FINAL COV REPORT
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For
FY 2009 NSF STEP COMMITTEE OF VISITOR (COV) REVIEWS

Guidance to NSF Staff: This document is the FY 2009 STEP NSF Committee of Visitors (COV) Final Report of the STEP Program. The COV followed the specific guidance for the COV process as described in Subchapter 300-Committee of Visitors Reviews (NSF Manual 1, Section VIII) found at <www.inside.nsf.gov/od/oia/cov>.

FY 2009 REPORT TEMPLATE FOR NSF COMMITTEES OF VISITORS (COVs)

The NSF STEP Program Staff completed the following table.

Date of COV: December 8-9,2009
Program/Cluster/Section: Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP
Division: Division of Undergraduate Education (DUE)
Directorate: Directorate for Education and Human Resources
Number of actions reviewed: **Awards:** 17 **Declinations:** 38 **Other:** 0
Total number of actions within Program/Cluster/Division during period under review: **Awards:** 68 **Declinations:** 418 **Other:** 0
Manner in which reviewed actions were selected: Type 1 awards from FY 2006-2008 whose proposal numbers ended in 3 and 7; and all Type 2 awards were selected. Type 1 and Type 2 declinations from FY 2006-2008 whose proposal numbers ended in 3 were selected. The numbers were accepted by the Chair of the COV, Cathleen Barton**.**

PART A. 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 under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

A.1 Questions about the quality and effectiveness of the program's use of merit review process. Provide comments in the space below the question**.** Discuss areas of concern in the space provided.

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	**YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE[1]**
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? **Comments:** Panels of varying size reviewed the proposals. In most instances, the panels included individuals from a two-year college as well as four-year institutions and representatives came from around the country. Panelists read proposals and submit reviews prior to coming together to discuss them. We commend the NSF for the healthy size of the panels and their pre-work efforts. The COV noted no site visits in our sample and realizes the limitation of staff time and dollars. Travel budget reductions notwithstanding, we feel there are transformational things that happen when actual site visits occur. Preparation for and engagement in a site visit activates the campus or division and increases the potential impact of the project. Also, a site visit often surprises some faculty who may not have been aware of the proposal and signals the need for their involvement. The COV recommends developing ways to replicate site visits. For example, consider using previous "Rotators" for some site visits as it is likely to reduce travel time and cost.	**YES**
2. Are both merit review criteria addressed a) In individual reviews? Yes	**YES**

[1] If "Not Applicable" please explain why in the "Comments" section.

b) In panel summaries? Yes

c) In Program Officer review analyses? Yes, however, the quality and substance varies from quite detailed to very boilerplate in others.

Comments:

The COV reviewed jackets, awards and declines that included individual reviews, summary reviews and PO review analyses. Reviews at all levels were substantive and attempted to address both merit criteria. This particular program makes the intellectual merit criteria a bit more challenging since it really is about designing a strategy that weaves best known methods and practices vs. creating new ones. What is unique are some of the combinations, the partners etc. On the other hand, the program is all about broadening impact.

All individual reviews addressed both criteria, some in much more detail than others.

The Panel reviews met the spirit and in most cases provided a detailed discussion of the criteria. There was an example of a summary that did not expressly talk about the criteria but rather listed their comments as "strengths and weaknesses." In doing so they still addressed some of the key considerations.

The PO review analysis had mixed results; some analyses were very substantive and provided meaningful information while others were a bit more "boilerplate", such as the use of the cursory statement that reviewers did include both merit criteria but without any articulation or expansion.

Intellectual merit included the research base for recommended strategies, the expertise and backgrounds of the PIs, staff and advisory groups, as well as the evaluation plans. The panels assessed Type 2 grants with clear hypotheses and strong experimental design components; they also assessed the literature and research base. For example, the PO review of one particular grant showed a good example of a substantive analysis of both merit criteria. By the same token the review addressed a lack of information about a key/critical member of the team in assessing intellectual merit.

Broader impact included "self- broadening", dissemination and communication plans, infrastructure created added/or enhanced that would outlive the project duration, and practices and programs likely to become embedded as systemic. Projects with robust evaluation plans have been viewed as positively affecting the broadening impact component. Additionally, analysis indicated that the presence of letters of support from organizations considered to be helpful to dissemination and scale were viewed as positive indicators of success in broadening impact.

In terms of broader impact, reviewers considered the partnerships between 2-year, 4-year and K-12 systems, as well as business partners in citing mostly

their strengths. A few proposals were mostly about “broadening impact” and reaching under-served populations.	

