EXECUTIVE SUMMARY

The Committee of Visitors (COV) met on September 15-16, 2014 to review programs in the Electrical, Communications, and Cyber Systems Division (ECCS) in the Directorate for Engineering. The review covered the three years of FY11-FY13. During the review, the COV evaluated 255 jackets (proposal actions) that were randomly selected over the three-year time period. Oral presentations of the programs and processes were provided by the Division Director, Dr. Samir El-Ghazaly, and Program Directors. The 2011 COV report and the Division response to that COV were also provided. To facilitate the work of the COV, the ECCS Division created an ECCS Self-Study Data Report to use in conjunction with the sampled jackets. Complementing the COV Report Template, the workbook presented data, definitions, and explanations that the COV found useful in evaluating merit review and program management processes from the period under review (FY11-FY13). Each tab of the workbook directly related to a question in the template, thus making it easy to use. In keeping with the charge to the COV, the data provided in the Self-Study presented primarily retrospective information.

The 2014 COV report follows the 2014 NSF template for COV Reviews. Part I addresses the quality and effectiveness of the program's use of the merit review process, Part II addresses the selection of reviewers, Part III concerns the management of the program under review, while Part IV answers questions about the portfolio of awards. The COV report concludes with comments and recommendations under Other Topics regarding agency-wide issues that might be addressed by NSF to help improve the program's performance.

The COV review of the ECCS was accomplished with the Division's mission in mind to:

- *Address fundamental research issues at the nano, micro, and macro scales underlying device and component technologies, energy and power, controls, networks, communications, computation, sensing and cyber systems*
- *Support integration of systems principles in complex engineering systems and networks for a variety of applications areas*
- *Ensure education of a diverse workforce to meet the technological challenges of a 21st Century global economy*

Research supported by the Division is critical to our international competitiveness in engineering science and technological innovation and to the development of the future generations of researchers. The Division's proactive engagement in cross-disciplinary research initiatives with other NSF Divisions and even other agencies (such as DoE and NIH) and industry have helped diversify the research breadth of ECCS and have inspired new research frontiers in science and engineering. The Division's support of cooperative efforts with the semiconductor industry on new nanoelectronics concepts beyond the scaling limits of silicon technology emphasizes emerging areas of diagnostic, wearable and implantable devices, brain-like networked architectures performing real-time learning, and neuromorphic engineering. Primary application emphasis is on revolutionizing healthcare, the efficient generation and management of energy from the environment, the continuous pursuit of cyber-physical systems to enable solutions to several of the NAE Grand Challenges, and enhanced access to the radio spectrum (EARS).

The Division is also to be complimented for its continued successful management of its core program and CAREER and EAGER programs, and for the tremendous impact on education, research and technology transfer it has had through these programs. The COV was very impressed by the active and thoughtful management, organization and new initiatives of the ECCS program. We commend the Division Director on the outstanding team he has assembled. All processes are well managed, staff morale is high and the leadership and enthusiasm of the Division Director and all the PDs help keep ECCS at the forefront of engineering science. It became obvious that the Division Managers and Program Directors are working cooperatively and are supporting each other's efforts and goals. The balance and breadth of the award portfolio is excellent, with a diverse awardee and reviewer base, and proposal dwell time well below foundation goals.

The 2011 COV identified some areas that had the potential to have an impact on the Division's ability to maintain excellence going forward, which the Division took actions to address. In response to the 2011 COV's recommendations, some of the actions taken addressed the issues (recom #3 of 2011 COV report), others solved the problem partially (recom #2 of 2011 COV report) and others may have introduced unwanted consequences (recom #1 of 2011 COV report).

Our observations and recommendations about new issues or derivative issues from actions taken in the past three years are presented below, in no particular order:

1. **Submission Window for Unsolicited Proposals**

The 2011 COV was concerned that the increasing number of proposals (1400 annually) combined with low award rates (16 percent funding rate for unsolicited proposals) and the impact these are having on the quality of proposals and reviews. In response to this observation, ECCS implemented a major change to partially address this concern: *the submission windows for unsolicited proposals were reduced from two to one window per year*. The rationale for this move was that with one window per year, the number of submitted proposals would decrease while the quality of the proposals would, presumably, increase. Also, program directors would have more time to organize and coordinate the panel meetings in addition to other important activities, such as planning workshops and to reach-out to technical communities.

