, current grantee, etc. The recommendation by the COV that we conduct our panels off-site around the country to reach a broader pool of participants is, in my view, too costly for ECCS to implement.

A.2.3: Not all e-jacket recommendations explicitly addressed whether there were conflicts of interest or how they were dealt with.

All ECCS Program Director recommendations for awards and declinations are now based on use of a standard template implemented in this past year, which has a category for Conflicts. Program Directors are required to state whether there was a conflict for the proposal, and if so, that the reviewer in conflict was recused from the panel discussion.

A.3: Resulting Portfolio of Awards

A.3.1-2: The overall quality of the projects funded appeared to be high, though it was difficult to judge project quality based on the annual and final reports provided by PIs. Integrating research and education is clearly an important consideration by reviewers in CAREER proposals, and there were positive instances in regular proposals that reviewers gave recognition to PIs for addressing education and broader impacts.

I believe the use of Highlights by the COV provides a better basis by which to evaluate the quality of projects. Many of us at NSF have suggested that the submission of Highlights be incorporated into the FastLane reporting system to more effectively improve the process by which PIs report on the Outcomes of their projects. We are finding that our reviewers are becoming increasingly familiar with use of NSF's two review criteria, and this is reflected more and more in their evaluations.

A.3.3: The average ECCS annual award size is small compared to other ENG Divisions, and ENG in turn is small compared to NSF as a whole. This was also noted by the previous 2005 COV. It is risky to under-fund projects, even when that is the only way to achieve higher funding rates.

These issues are addressed by the COV more fully later in sections C.1, C.2, and C.4, and are responded to there.

A3.4-5,7-12: The ECCS program portfolio contains an appropriate mix of innovative and evolutionary projects. CAREER, SGER, and NER programs are seen to play particularly important roles in potentially transformative research. ECCS is commended for bringing the funding rates for CAREER awards up from 11% in FY2005 to 19% in FY2008. The program portfolio has an appropriate balance of interdisciplinary projects. ECCS makes a significant percentage of awards to new investigators, which was 31% of all awards in FY2007. The portfolio displays good geographic balance, balance across disciplines, and appears to have appropriate participation of underrepresented groups, as best as could be determined. The ECCS programs are highly relevant to national priorities and the Division allocates resources accordingly.

A3.6,13: There is good balance between single and multiple investigator awards, but the award size needs to be commensurate with the number of investigators. A large number of the proposals reviewed had proposed budgets reduced prior to the awards, sometimes by rather large amounts, which can seriously affect the scope of work. In situations where a budget reduction will likely be requested, the panel should be asked to comment on whether the projects will downscale effectively.

ECCS will seek to address this concern in the panel review process. For those proposals recommended by the panel, Program Directors will ask the panel to comment whether a resultant lower level of effort is still consistent with the panel's evaluation when a possible award may be funded at a lower budget level. We will continue to monitor progress in this area.

A.4: Management of the Program Under Review

A.4.1-3: Division Director Varshney was complimented for her effective management and reorganization of the Division and in developing a fine sense of teamwork among the Program Officers. The Division was proactive in identifying and responding to changing and emerging opportunities, and in leveraging investments through joint programs with other agencies. The Division was also complimented for its management of Foundation-wide

activities such as the National Nanotechnology Infrastructure Network (NNIN) and the Network for Computational Nanotechnology (NCN), and in initiating the Graduate Research Supplements (GRS) program.

ECCS will continue to engage its research community in helping to define the emerging and future challenges. ECCS will also continue to seek cooperative opportunities within NSF and with other agencies and organizations. We are proud of the critical role the Division has had in guiding the NNIN, NCN, and GRS activities.

A.4.4: ECCS has addressed all six key issues identified in the 2005 COV report in an effective and fully satisfactory manner, providing an annual response documenting its progress in each area. These six issues were: (i) Impact of program outcomes; (ii) Appropriate use and support of innovative projects; (iii) Breadth of research program; (iv) Understanding and use of NSF Merit Review Criterion 2; (v) Diversity of reviewer base; and (vi) Follow-up on GOALI awards.

The guidance provided by the previous 2005 and current 2008 COV is critical to keeping the Division focused on those issues and metrics important to sustaining effective stewardship and progress.

A.4.5: The COV recommends that future GOALI grant recipients be required to demonstrate and report efforts to disseminate and commercialize results.

The GOALI FY2007 solicitation targets research that includes a focus on transfer of new knowledge between academe and industry, but does not itself require efforts to commercialize results. ECCS will assess its existing and prospective GOALI awards based on the efforts by the PIs for effective knowledge transfer between academe and industry. We will continue to monitor progress in this area.

Part B: Results of NSF Investments

B.1-3: The discovery-mission of NSF is well addressed by ECCS programs, with important examples identified in energy, communication systems, medical applications, control systems, nanoelectronics, sensors, networks, among others. The ECCS Division is also investing through its grantees in a broad scope of learning programs, ranging from teacher training to K-12 to general outreach to programs addressing undergraduate and graduate education, some of them targeted at underrepresented groups. NSF's goal of building the nation's research capability through critical investments in advanced instrumentation, facilities, cyber-infrastructure, and experimental tools has been met with a high degree of success, particularly through the large-scale facility networks that ECCS manages: NNIN, NCN, and the Photonics Technology Access Program (PTAP), and its significant investments through the Major Research Instrumentation (MRI) program. Many of the smaller funded proposals reviewed, while not having infrastructure as a principal focus, appear to be laying the grounds for later infrastructure development.

ECCS considers its investments to be well balanced in advancing discovery, learning, and research infrastructure. We are particularly proud of the role ECCS has had in leading the establishment of an NSF-wide investment in the NNIN.

Part C: Other Topics

C.1: The importance of ECCS programs is substantial, but because of limited funding its programs cannot be very deep in the coverage of their topics and this can present a serious risk in dealing with emerging areas and grand challenges.

C.2: ECCS is funding research grants at levels significantly below the ENG and NSF averages, thus impacting the effectiveness of the projects.

C4: ECCS has done an excellent job of responding to upper management's emphasis of increasing award success rates, with clear trends over the past three years. However, the ECCS discretionary funds have actually decreased such that in FY2007 they accounted for just 42% of its budget. The proposed budgetary percentage increase for ECCS in FY2009 is less than half that planned for CMMI, and only a third of that for CBET. ECCS is already seriously underfunded, and the planned budget simply compounds the problem. If the budgetary constraints are not alleviated, ECCS should cut back on its success rates rather than continuing to underfund projects.

The COV'S concerns expressed in Sections C.1, C.2, and C.4 were summarized in the COV Executive Summary, and are responded to by ECCS at the beginning of this document in the fifth paragraph.

C.3: The statistics on gender, underrepresented minorities, and persons with disabilities are impossible to interpret with any confidence, given that only about 55% of PIs report this information.

This was discussed earlier in A.2.1-4. NSF is exploring ways to address this issue.

C.5: Four categories of changes in procedures are recommended that could streamline the COV process: (i) Each COV member should complete the jacket review in advance electronically and send initial remarks on Sections A-1 and A-2 to the Chair; (ii) choose break-out sessions on discussions of major sections of the report, rather than on the basis of program areas; (iii) create a template for pulling EIS summaries relevant to each section of the COV report; and (iv) included at least one member of the previous COV in the group.

Each of these suggestions are thoughtful and should be considered by ENG in setting up future COVs.