3. Do the individual reviewers provide substantive comments to explain their assessment of the proposals? **Comments:** Most reviewers provided comprehensive, relevant comments, although sometimes the comments were brief. In one instance each question had one-word answers. Occasionally NSF staff followed up on questions about the proposals and addressed them in staff summaries..	**YES**
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? **Comments:** Panel summaries, both in discussion of merit criteria and in summary statements where they are included, describe the points of consensus. The jackets and panel summaries we reviewed showed variations in the strengths, weaknesses, and quality level of the grant in the individual reviews. However, we found no panel summary recommendations that were not consensus recommendations for either awards or declines. In our review of those PO review analyses that provided more detail, we found no evidence to suggest that there was lack of consensus from the panelists.	**YES**

5. Does the documentation in the jacket provide the rationale for the award/decline decision? (Note: Documentation in jacket usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.) **Comments:** Considerable information/documentation is provided in the jacket for the award/decline decisions. Key areas identified for supporting a grant included: clarity and reality of goals, good research and evidence base, appropriate identification of key staff and statement of work, connections for high school through higher education, and with the business community. Summaries hold a positive view of connecting key strategies across multiple departments. Panelists identified key areas for not supporting a grant to include: lack of information on key grant participants, missing or confusing information about goals, seemingly unrealistic goals with respect to capacity, lack of identified key resources, and letters of recommendation. Questions on funding, budgeting and related costs also seemed to engender common concerns among panelists. As a proposal moves to an award, the inevitable and essential necessity of explaining details that were not clear in the proposal emerges. One less familiar with the contents of jackets may wonder why one proposal was "permitted" to answer concerns while another proposal that was declined lost the opportunity to clarify information. Nonetheless, the reviewers raised substantive questions about such things as data presented, past funding, the role and level of support of industry partners, student recruitment methodology, and a focus only on underrepresented students.	**YES**
6. Does the documentation to 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 or telephoned with diary note in jacket) of the basis for a declination.) **Comments:** The Committee reviewed a total of 55 proposals, 17 awards and 38 declines. Based on examination of context statements, Program Officer comments, individual reviews and panel summaries, we are of the opinion that sufficient rationale for the award/decline decision is provided to the principal investigator(s). However, we encourage more detailed responses to all PIs, and especially to those who were unsuccessful in order to give them a stronger and	**YES**

more informed base from which to strengthen future proposals. Assist first time reviewers with examples of helpful reviews.	
7. Is the time to decision appropriate? Note: Time to Decision --NSF Annual Performance Goal: **For 70 percent of proposals, inform applicants about funding decisions within six months of proposal receipt or deadline or target date, whichever is later**. The date of Division Director concurrence is used in determining the time to decision. Once the Division Director concurs, applicants may be informed that their proposals have been declined or recommended for funding. The NSF-wide goal of 70 percent recognizes that the time to decision is appropriately greater than six months for some programs or some individual proposals. **Comments:** Of 57 proposals available for review, 54 applicants learned of either acceptance or declination well within the six-month target date. Of the two which were not received within the six month window, one was three days late and the other was one month late. We commend the NSF for timely reviews.	**YES**
8. Additional comments on the quality and effectiveness of the program's use of merit review process: The merit review system is effective and provides adequate and useful feedback to the Principal Investigator(s) to conduct successful projects for those awarded or to resubmit for those declined. The reviews reflect the diversity of the reviewers' expertise.	

A.2 Questions concerning the selection of reviewers. Provide comments in the space below the question. Discuss areas of concern in the space provided.

SELECTION OF REVIEWERS	**YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE[2]**

[2] If "Not Applicable" please explain why in the "Comments" section.

1. Did the program make use of reviewers having appropriate expertise and/or qualifications? **Comments:** In all cases reviewed, the reviewers had appropriate expertise, credentials and qualifications and good geographical distribution. However, in some of the declined proposals from community colleges it appears that there are usually only two reviewers from community colleges with the others predominately from universities, often with 1-2 reviewers from research universities. This discovery raises a question about how well Research One reviewers understand and have direct contact with the issues specific to community colleges.	**YES**
2. Did the program use reviewers balanced with respect to characteristics such as geography, type of institution, and underrepresented groups? Note: Demographic data is self reported, with only about 25% of reviewers reporting this information. **Comments:** With respect to institutional type and representation of under-represented groups, we relied on the reviewer demographic information the NSF provided to us (and ultimately provided by some of the reviewers themselves). Data reveal an approximately equal distribution of men and women and represent all institutional types. We note that the NSF is making a serious effort to reach out to two-year institutions, though this effort is not always successful. With respect to geographic diversity, we checked a randomly selected set of eleven proposals, including both acceptances and declines, and classified the reviewers as being east coast, central US, and west coast. The table below gives the actual number of reviewers, as well as the expected number, normalized to the east coast number, if reviewers were distributed in the same way that electoral votes in the states that house their institutions are (electoral votes being an easily available proxy for population). We see evidence that the NSF pays appropriate attention to getting reviewers from all regions of the country, including the central region. The COV has concerns that reviewers from the south and perhaps EPSCOR do not seem to be sufficiently represented. Our review found that a very good distribution of reviewers comes from minority serving institutions.	**YES**

Area	Number of reviewers	Expected number of reviewers
East Coast	25	25
Central	35	32
West Coast	7	8

3. Did the program recognize and resolve conflicts of interest when appropriate? **Comments:** The Committee reviewed a total of 55 proposals, 17 awards and 38 declines. We found three conflicts of interest, two among awards and one among the 38 declines. We noted that the program recognized the small number of conflicts and resolved them appropriately. A reviewer on one panel submitted a review that was subsequently determined to be a conflict of interest for him. Once the panel discovered the conflict, the individual left the room and did not take part in the discussion. The panel disregarded his review when they made the funding decision.	**YES**

4. Additional comments on reviewer selection:

See our comments under Sections A.2.2 and C.1 regarding EPSCOR and minority representation.