However, limited data so far are inconclusive whether the anticipated outcomes have been achieved. On the contrary these data indicate that the unsolicited proposal rate became marginally lower. The 2014 COV expressed a concern about the impact of the single window per annum relative to the ability of junior faculty members to successfully compete for grants in a way that makes them successful in their faculty careers, especially as it pertains to the promotion and tenure requirements. The COV makes the following two recommendations in relation to the above concerns:

- ECCS should collect more data and should modify the submission process (timing of submission and submission window) as needed to achieve the desired outcomes
- ECCS should consider developing a program similar to the Research Initiation Grant Program to help young investigators in their early stages of their research career

2. Understanding the impact of the extensive use of panels on the merit review process:

As per ECCS self-study, the vast majority of the proposals are reviewed via traditional on-site panels. More specifically, approximately 80 percent of the proposals are reviewed by on-site panels, while less than 20 percent are reviewed by hybrid panels and less than 10 percent are reviewed by virtual panels. The overall impression of the COV is that the panels consist of experts in the field, are well run and provide an effective and fair review of the quality of proposals with regards to their intellectual merit and broader impacts. The panels promote active dialog among the panelists, which yields a more thorough review than would individual ad hoc reviews.

While panelists are carefully selected to provide the panels a fair review of the quality of the proposals, the division directors and program managers report that the selection process and arranging for onsite visits are both time consuming and cost ineffective. ECCS is encouraged to consider running a pilot program to assess the effectiveness of virtual and hybrid panel reviews. Such a pilot will point to the efforts that need to be undertaken to make these panels effective and efficient. Using technology effectively to reduce the number of on-site visits may reduce the time of review and may encourage more experts to participate in review panels.

3. Success of the Supplemental Funds Programs (REUs/RETs)

ECCS and NSF have spent substantial resources as part of the Supplemental Funds Program (REUs/RETs) but have done so without assessing the success of this program in achieving its expected goals: to provide more opportunities to undergraduate students for participation in research and thereby making U.S. students more interested in pursuing higher degrees. The COV suggests that ECCS device a way to assess the effectiveness of this program.

4. Understanding the Broader Impact Merit Review Criterion

The 2011 COV mentioned in its executive summary that "Foundation-wide there appears to be confusion in the review base about what is meant by broader impact, and what high quality broader impact might look like." In its report, the 2011 COV suggested that there is a need to continue and enhance these efforts by ensuring that every panel begins with a discussion of the merit criteria, including examples of what constitutes good "Broader Impact". Also, the 2011 COV suggested that a series of questions in the review form could prompt high-level critical evaluation of the proposal and its broader impact. In response to this suggestion and other similar ones, the National Science Board revised its guidance to PIs and reviewers in addressing the criterion of "Broader Impact" during the proposal writing and proposal review.

The 2014 COV believes that "Broader Impact" has remained undefined despite many efforts. In fact, there is a belief that the effort to address the concerns of the previous COV did not make understanding better. NSF's mission to fund research that has a broad social impact is of paramount importance to the ability of the U.S. to make social change and support social progress through breakthrough research and talent development in science and engineering. Based on our reading of the existing guidelines, it appears that balancing breakthrough research with education and outreach, two elements that contribute to broader impact, is expected to happen within each submitted

proposal. As such, there is inconsistency in the understanding among the PIs and reviewers that this balance is important in making a proposal successful. The 2014 COV believes that achieving this balance within every proposal is not always possible and an effort to force the issue results in proposals where the broad impact component is less developed and less meaningful and not always possible to achieve.

We would like to encourage ECCS to consider how "Broader Impact" can be achieved within the Program Officer's portfolio and within the individual proposals to produce better outcomes and focus the research community in breakthrough science and engineering that has the potential to change the world in the near and long-term.

5. Reduced funding and duration of the unsolicited grants

From the ECCS self-study data provided to the COV it seems that the funding and duration of the unsolicited grants in 2013 has been reduced. The COV would like to strongly encourage the Division to protect the integrity of the unsolicited proposals both in funding and duration.

FY 2014 REPORT OF
NSF COMMITTEES OF VISITORS (COVs)

Date of COV: September 15th and 16th, 2014

Program/Cluster/Section:
- Electronics, Photonics and Magnetic Devices (EPMD)
- Energy, Power, Control and Networks (EPCN – formerly EPAS)
- Communications, Circuits, and Sensing-Systems (CCSS)

Division: Electrical, Communications and Cyber Systems Division (ECCS)

Directorate: Engineering (ENG)

Number of actions reviewed:

Awards: 129

Declinations: 122

Other*:   4

*Returned without review

Total number of actions within Program/Cluster/Division during period under review:

	All ECCS Actions	ECCS Competitive* Proposal Actions
Awards	1490	860
Declinations	3612	3588
Other**	52	0
Total	5153	4448

*Competitive proposal actions include all research and education proposals which have gone through the merit review process resulting in award or decline decisions; this excludes supplements, continuing grant increments, and any proposals that were withdrawn or returned without review.
**Returned without review and withdrawn actions

Manner in which reviewed actions were selected:
Random sample performed on ECCS new proposal actions from Fiscal Years (FY) 2011-2013. This included competitive, returned and withdrawn actions. Proposal actions not included in the sampled population set:
- Supplements
- Continuing grant increments
- Withdrawn proposals that did not enter any part of the ECCS merit review process
- Initiatives not led by ECCS or not subject to ECCS merit review process
- IPA Funds (Intergovernmental Mobility Assignment)

The resulting population (N) came to 4094 proposal actions (or jackets). The jackets were each assigned a random number from 0 to 1 using the Excel RAND function assuming a linear distribution.

All 4094 jackets were then binned to ensure an equal and representative sample based on:
1. *Awards/Declinations*
2. *Program*
3. *Year awarded*

Based on a target quantity of samples (approximately 20 jackets to review per COV member), threshold levels of the random number assigned were set for awarded and declined jackets. After inspection aided by the binning, some jackets were manually added to ensure representation of smaller initiative categories and "Return Without Review" actions. No withdrawn proposal actions were identified. Total jackets sampled for COV review amounted to 255 or 6% of the initial population (N = 4094).

To facilitate the work of the COV, the ECCS Division created an ECCS Self-Study Data Report to use in conjunction with the sampled jackets. Complementing the COV Report Template, this workbook presented data, definitions, and explanations that the COV found useful in evaluating merit review and program management processes from the period under review (FY11-FY13).

The information provided in the Self-Study references unpublished data from NSF's internal systems.

In addition to the Self-Study Data Report, details regarding the previous COV Report, the associated ENG/ECCS response, and additional resources such as maps, viewgraphs, program solicitations, helpful acronyms, and the NSF Grant Proposal Guide (GPG) were provided..
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COV Membership

	Name	Affiliation
COV Chair or Co-Chairs:	Linda Katehi (Chair) Lance Collins* (Co-Chair) Karen Butler-Purry* (Co-Chair) *NSF Directorate for Engineering Advisory Committee Members*	University of California – Davis Cornell University Texas A&M University
COV Members:	Anjan Bose William Chappell Abbas El Gamal Rhonda Franklin Sheila Hemami Robert Mattauch Saifur Rahman Mark Spong Andrew Weiner Ellen Yoffa Fawwaz Ulaby	Washington State University DARPA, Microsystems Technology Office Stanford University University of Minnesota – Twin Cities Northeastern University Virginia Commonwealth University Virginia Tech University of Texas - Dallas Purdue University IBM, Thomas J. Watson Research Center University of Michigan – Ann Arbor

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES
AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question.

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE

1. Are the review methods (for example, panel, ad hoc, site visits) appropriate?
 	
Comments: Review methods are appropriate. The vast majority of proposals are reviewed by panel – approximately 80 percent in person and 88-91 percent panel only reviews for all proposals submitted to ECCS Division. The overall impression of the COV is that panels consist of leading experts in the field, the panels are well run and provide an effective and fair review of the quality of proposals in terms of their intellectual merit and broader impacts. The panels promote active dialog among the panelists, which yields a more thorough review than individual ad hoc reviews would. As noted in the Executive Summary, however, requiring the entire panel to fly to Washington D.C. is inefficient. For example, one NSF Program Officer noted difficulty in formulating panels with the right cross-section of expertise and seniority. The COV recommends the NSF continue to explore ways of using the hybrid and virtual panels where appropriate. While this may be an effective way to increase the participation of more senior faculty who cannot afford to travel for two days, it may also be somewhat less effective for junior faculty who benefit directly from the visit to the NSF. It is noted that facilitation of hybrid and virtual panels may be somewhat more complicated than the traditional panel and that the Program Officers should receive training on the most effective ways to operate these panels (both regarding the technology and for strategies to ensure that all panel members, those physically present and those who are virtual, are able to participate equally). Hybrid panels will also help to attract international reviewers who cannot easily travel to NSF. This is important because with large solicitations, it is sometimes difficult to find enough qualified U.S. panelists without a Conflict of Interest (CoI).
 	
COV Data Resource:
    ▪   Assigned Jackets
    ▪   ECCS Self-Study Workbook "Question I.1" Tab
	Yes

2. Are both merit review criteria addressed
 	
    a) In individual reviews?
 	
    b) In panel summaries?
 	
    c) In Program Officer review analyses?
 	
Comments: The majority of individual reviews addressed both intellectual merit and broader impacts (90-94 percent of reviews of all Division proposals addressed both review criteria). In most cases, the individual reviews placed a greater emphasis on the intellectual merit review than the Broader Impacts; this was especially noticeable with reviewers from industry, who may be less familiar with the Broader Impacts criterion. Remaining confusion over this concept leads to PIs embedding "boilerplate" add-ons to satisfy the criterion and "benign neglect" on the part of reviewers who don't want to criticize a proposal with otherwise strong intellectual merit. There was considerable discussion in the COV as to whether the incorporation of the 5 new review elements clarifies the Broader Impacts. The consensus from the COV was that they do not fully resolve the problem. The COV recommends the NSF adopt clear guidelines for Broader Impacts based on the activities they would like to see from the PIs. For example, one category would be the impact the research has on neighboring disciplines. This could be separated from outreach or educational impact that the PI undertakes as part of the grant. A simple statement of the expectation of the former, and a list of acceptable examples of the latter would clarify the expectations for both the PI and the reviewer.
 	