A.3 Questions concerning the resulting portfolio of awards under review. Provide comments in the space below the question. Discuss areas of concern in the space provided.

RESULTING PORTFOLIO OF AWARDS	APPROPRIATE, NOT APPROPRIATE[3], OR DATA NOT AVAILABLE
1. Overall quality of the research and/or education projects supported by the program. **Comments:**	**APPROPRIATE**

[3] If "Not Appropriate" please explain why in the "Comments" section.

The scores on the funded proposals were in most cases greater than or equal to 4.0, although a score of 4 or more was not a guarantee of funding. A few proposals with scores of 3.83, 3.4 and 3.67 received funding.	
2. Does the program portfolio promote the integration of research and education? **Comments:** In our review a significant number of projects included the integration of research and education in their strategies to increase the number of students pursuing and receiving degrees in STEM education. One would question future projects that do not incorporate the integration of research. Project Pathways: Broadening Access and Success for STEM Students at Dallas County Community College engages students in a research expedition to the Big Thicket National Preserve. Students, many of whom are first generation college students, women, Hispanic or persons with disabilities, assisted the U.S. National Park service researchers in collecting data used for national strategic planning related to environmental issues. Regarding the integration of research experiences for STEM students as an attraction and retention tool; this approach is also a possible tool to incentivize persistence to graduate level work. For example, STAIRSTEP adopts strategies for increasing participation of women and underrepresented minorities in STEM as identified by the Building Engineering and Science Talent organization (BEST) in 2004 [4]. STAIRSTEP extends this program to serve a larger student population and a broader area of science. STAIRSTEP integrates at risk students into the field of science and the departmental communities through early engagement in an enriched research program. Strategies include: (1) engage STAIRSTEP students in an enriched research plan with tutoring, mentoring, and peer support; (2) use institutional relationships to help students bridge to the next level; (3) dispel misconceptions that discourage participation in science; and (4) engage STAIRSTEP students in outreach programs for high school students and university students in general studies or undeclared majors. STAIRSTEP students receive a stipend to perform research and participate in outreach functions for ten hours per week. Students work in teams under the direction of faculty members who serve as mentors and role models. Watershed Watch: Monitoring the Merrimack and Pasquotank Drainage Basins as a STEM Undergraduate Recruitment Tool is a collaborative project between the University of New Hampshire and Elizabeth City State University, an HBCU. The program provides research opportunities for students and creates a pathway for underrepresented students to move from Elizabeth City to the University of New Hampshire. Queensborough Community College also embeds research as a protocol to increase interest and retention. The Queens Borough Bridge, a consortium between a two-year college, four-year college and national laboratory, will increase the enrollment, retention, and graduation of STEM students by involving them in high-caliber research during their first year of study and	**APPROPRIATE**

integrating research throughout their undergraduate education; increasing their skills, confidence and commitment to STEM during the critical first semesters; and establishing Science Academies, through which small cohorts of students will study and progress to graduation together. The intellectual merit builds on a strong foundation and incorporates design principles that have been shown to contribute to success in the early stages of STEM majors' training and expand higher education capacity: *Enriched research experience* beginning in students' first year and extending throughout their undergraduate careers; *institutional leadership* and *engaged faculty*; a *peer support* component that engages students in research and education via small cohorts and builds camaraderie and commitment to STEM; *personal attention* through faculty mentoring, Peer-Led Team Learning (PLTL) workshops, and peer tutoring and advisement; *bridges to the next level* that smooth pathways to baccalaureate degrees; *targeted recruitment* via existing high school programs; and *continuous evaluation.*	
3. Are awards appropriate in size and duration for the scope of the projects? **Comments:** The awards reviewed ranged in size from $370,640 to $2,500,000 and are five years in length. Projects appear to be appropriate in size, duration, and scope. In many cases projects need five years in many cases to implement the program and achieve results. Our review of several awards indicated that the program officer provided funding in addition to the requested amount in response to panel comments or concerns. One reviewer questioned the high administrative cost that included salaries, fringes, evaluation, and indirect costs because it was more than 50% of the project when compared with the participant costs of the project. These costs may be dependent on the type of institution and its funding. Another COV reviewer commented that the PI's management role is sufficiently great that they might deserve more compensation; we believe that in some cases this increase could be justified.	**APPROPRIATE**
4. Does the program portfolio have an appropriate balance of: • Innovative/potentially transformative projects? **Comments:** The intent of STEP is to increase the numbers of participants in STEM fields in lieu of producing innovative/potentially transformative projects. With this purpose in mind, the STEP program will increase the number of STEM graduates and most proposals will use best practices to achieve this	**APPROPRIATE**