    Panel summaries, in general, addressed both review criteria well and more consistently than the individual reviews, the above ambiguities notwithstanding. These summaries benefited from the panel discussion.
 	
The PO summaries consistently reviewed both criteria. The COV found no exceptions.
 	
COV Data Resource:
    ▪ Assigned Jackets
    ▪ ECCS Self-Study Workbook "Question I.2" Tab
	Yes

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: Overall the quality of the individual reviews was high. It was noted that some senior panelists went to great lengths to provide detailed feedback and effectively "mentoring" to the PI. This provides an important means of educating PIs on what it takes to write a successful NSF proposal. However, there was considerable variability. In particular, it was noted by some COV members that some of the individual reviews were cursory and uninformative, essentially restating the goals of the proposals without providing an effective critique of the ideas or, more importantly, an evaluation of how the proposal compared with the pool. The only real evaluation came from the score. The COV recommends that panelists be given some coaching on the expectations of the reviews (e.g., samples of strong and weak	Yes

reviews). Additionally, panelists could be given a short on-line tutorial with sample proposals and clear expectations for their reviews. This would be especially useful for panelists serving for the first time (e.g., younger faculty or panelists from industry).

Another consideration is the breadth of submissions that a particular panel receives. There were a couple of jackets that contained proposals that outside of the mainstream of the proposals that were received. The Program Officer could address this by adding a panelist with the requisite expertise; however, this individual might not be able to contribute to the reviews of the other more mainstream proposals. An alternative approach would be to add an ad hoc reviewer to COVer the needed area.

Finally, it was noticed by the COV that the acceptance rate of EAGER proposals was essentially 100 percent. This led to considerable discussion by the COV around the process for the EAGER program. The discussion revealed the fact that indeed most EAGER proposals were not funded, but the precise means by which ideas were evaluated remained unclear. The conclusion from the COV is that the EAGER program is an important program for stimulating new, high-risk research that likely would not be funded as an unsolicited proposal. The concerns were mainly around the process for soliciting these proposals. The COV recommends the ECCS more clearly document this program's selection process and disseminate this to the community.

COV Data Resource: Assigned Jackets

4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: In general, the panel summaries provided detailed feedback that was more consistent than the individual reviews. Panel summaries provided some guidance for the PI. Most panel summaries ended with a score of Highly Recommend, Recommend, or Do Not Recommend for funding, although this categorization was not consistently followed for all of the jackets. The COV recommends that panel summaries consistently capture the oral discussion in addition to summarizing the written reviews. Furthermore, it is recommended the NSF adopt a consistent scoring system for the panel evaluation, say "Highly Recommend", "Recommend" and "Do Not Recommend" (analogous to the E, VG, G, F, P scoring system for reviewers). COV Data Resource: Assigned Jackets	Yes

5. Does the documentation in the jacket provide the rationale for the award/decline decision? *[Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.]* Comments: Overall documentation was very good and the rationale for the decision was clear. Some of the COV members found the documentation for the awards to be somewhat more complete than the documentation for the rejections. An effort to consistently document each jacket should be made. On a few occasions, the decision to make an award was done despite a somewhat lower score from the panel. In every case, there was additional correspondence between the Program Officer and the PI to address concerns raised by the panel. The documentation was excellent for these cases. The COV supports the idea of the Program Officer having some discretion in making awards, as long as the documentation for the decision is provided. COV Data Resource: Assigned Jackets	Yes

6. Does the documentation to the PI provide the rationale for the award/decline decision? *[Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.]* Comments: In all cases the rationale for the decision was well documented. However, the documentation did not always address the inconsistencies in the reviews. The COV recommends that Program Officers explicitly address the variation in reviews and how they arrived at their final decision. COV Data Resource: Assigned Jackets	Yes
7. Additional comments on the quality and effectiveness of the program's use of merit review process: Overall the ECCS division used the merit review process very effectively. The individual reviews and summary provided adequate feedback for the decision. The panelists appeared to have the required expertise to render informed reviews and written reviews were consistent with ratings scores. The consensus of the COV is that panel reviews are good quality and with a reasonable consistency, especially given the heavy volume to this division. The division should be applauded for its performance. On the occasions where there was some variability, this was mostly observed with specific Program Officers.	