goal. The research projects which elicit student involvement are unique to the locale of the institution. The type II awards conduct research in areas that can further an understanding of factors that contribute to the attraction to and retention of students in STEM fields. Several projects address students from underrepresented groups. Findings can impact ways in which institutions recruit and retain STEM majors.	
5. Does the program portfolio have an appropriate balance of: • Inter- and Multi- disciplinary projects? **Comments:** All STEP projects are inherently interdisciplinary, because the goal of the program is to increase the number of students across the range of STEM disciplines. A campus-wide group of representatives of various departments manages every one of a randomly selected set of projects. In the case of grants that involve more than one institution, representatives of more than one campus participate in the project steering committee. Chemistry, biology, and mathematics are almost always represented on the steering committee. Representation of faculty from the various sub-disciplines of engineering and faculty from computer science occurs often. Less conspicuous representation comes from Physics and Earth science. Data in the jackets demonstrate that in some of these projects, interdisciplinarity goes beyond a group of high-level people meeting about the project and seems to have led to a group of faculty who actually work together on something. At Roosevelt University and Harold Washington College in Chicago, a very robust faculty development effort has called on the efforts of several faculty members. At the New York institute of Technology, part of CUNY, the design of a new course for freshmen has science faculty talking to others in different science disciplines as well as mathematicians. The project at the University of South Carolina embeds insights from cognitive science into the project design from the beginning. One of the faculty at South Carolina has become a content-area faculty member who regularly participates in national meetings of a prominent education group, the AERA. As the study of STEM education increases in prominence, especially at the high school level, stressing the importance of interdisciplinary teaching, not just across the areas of math and science and engineering but also integrating the humanities will take on increased importance in higher education as well.	**APPROPRIATE**
6. Does the program portfolio have an appropriate balance considering, for example, award size, single and multiple investigator awards, or other characteristics as appropriate for the program?	**APPROPRIATE**

Comments: Though the statistical sample is relatively small -- fifteen Type 1 awards of which three are in reality a single proposal bringing the total of independent Type 1 awards reviewed by the COV to thirteen – and four Type 2 awards, the portfolio appears to be appropriately balanced. Among the Type 1 awards, the range of award size is appropriate given the guidelines from slightly less than $500K to $2M. Only one single investigator award appears among the thirteen separate awards; otherwise, the portfolio has good balance. Four of fifteen are smaller institutions, five are mid-sized, and six are large. About half the awards are urban universities; about half are minority-serving. Four awards went to 2-year institutions and four others involve collaboratives among 4- and 2-year institutions. Doctoral intensive institutions received Two Type 1 awards. Of the four Type 2 awards we reviewed, no single investigator received an award. Award size ranges from just under $600K to just shy of $1.5M. All awards went to doctoral intensive, flagship universities.	
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:** 100% of the PIs who have received STEP funding have previously served as PIs on NSF grants; about 50% of the declined proposals were from PIs who have not previously served as a PI on an NSF grant. Therefore, it appears that previous success as a PI has resulted In a much greater probability of success in the STEP. We recommend that NSF look for ways to increase the number of new PIs – training, Webinar…	**APPROPRIATE**
8. Does the program portfolio have an appropriate balance of: • Geographical distribution of Principal Investigators? **Comments:** After we reviewed grants including 4 type 2 grants, the overall portfolio seems to have a strong geographical distribution of PIs. Our best estimation of the breakout is: NE-14, Mid Atlantic-5, South-12, Central 15 and W/SW-22. Since we	**APPROPRIATE**

reviewed only 4 Type 2 grants, this sample is not statistically significant, but 3 are from the W/SW and one comes from the South. Panelists would want to look for opportunities in the Northeast, West and Central locations.	
9. Does the program portfolio have an appropriate balance of: • Institutional types? **Comments:** The sample of jackets we reviewed included two-year colleges and public four-year colleges. In a number of instances, four-year institutions were working with one or more two-year colleges, and the two-year colleges received a significant amount of the funding.	**APPROPRIATE**
10. Does the program portfolio have an appropriate balance: • Across disciplines and sub disciplines of the activity? Comments: In general, the vast majority of Type 1 awards represent a broad cross-section of disciplines. In only two of the thirteen was the focus exclusively engineering. From a review of declinations, we found clear evidence that in several instances projects do not receive awards due to an overly narrow focus on a small subset of sciences or on applied fields, e.g., preparation for health professions not central to the NSF mission sensu stricto. We recommend looking at numbers more closely. The COV found that proposals have been rejections because they were not sufficiently multidisciplinary.	**APPROPRIATE**
11. Does the program portfolio have appropriate participation of underrepresented groups? **Comments:** The COV found commendable participation of underrepresented groups in the 17 awards we reviewed. Several of the projects focus extensively on increasing participation by underrepresented groups, and a number of others have significant components directed toward underrepresented groups - African Americans, Hispanics, Native Americans, and women. Two of the research studies address the issue of lack of participation by and success of underrepresented groups. The study proposed by the University of Texas – Austin examines high school factors that contribute to participation by African Americans and Latinos in STEM fields. The University of California – Los Angeles focuses on the factors that increase the likelihood of retention in STEM fields by students, particularly underrepresented	**APPROPRIATE**

minorities. The University of Minnesota – Morris centers its activities on Native American students. The portfolio includes a diversity of institutions including Fayetteville State University, an HBCU, and Hispanic serving institutions such as Southwestern College, and San Diego City College. The portfolio also includes Community Colleges as lead institutions as well as partner institutions.	
12. Is the program relevant to national priorities, agency mission, relevant fields and other constituent needs? Include citations of relevant external reports. **Comments:** Projects of the STEP program are relevant to national priorities, agency mission, relevant fields and other constituent needs. The purpose of STEP is to increase the number of students (U.S. citizens or permanent residents), an receiving associate or baccalaureate degrees in established or emerging fields within science, technology, engineering, and mathematics (STEM). Awards made in this program are consistent with STEP's intent, and also focus on increasing the diversity of students studying STEM. This is consistent with reports citing the need for more students and workers with STEM literacy and capability as an issue of US competitiveness in the global innovation economy and of national security, dating back to A Nation at Risk, Rising Above the Gathering Storm, The Quite Crisis, Tapping America's Potential and the widely read book, "The World is Flat", by Thomas Friedman.	**APPROPRIATE**
13. Additional comments on the quality of the projects or the balance of the portfolio: The COV commends NSF for the quality and balance of the portfolio.	

A.4 Management of the program under review. Please comment on:

1. Management of the program. **Comments:** NSF STEP staff has done a commendable job in managing and improving the program. As previously noted we do believe that the impact of site visits can add significant value to the program and culture by contributing to the institutional change needed to support the attraction and retention of STEM majors. Based on our review of the STEP program, it appears to us that the internal

organization of the NSF-DUE has established an excellent organizational structure which effectively promotes the STEP to prospective PIs. Then, through its work with potential proposal PIs, the peer review process and internal staff support and engagement with the proposals results in an objective, highly effective and efficient review and award process. We realize that the thorough review of proposals by a relatively small NSF staff results in a demanding workload; however we believe that NSF conducts this process well and commend the STEP-related personnel on their fine work.

Our one criticism in this area is our hope that in the future the funding for this and other undergraduate education programs will increase in order to fund more worthy projects and, thereby, increase the number of undergraduate students who choose careers in STEM fields.

Additionally we noted less diversity in year 3 reviewers than desirable. Community colleges and minority serving institutions would benefit greatly from better representation on the Year 3 review panels.

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

Comments:

The STEP program guidelines clearly state Type II grants are for educational research which can lead to the increase in the number of students who choose STEM careers. Proposal announcements and reports indicate that the program's management has been responsive to utilization of emerging research and educational opportunities in this part of the STEP. We also suggest placing stronger emphasis on some of the non-traditional educational practices which have been shown to increase student interest in STEM fields. Examples of these initiatives include: incorporation of service-learning activities at an early level; creation of college-industry alliances early in the college experience; ensurance that first-year initiatives to attract new students into STEM careers are continued and strengthened throughout the undergraduate experience; connections between two and four-year institutions are relatively seamless so that barriers to transfer to undergraduate degree programs are minimized; and incorporation of ICT to enhance learning, etc.

The COV reviewed seven Type II proposals with four receiving funding. In the funded group, reviewers and the NSF staff appear to have given full consideration to the guideline of utilizing appropriate research methodology to study trends and factors leading students, often from under-represented groups, to select careers in STEM fields. NSF staff follow up with the PIs was probing and seemed to ascertain appropriate responses to any questions or concerns the reviewers raised. After the conclusion of the research proposed by the funded proposals, we expect that the results will provide a better understanding of what is working and what is not in helping students decide upon careers in STEM fields.

We note that this is an area where research, widely distributed, could make a significant impact upon undergraduate STEM programs and, consequently, might result in an increase in the number of students who decide to pursue careers in STEM fields. The COV recommends that more grants focus on some emerging education practices that feed into the 2- and 4-year programs including Early College High Schools, dual and concurrent enrollment, and Pathways.

We further recommend that future grants look more at the emerging practice of virtual learning environments, effective use of technology and industry based experiences through exploration from both a research and a practice focus.

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

Comments:

Based upon the evidence available to the COV, program announcements and materials, the quality of proposals funded, the follow up on issues raised by the reviewers, and the distribution of funds to the awarded proposals, we conclude that the program planning and prioritization process was appropriate.