Recommendations:

a. It may be useful to provide the POs some case study data from a COV review of what to accept and what not to accept from reviewers. Similarly, it may be helpful to provide the reviewer's with case studies that illustrate why one approach or another is or is not helpful.

b. A short on-line tutorial (10-15 min) for reviewers about the expectations and samples could help correct the problem with little time lost by the POs and reviewers. Similar to the requirement to sign the conflict of interest and signing in to get paid, the reviewer would have a similar requirement to review the tutorial prior to submitting their reviews. Some consideration should be given in the tutorial to how the reviewer should address the five review elements in the latest revision of the NSF Review Criteria.

Another question that came up is whether the virtual panel will continue to trend upward. At this stage, the COV recommends the ECCS continue to explore the use of hybrid panels. The NSF should consider performing a study that looks at the advantages and disadvantages to the quality of reviews from remote panelists.

COV Data Resource:
- Assigned Jackets
- ECCS Self-Study Workbook "Question I.7: Additional Data" Tab
- NSF GPG Manual

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE

1. Did the program make use of reviewers having appropriate expertise and/or qualifications?
 	
Comments: Generally, the ECCS Division continues to identify and attract highly qualified experts as panelists with extensive knowledge of the field of work being reviewed. The depth and breadth of reviewers' expertise is appropriate with almost 70 percent in ECE, 10 percent in Physics, and the remaining in other fields to provide a broader perspective of the applicability and impact of the proposed work along with a detailed knowledge of the fine points of the science/technology. From the reviewers' comments, it seems that, in most cases, they spend the time necessary to review the proposals before they come to NSF, which results in more relevant and in-depth panel discussions.
 	
The representation of two-thirds of reviewers from PhD and research intensive PhD granting universities and approximately 80 percent of the states seems to be appropriate. However, more complete information is needed on the type of institution of the reviewers. Almost 20 percent of the reviewers having no institution type is too high. The COV recommends improving the data collection process to try to reduce the unknown institution type to 0 percent.
 	
Also, it was noted that the six states and U.S. territories (all of which are EPSCoR states) which had a total of zero to two reviewers over the three year analysis period also had zero awards. It is recommended that the ECCS Division aim to include reviewers from all states, as participation as a reviewer is the most successful strategy in increasing the quality of submitted proposals.
 	
It is also difficult to conclude from the data whether the demographic composition of panelists is adequate, as less than 50 percent of the reviewers reported this data and no target numbers were articulated. Of those who reported, almost 20 percent of the reviewers were female and slightly over 5 percent were from underrepresented minority groups over the three-year period. While most panels had at least one female reviewer, several review panels consisted of all men. The ECCS Division should continue to actively work to include women and minorities in the ECE community as reviewers.
 	
COV Data Resource:
    ▪ Assigned Jackets
    ▪ ECCS Self-Study Workbook "Question II.1" Tab
	Yes

2. Did the program recognize and resolve conflicts of interest when appropriate?
 	
Comments: In science and technology, conflicts of interest may occur by the nature of the mission. This becomes even more evident when the topical area is highly specialized and the number of experts in that area is small. The key aspect is to manage any conflict, or the appearance of a conflict, that occurs. From our review of the jackets, the program managers have documented a systematic approach for managing potential conflicts and have appropriately managed the few cases where a conflict of interest occurred.
 	
Also, a COV member expressed some concern about reviewers who come from other U.S. government agencies and review NSF proposals from PIs who are funded by the reviewer or the reviewer's agency. One such instance was identified, where the PI had grants from a federal agency, and one of the reviewers may have been the proposer's program manager at that federal agency, creating what the COV considered to be a clear conflict of interest. Currently this relationship is not explicitly stated as a conflict of interest under NSF guidelines, but the COV recommends that NSF include it as a conflict and develop a process to manage it.
 	
Another question discussed by the COV is: *how do program managers address the potential conflict of interest of a reviewer whose intellectual expertise or organizational representation (for industry representatives) may be in direct competition with the proposed ideas?*
 	
COV Data Resource:
    ▪ Assigned Jackets
    ▪ NSF GPG Manual
	Yes

Additional comments on reviewer selection: For some broad solicitations such as the CPS program, there are so many proposals from almost everyone in the field that it becomes difficult to find reviewers who are not connected to the proposers in some way. Getting some reviewers from outside the U.S. may help the situation, and using them as virtual reviewers could be a good approach. Also, the program could possibly use industry and government representatives to fill the gaps.
 	
The COV felt that the practice of some ECCS program officers sending the list of proposals to the panelists to identify those with expertise to review was a good one. To further improve the process in distributing proposals to panelists with appropriate expertise and identifying gaps in a proposed panel, the COV recommends that the program officers consider having the panelists rate their expertise for each research proposal.
 	
COV Data Resource:
    • Assigned Jackets
    • ECCS Self-Study Workbook "Question II: Additional Data" Tab
    • ECCS Geographical Slides	

III. Questions concerning the management of the program under review.
Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW

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1. Management of the program.

Comments: The COV commends the ECCS Division for its effective management of an extensive portfolio of Division-specific programs and an impressive array of strategic partnerships with engineering- and NSF-wide programs and federal agencies on special initiatives. The program is managed by highly dedicated professionals who are well connected to the scientific community and are aware of the frontier directions of science and technology in relation to their own individual programs.
The distribution of awards across the spectrum of the 12 programs of the ECCS Division is impressive. The fact that a large portion of the program's budget is focused on the development of researchers who are relatively new to their fields through both the CAREER and PECASE programs is felt to be critical to our nation's continued technological leadership.

There was a lengthy discussion about the EAGER program. There was concern about the process as there did not appear to be enough documentation for these awards and the award funding rate appeared to be almost 100 percent. There was no documentation on how these proposals were solicited or ultimately reviewed once submitted. The overall value of the program is very much appreciated and the COV questions focused on whether the process could be performed more systematically or whether it could at least include more documentation on the actions that occurred before the final proposal was submitted. It was noted that EAGER has increased its budget in FY13. A comment from the ECCS program officers was that the EAGER funding is capped at approximately 5 percent of the total Division budget, which is about where it is now.

The competitive proposal funding rate of the overall program increased over the three-year period. But the unsolicited proposals funding rate of the core programs remained around 14-16 percent. Thus the benefit of the change to a single review window is not clear.

Additionally, perhaps NSF should look into the statistics of individual PI submissions. Are there a small number of PIs who are submitting a large number of proposals, particularly those that are routinely rejected? There could be some consideration given to limiting the number of proposals submitted by a PI in a given window.

The COV questioned whether there is an appropriate balance of funding of the unsolicited core programs and initiatives. While the initiatives provide outstanding opportunities for the ECCS Division to leverage funding with other engineering and NSF entities of broader reach, the COV cautioned against expanding the initiatives to a point that the unsolicited core program total funding amount was reduced. The COV felt it was critical to protect the unsolicited core program funding to support fundamental research issues in ECCS.

 [Note: We encourage the COV to refer to relevant documents available in eJacket such as Program Solicitations for general information as well as Diary Notes and Correspondence in the jackets that provide information about the management of the specific projects.]

COV Data Resource:
- Assigned Jackets
- ECCS Self-Study Workbook - all tabs
- ECCS Organizations slides
- Additional Documents from NSF COV eJacket Module
- Discussions with ECCS Management

2. Responsiveness of the program to emerging research and education opportunities.

Comments: The ECCS Division has done a good job in responding to emerging research and education opportunities through support of transformational EAGER awards, and partnerships with other NSF Divisions in NSF programs such INSPIRE. The same is true of initiatives with other federal agencies, such as the Department of Energy and the Department of Homeland Security. The EAGER program, which is oriented toward exploratory, untested, and potentially transformative research ideas and approaches, answers this need quite well. A significant increase in the EAGER awards from 2011 to 2013 is perhaps an effort to identify and support high-risk projects.

Some COV members encourage the ECCS Division to consider partnering with the EEC Division in its efforts to put greater focus on the Energy and Power workforce issues and ECE curriculum reform needs, instead of diverting more ECCS technical research funds towards this identified need.

COV Data Resource:
- Assigned Jackets
- ECCS Self-Study Workbook "Question III.2" Tab
- Additional Documents from NSF COV eJacket Module
- Discussions with ECCS Management

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments: The ECCS Division uses a systematic analysis of its portfolio and internal discussions as well as input from the scientific community for program planning and to help set priorities and new programs. However, it is not clear how the data reported by PIs in their annual and final reports are used for planning and prioritization of future programs. NSF-supported workshops have been effectively used to get input from the community. Further, the continued communication of program managers with various federal laboratories and agencies, along with their support of and participation in topical workshops, appears to produce impressive programming prioritization and planning.

[Note: During the three-year time period under review, the ECCS Division used one or more of the following methods for prioritizing funding recommendations:

- *Portfolio analysis with respect to demographics and subject areas at the program level*

- *Annual reports*
- *Community workshop reports*
- *Directorate/Division retreat discussions]*

COV Data Resource:
- Assigned Jackets
- ECCS Self-Study Workbook - all tabs
- Additional Documents from NSF COV eJacket Module
- Discussions with ECCS Management

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4. Responsiveness of program to previous COV comments and recommendations.

  Comments: Previous COV main comments and recommendations are shown in bold:

Division workload and continuity. The significant growth in workload (from proposal pressure and the need to support interdisciplinary proposals) is stretching the ECCS PDs whose number has not increased commensurately.