See recommendations on support in Section C.

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

Comments:

The program responded very constructively to the previous COVs comments and suggestions. We noted that a number of the suggestions from the previous COV have been implemented. For example, the 2007 and 2008 competition used Webinars to inform reviewers about what they need to do prior to writing their reviews. This procedure evolved in response to suggestions that some reviewers needed more guidance about what was expected in a review. Another implemented recommendation was to increase the award size for submissions by consortia.
The program also added options under Type 1 proposals for institutions that have previously received STEP grants as well as those that have no prior STEP awards.

5. Additional comments on program management:

The STEP program appears to be a very strategic and very focused program, building on the best known methods available, and through program evaluation, having provided evidence for those initiatives that are less successful (i.e., voluntary supplemental education programs). Early evaluation data would indicate that we are making a difference. More longitudinal evaluation and research would be very helpful in this area. Sharing the best practices and research with other mission agencies is critical, as is sharing with the Dept of Education to inform such programs as the Noyce Scholarship program; perhaps indicating that over time, the ability for an institution to receive funding was in part dependent on demonstrating evidence of implementing some of these highly effective strategies.

We commend the NSF staff's ability to work with PIs in resolving individual issues despite the increase in proposal workload, and in its charge to manage highly complex programs.

PART B. RESULTS OF NSF INVESTMENTS

.

The NSF mission is to promote the progress of science; advance national health, prosperity, and welfare; and secure the national defense.

The COV commented on (1) noteworthy achievements based on NSF awards in the portfolio under discussion; (2) ways in which funded projects have collectively affected progress toward NSF's mission and the strategic outcome goals of Discovery, Learning, and Research Infrastructure: and (3) expectations for future performance based on the current set of awards. As requested, we did not comment on the fourth strategic outcome goal of stewardship.

NSF investments produce results that appear over time. The COV review gave consideration to significant impacts and advances that have developed during the last four years regardless of when the investments were made.

The COV used the program and award portfolio information that NSF provided, as well as members' own knowledge, and other appropriate information to develop the comments for this section. We assessed award "highlights" as well as information about the program and its award portfolio as it relates to the three outcome goals of Discovery, Learning, and Research Infrastructure.

B. Please provide comments on the activity as it relates to NSF's Strategic Outcome Goals. Provide examples of outcomes ("highlights") as appropriate. Examples should reference the NSF award number, the Principal Investigator(s) names, and their institutions.

B.1 OUTCOME GOAL for Discovery: "*Foster research that will advance the frontier of knowledge, emphasizing areas of greatest opportunity and potential benefit and establishing the nation as a global leader in fundamental and transformational science and engineering."*

Comments:

For the most part this program focuses on excellent implementation of best practices to increase attraction and retention of students to STEM majors. Only 4 Type 2 Awards were made of the 56 jackets reviewed even though the vast majority of Type 1 grants awarded base their projects on the existing research.

The research Type 2 grants, while rarely tackling transformative research questions, provide data to enhance the research and evidence base for the practices that are most successful. This activity guides education leaders and other practitioners in their decisions regarding strategies to increase the number of STEM majors.

Surprisingly enough, research on the use of technology to engage, reach and teach students at both the high school-feeder level and at the university level is still minimal. We recommend exploring possibilities that make use of the cyberlearning initiative, as well as exploring the effectiveness of other virtual learning and non-traditional classroom environments.

Some important projects "fostering research that will advance the frontier of knowledge, emphasizing areas of greatest opportunity and potential benefit" can be seen in the South Carolina project **DUE #0653160**. Per the project summary "the purpose of this project is to improve undergraduate retention in the biological sciences through the reformulation of instruction in the core course sequences. Prior research using a national sample indicates 90% of undergraduates who leave STEM majors cite poor instruction as a primary cause. Further, 74% of students successfully graduating from their STEM programs identify poor instruction as a major obstacle (Seymour & Hewitt, 1997).
Using a double-blind design, the proposed study will test the hypothesis that the lack of explicit

instructions in scientific problem solving is a **major factor in low STEM retention**. The project will determine the extent to which explicit, comprehensive problem solving instruction contributes to STEM retention. Additionally, this project seeks to validate a general model of instructional design for STEM disciplines that can be easily transferred and adapted across fields and institutions

Of paramount importance is **DUE #0653280** designed to research the impact of financial aid on Hispanic students' progress through STEM. Hardly novel but with conclusive research and evidence this project could generate the kind of research that drives policy changes and funding decisions of institutions, philanthropies, and the business community.

Although the STEP program has not been designed to conduct transformational research, many of the STEP awards engage undergraduate students in research early in their educational career. The students work with researchers on projects of significance to the state, region, and nation. Their research experiences which in fact build the national research capacity, also provide them with training in research methods and techniques, and prepare them for careers in which their research has the potential for advancing "the frontier of knowledge" and "establishing the nation as a global leader in fundamental and transformational science and engineering".