> The ECCS Division addressed the recommendation related to this concern by adding a Deputy Division Director in April 2012. This decision proved timely as the new deputy was able to serve as Interim Division Director during a three-month vacancy between the outgoing and incoming deputy director, as well as maintain policy continuity and provide corporate memory for the Division.

Understanding the "Broader Impact" merit-review criterion. As is the case Foundation-wide, there still appears to be confusion in the review base about what is meant by "Broader Impact," and what high quality broader impact might look like.

> In 2013, NSF implemented clarifications of the intellectual merit and broader impact criteria and modified the templates for written reviews to include more specific questions for the reviewers to address. But the recent NSF clarifications created more confusion on the definition of Broader Impacts than clarity, which the COV believes is also the case of PIs and reviewers. Is it the intention that each merit review criterion be evaluated for each of the five review elements listed in the Revised Merit Review criteria in GPG (13-1), Chapter III.A.2? NSF needs to provide better guidance, specifically on the definition of "Broader Impacts" as it relates to research programs and what is expected of PIs in a proposal and award.

> The COV recommends that NSF, and possibly ECCS, consider including examples of acceptable "Broader Impact" statements. NSF should also consider making a video that clarifies what this division needs/wants for the reviewer and creating a reviewer template that organizes the questions in the individual proposal.

> Some COV members also questioned how PIs are held accountable for the "Broader Impacts" efforts they propose. Should they be required to report on their "Broader Impacts" efforts explicitly in their Annual and Final Reports? Should PIs have to report on the impact of their "Broader Impact's efforts in the prior support section of the project description of proposals?

COV Data Resource:

- Previous ECCS COV Report (FY08-FY10)
- ENG/ECCS Response to Previous ECCS COV Report
- ECCS Self-Study Workbook - all tabs
- Additional Documents from NSF COV eJacket Module
- Discussions with ECCS Management

IV. Questions about Portfolio. Please answer the following about the portfolio of awards made by the program under review.

RESULTING PORTFOLIO OF AWARDS	APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE
1. Does the program portfolio have an appropriate balance of awards across disciplines and sub-disciplines of the activity? Comments: The balance between the core program and the various initiatives seem to be appropriate. However, the COV wants to strongly recommend that the core program (in particular unsolicited proposals) be protected against any erosions in its budget. There were questions about the success rates between the core program and the success rates of the various initiatives. Additionally, there were serious concerns about the way the EAGER program runs. While there is strong support for having this program, we need a better process that measures a 100 percent success rate in the program. COV Data Resource: • Assigned Jackets • ECCS Self-Study Workbook "Question IV.1" Tab • ECCS Geographical Slides	Appropriate
2. Are awards appropriate in size and duration for the scope of the projects? Comments: Although the award size and duration is adequate, there is a concern that the amount of the awards is not reflecting the research needs and associated cost for the graduate students and faculty involved in the funded work. Although any substantive changes in the award size may reduce the award rate to an unacceptably low level, ECCS needs to always guard against eroding the funding base of the individual PI proposals. COV Data Resource: • Assigned Jackets • ECCS Self-Study Workbook "Question IV.2" Tab	Appropriate
3. Does the program portfolio include awards for projects that are innovative or potentially transformative? Comments: The projects are innovative and potentially transformative. The division has done an excellent job in ensuring that the awards have these attributes	Appropriate

COV Data Resource: • Assigned Jackets • ECCS Self-Study Workbook "Question IV.3" Tab	
4. Does the program portfolio include inter- and multi-disciplinary projects? Comments: Most of the awards funded under the various initiatives are inter- and multi-disciplinary in nature, and the blend of disciplinary and multi-disciplinary awards seems to be very good. COV Data Resource: • Assigned Jackets • ECCS Self-Study Workbook "Question IV.4" Tab	Appropriate
5. Does the program portfolio have an appropriate geographical distribution of Principal Investigators? Comments: The division has tried very hard to have an appropriate geographical distribution. The COV feel that the outcomes are satisfactory (although it is noted that six states and U. S. territories, all of which are EPSCoR states, did not receive a grant over this three-year period). COV Data Resource: • Assigned Jackets • ECCS Self-Study Workbook "Question IV.5" Tab • ECCS Geographical Slides	Appropriate
6. Does the program portfolio have an appropriate balance of awards to different types of institutions? Comments: The program portfolio has a good balance of awards to various types of institutions. About seventy percent of the awards go to research intensive Ph.D. institutions (Top 100), about twenty percent to Ph.D. institutions, less than five percent to Master institutions and less than three percent to business, state, local, foreign and other COV Data Resource:	Appropriate

• Assigned Jackets • ECCS Self-Study Workbook "Question IV.6" Tab	
7. Does the program portfolio have an appropriate balance of awards to new investigators? [*NOTE: A new investigator is an investigator who has not been a PI on a previously funded NSF grant.*] Comments: About one quarter are new PIs and three quarters are returning PIs. This is considered a good balance. COV Data Resource: • Assigned Jackets • ECCS Self-Study Workbook "Question IV.7 & IV.9" Tab	Appropriate
8. Does the program portfolio include projects that integrate research and education? Comments: The funded projects have both a research and an educational component. The question is whether it is possible or appropriate to balance research and education on every proposal or whether the division should look to achieve this balance across its portfolio. As stated earlier in this report, this COV believes that "Broader Impact" has remained undefined after so many efforts and that the efforts to address the concerns of the previous COV have not helped make it any clearer. NSF's mission to fund research that has a broad social impact is of paramount importance to the ability of the US to make social change and support social progress through breakthrough research and talent development in science and engineering. However, this COV believes that this can be achieved within the portfolio of activities of the Foundation and not forced on every individual proposal. We would like to encourage ECCS to consider this change in how "Broader Impacts" is achieved, believing that the appropriate changes in the strategies on how to achieve the mission of social change will make success easier, produce better outcomes and focus the research community in breakthrough science and engineering that have a visible social impact in the near and long terms. COV Data Resource: • Assigned Jackets • ECCS Self-Study Workbook "Question IV.8" Tab	Appropriate

9. Does the program portfolio have appropriate participation of underrepresented groups[1]? Comments: The COV believes the ECCS program portfolio has appropriate participation of underrepresented groups: About 15 percent female PIs and approximately 5 percent to URMs. This balance reflects the trends of the current research community demographics. COV Data Resource: ▪ Assigned Jackets ▪ ECCS Self-Study Workbook "Question IV.7 & IV.9" Tab	Appropriate
10. Is the program relevant to national priorities, agency mission, relevant fields and other constituent needs? Include citations of relevant external reports. The COV is impressed with the responsiveness of ECCS to national priorities, which drive the research portfolio of ECCS within the context of the NSF mission of supporting basic academic research. COV Data Resource: ▪ Assigned Jackets ▪ ECCS Self-Study Workbook - all tabs ▪ Additional Documents from NSF COV eJacket Module ▪ Discussions with ECCS Management	Appropriate
11. Additional comments on the quality of the projects or the balance of the portfolio: *See under other topics*	

OTHER TOPICS

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[1] NSF does not have the legal authority to require principal investigators or reviewers to provide demographic data. Since provision of such data is voluntary, the demographic data available are incomplete. This may make it difficult to answer this question for small programs. However, experience suggests that even with the limited data available, COVs are able to provide a meaningful response to this question for most programs.

1. Please comment on any program areas in need of improvement or gaps (if any) within program areas.

Assess the success of the Supplemental Funds Program (REUs/RETs). Please see previous sections for more discussion

2. Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

The COV would like to encourage ECCS to work with the community and try to think of new domains in which innovation could happen. For example, in many of the areas defined by the NAE's grand challenges Electrical Engineering can contribute greatly. NSF used to organize workshops for the community to come together and think forward about breakthrough science and engineering. We encourage NSF to go back to this practice.

3. Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

Better implementation of the Broader Impact component in the proposed and awarded efforts. Please see previous sections for more discussion.

4. Please provide comments on any other issues the COV feels are relevant.

The COV would like to strongly encourage ECCS and the Engineering Directorate to protect the core program (unsolicited proposals) and try to define the proper balance between the initiatives and the core program. Of these initiatives, the CAREER award is extremely important and the same applies to the EAGER program. However, there are some concerns expressed about the quality of the merit review of the EAGER and the way the program is promoted and made easily available to junior PIs.

To support junior PIs' in effectively setting their research efforts and in developing exciting research career directions, the COV strongly recommends the re-instatement of the Research Initiation Grants Program.

5. NSF would appreciate your comments on how to improve the COV review process, format and report template.

The COV would like to suggest that for the next COV each member finds all the information in a folder well organized, easy to access and utilize accordingly. Also, we would like to suggest that all the presentations are included as well. This should not replace the e-files which should be emailed ahead of time as done for this COV. Also, we would like the information to be as visually presented as possible and not in table form.

SIGNATURE BLOCK:

Dr. Linda Katehi, *COV Chair*

_____
Dr. Lance Collins, *COV Co-Chair*

_____
Dr. Karen Butler-Purry, *COV Co-Chair*

On behalf of the 2014 ECCS COV Committee:

Dr. Anjan Bose

Dr. William Chappell

Dr. Abbas El Gamal

Dr. Rhonda Franklin

Dr. Sheila Hemami

Dr. Robert Mattauch

Dr. Saifur Rahman

Dr. Mark Spong

Dr. Andrew Weiner

Dr. Ellen Yoffa

Dr. Fawwaz Ulaby