B.2 OUTCOME GOAL for Learning: "*Cultivate a world-class, broadly inclusive science and engineering workforce, and expand the scientific literacy of all citizens."*

Comments:

The STEP program has been designed to increase the number of students completing STEM majors. As such, it does not address the literacy of all citizens, and so it does not meet the second part of this outcome goal. However, since all undergraduate institutions and many community colleges have some type of general education program which includes STEM subjects required of all students, improvement in STEM educational programs developed under STEP should either automatically reach all students, or be easily adapted to do so. While most of the STEP proposals we reviewed focused on students who already have expressed some interest and capability in STEM areas through the STEP proposal guidelines, we recommend reinforcing the importance of inclusion of scientific literacy to all students in STEP projects.

Since the STEP programs focus on increasing the size of the U.S. science and engineering workforce, they broadly contribute to the development of a world-class group of people engaged in STEM careers. Several STEP projects make the group of STEM participants more inclusive by appealing specifically to underrepresented minorities. Representative and exemplary projects include the Medgar Evers college STEP program and the Roosevelt University/Harold Washington College program, both of which explicitly address the recruitment of urban African Americans. The program at Cal State-Fullerton is one of several which specifically recruit Hispanic students. An interesting program at the University of Minnesota-Morris shows how a non-minority-serving institution can successfully recruit Native American students from the surrounding area. (**DUE #0757073)**

One project previously highlighted by the NSF (highlight 13435 in the briefing book) addresses the learning aspect of this question by trying to identify certain particularly appealing aspects of the undergraduate research experience and incorporating them in a freshman course for engineers. UCLA's Introduction to Engineering Disciplines course, designed to support new freshmen students, uses team projects and field trips to help students focus on what makes professional engineers special. Other disciplines at UCLA plan similar courses.

B.3 OUTCOME GOAL for Research Infrastructure: "*Build the nation's research capability through critical investments in advanced instrumentation, facilities, cyberinfrastructure and experimental tools.*"

Comments:

In general, the STEP program goals do not directly address the usual interpretation of instrumentation or research infrastructure. However, as the express goal of STEP is to build intellectual and human capital, increasing the net numbers of STEM graduates is, by definition, building research infrastructure.

PART C. OTHER TOPICS

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

With an eye on assessing current reality and determining the important role that STEM plays in the White House agenda and in the STEM Competitive priority for Race to the Top, we feel that it is time to maximize STEM effectiveness. By increasing the awareness of the importance of two-year institutions in STEM education and addressing the common core standards that STEM supports, the interest in STEM's broad scientific agenda attracts new proposers and motivated students. The COV has several suggestions for improving program areas as follows:

PROGRAM MANAGEMENT

- Increase The Number of Site Visits Due to Transformative Value to Institutions.
- Develop Assessment Tools to Determine Program Successes.
    - Strengthen Institutional Research Data Bases.

REVIEWERS

- Encourage Reviewers to Provide More Substantive Comments to Support Funding Proposals.
    - Provide Examples of Excellent Reviews.
- Increase the Number of Community Colleges and MSIs on Third-Year Review Panels.
- Ensure That Panel Membership Includes Educational Research Expertise.

PRINCIPAL INVESTIGATORS (PIs)

- Expand the Pool of Successful PIs.
    - Provide Mentoring and/or Training for First Time Proposers.
    - Encourage PIs to Develop Leaders to Fill the Pipeline With a Cadre of Experts.
- Increase Success Rate for Resubmissions.
    - Openly Encourage PIs to Communicate Directly with POs.
    - Provide More Information in Reviews to Unsuccessful Proposers.

STEM STUDENTS

- Increase Number of STEM Graduates by Meeting Pent Up Demand for STEP Program
    - Fully Fund A Significantly Higher Number of Quality Proposals
    - Tie Funding Goals to National Priorities.
    - Increase Cross-Agency Collaboration.
- Encourage the Integration of Liberal Arts and STEM.

SUSTAINABILITY

- Encourage Shared Funding With Public/Private Partnerships to Increase Impact and Sustainability.
    - Improve Knowledge Management to Fund High Quality Proposals.
    - Provide Funding Support for Replication of Successful Programs
- Utilize Accepted Educational Research Methods for Determining the Outcomes of the Project.
- Sharing the best practices and research with other mission agencies is critical, as is sharing with the Dept of Education to inform such programs as the Noyce Scholarship program; perhaps indicating that over time, the ability for an institution to receive funding was in part dependent on demonstrating evidence of implementing some of these highly effective strategies.

C.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 previous COV suggested that efforts be made to determine, in some way, the number of additional STEM graduates who were encouraged to continue in science in whole or in part as a result of the STEP program. We applaud the efforts which the NSF and its contractor partners have made as a result of this suggestion. We received an extensive verbal report from Susan Hixson on the morning of our first meeting, and we also noticed that the annual report of many of the STEP grantee institutions included various types of statistical information.

We appreciate the difficulties involved in collecting this kind of information. Since institutions often take some time to set up a STEP program, at what point do you regard a STEP program as having been "started?" How long should we wait until we determine whether or not a STEP-supported student has graduated? Data suggest that it takes six years for a four-year institution to make this determination. Two-year institutions have their own special issues. What does it mean to "major" in a STEM field at a two-year institution? When a student almost, but not quite, completes an AA degree at a two-year institution and then transfers to a four-year institution, how do we ensure that this student is regarded as a successful outcome from the two-year school, even though this student did not get a degree?

The NSF and its contractor partner have made considerable efforts to get past these difficulties and gather the data needed to obtain a global answer to the question of how many graduates receive help through a particular STEP program. We hope that these efforts will continue.

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

Allocation of resources is critical to setting and funding national priorities. The global perspective calls for a unique vision so that projects add value to resources and take advantage of evolving pathways. To shape the future, we recommend focusing on emerging areas of science, in particular, Cybersecurity and Energy. This emphasis will facilitate more effective choices for non-traditional STEM students and encourage increased international STEM experiences. We advocate collaborating with the Cyberlearning Initiative and making it a high priority. Additionally we encourage a research agenda that explores and highlights the effective and innovative use of technology. We also suggest building on emerging educational trends including early college high schools and concurrent/dual enrollments.

To further look ahead, we recommend driving Cross-Agency collaboration to facilitate efficiency and a return on the investment of resources. By increasing the funding of high quality grants via public and private partnerships, NSF has an opportunity to realize significant gains in the improved dissemination of the most promising strategies.

An important agency-wide issue, indeed a national issue, is the overall support for undergraduate education in STEM fields throughout the entire undergraduate experience. STEP is an essential step toward increasing STEM graduates with most of the proposals focused on the first year experience of students in STEM disciplines. We feel it is appropriate to begin to address the number of STEM graduates by focusing on the first year of instruction. At this level we find the greatest attrition of students who have shown interest and aptitude in STEM fields. However, high quality teaching, curricular innovations and activities begun in the first year will set expectations for subsequent years. If these expectations are not fulfilled, particularly in the second year (often referred to as the “sophomore slump”), many of those students who were “on the bubble” in the first year will decide not to pursue STEM careers, even though they have the talent to do so. Therefore, we suggest that NSF in general, and STEP in particular, urge proposers and reviewers to look for programs that show promise for and commitment to continue and build upon what is found to be successful in the first year STEP. Such a comprehensive undergraduate STEM experience will need new and expanded NSF funding. Support for the development of some model STEP programs which reach throughout the undergraduate educational experience, along with inclusion of a rigorous learning outcomes and assessment program, should become transformational in the STEM undergraduate educational programs. (Think of the extraordinary initiatives developed in the sixties in response to Sputnik and our own “Man on the Moon” projects. Today’s shortage of US citizens in science and technology fields is similar.)

This might also suggest and reinforce the recommendation to provide a greater focus on other issues of national security that can tap the hearts, minds, creative and competitive talents and sprits of our nations youth in similar ways. Creating these cross disciplinary, cross program and cross mission agency ‘call to action” in areas like energy, sustainability and cyber security could finally address the cry of many for “the next Sputnik”.

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

The COV discussed the issue regarding the size of the grant that an institution receives and found it is directly tied to the size of the institution vs. the number of students reached by the school. For instance a large institution might address a smaller number of students than a medium sized institution but would still receive more funding due to the institution size. The COV recommends reviewing the number of students impacted as a larger component of the funding allocation, in addition to the size of the institution.

Additionally the amount of funding that an institution may need for personnel depends on the type of institution; it was unclear to at least one Committee member how this was factored into the decisions regarding amount of funding, but was felt to be important, as well as the ft/pt ratio of faculty and staff.

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

COV members who previously participated in COV reviews raved about the positive improvements in the process, especially those who had served on STEP panels. The electronic links to proposals and information from the report template make it MUCH easier to locate relevant information in a shorter period of time. Use of the technical writer with the knowledge of process and protocols enhanced the COV experience. Even the telephone call between the Chair and Writer set a positive, informative tone. We unanimously appreciate the logistical cohesiveness that flowed throughout the meeting. The room set-up, accommodations, and supplies were at our fingertips, and the working lunch option helped us work efficiently and productively to produce our draft report and presentation.

All of us commend NSF for being very responsive to the needs of the group. The quality of time spent with us, the flexibility, and the accessibility of staff during our meeting were outstanding. We were very impressed with how well you implemented many of the FY 2006 recommendations including increasing the quality of the proposal reviews, the increase in the number of community college reviewers, and the addition of continuation grants, Type 1B.

Our only recommendation is to refine the meeting agenda to more closely match the actual procedures. Perhaps this change would be possible by working with the writer and having the writer participate in the Webinar to provide a brief overview of the work plan.

SIGNATURE BLOCK:

Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP)
Cathleen Barton, Chair