CEOSE

Committee on Equal Opportunities in Science and Engineering

2011-2012 Biennial Report to Congress

Broadening Participation in America's STEM Workforce

MISSION

The Committee on Equal Opportunities in Science and Engineering (CEOSE) advises the National Science Foundation (NSF) on policies and programs to encourage full participation by women, underrepresented minorities, and persons with disabilities within all levels of America's science, technology, engineering, and mathematics (STEM) enterprise.

BACKGROUND

The Committee on Equal Opportunities in Science and Engineering was established by the United States Congress through the Science and Engineering Equal Opportunities Act of 1980 to address the problems of growth and diversity in America's STEM workforce. The legislation specifically provides that:

There is established within the National Science Foundation a Committee on Equal Opportunities in Science and Engineering (hereinafter referred to as the"Committee"). The Committee shall provide advice to the Foundation concerning (1) the implementation of the provisions of sections 1885 and 1885d of this title and (2) other policies and activities of the Foundation to encourage full participation of women, minorities, and persons with disabilities in scientific, engineering, and professional fields [42 U.S.C.§1885(c)].

Every two years, the Committee shall prepare and transmit to the Director (of the Foundation) a report on its activities during the previous two years and proposed activities for the next two years. The Director shall transmit to Congress the report, unaltered, together with such comments as the Director deems appropriate [42U.S.C. §1885(e)].

CEOSE is composed of 15 individuals from diverse STEM disciplines, drawn from diverse institutions in higher education, industry, government, and the non-profit sectors. Its membership also reflects the racial/ethnic and gender diversity of the country's citizenry and includes persons with disabilities. Members of the Committee typically serve a three-year term. A full committee meeting is held three times a year (usually winter, spring, and fall) to review and evaluate policies and program opportunities focused on the state of the participation and advancement of women, underrepresented minorities, and persons with disabilities in education, training, and science and engineering research. On the basis of its findings, the Committee makes recommendations to the Foundation for improving the levels of participation of underrepresented groups in STEM professions. Committee members also interact with other federal agencies, such as the Department of Defense, National Institutes of Health, Department of Energy, the National Aeronautics and Space Administration, and the National Oceanic and Atmospheric Administration in forging multi-agency collaborations to broaden participation by underrepresented groups in the Nation's STEM workforce.

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EXECUTIVE SUMMARY

To retain the Nation's tradition of STEM leadership and to help solve America's competitiveness dilemma, the country must increase its efforts toward successfully educating those groups within the Nation that are not being sufficiently tapped for the STEM workforce, particularly African Americans, American Indians, Hispanics, women, and persons with disabilities. Tapping this pool of talent is urgent to the well being of our country! This message has been stated multiple times before by CEOSE and others, and repeated, persuasively, in the recent report *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*. The more time that passes without action, the more urgent the problem becomes.

Progress and Challenges

Over the past half-century, the numbers of women, minorities, and persons with disabilities earning science and engineering degrees and the numbers entering science and engineering employment have increased. This is progress, but not sufficient progress to redress the historic patterns of underrepresentation for these groups. Women have come closest to achieving parity, yet remain underrepresented in areas like engineering, physics, computer sciences as well as among the top academic ranks in all areas of science and engineering. African Americans, Hispanics, American Indians, and persons with disabilities remain woefully underrepresented in science and engineering. Only a small percentage of African Americans, Hispanics and American Indians complete college and earn bachelor's degrees in any field, even fewer complete advanced degrees, and they remain severely underrepresented among science and engineering faculty. Students with disabilities have greater college attrition than students without disabilities; they remain a small share of the science and engineering workforce, and they have lower employment rates than those without disabilities.

NSF Investment in Broadening Participation

NSF has invested in Broadening Participation (BP) efforts to increase the involvement of African Americans, Hispanics and Native Americans, women, and persons with disabilities in the academic community and in the STEM workforce through its grant making, through its staffing decisions, and through its engagement in outreach and related activities. The Foundation has implemented most of CEOSE's prior recommendations. A noteworthy exception is CEOSE's standing recommendation that NSF establish a Hispanic-Serving Institutions (HSI) program, as authorized in the America COMPETES Act. CEOSE remains committed to this recommendation.

In FY2011, the Foundation spent $754.05 million dollars on broadening participation, and in FY2012 it spent $911.90 million. The funding for NSF's flagship broadening participation programs, such as Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE), Historically Black Colleges and Universities Undergraduate Program (HBCU-UP), and Louis Stokes Alliances for Minority Participation (LSAMP), was $190.6 million in FY 2010, 182.6 million in FY 2011 and 157.7 million in FY 2012. In addition to its funding of broadening participation programs, NSF's broader impacts criterion has fostered broadening participation activities by individual researchers not accounted for in official data. In addition to funding programs, NSF has striven to build a diverse and inclusive workforce within the agency. NSF directorates actively work to reduce implicit bias through training for staff and for proposal reviewers.

These commendable efforts have had positive impacts on the participation of women, African Americans, Hispanics, Native Americans, and persons with disabilities, but, as noted above, the

cumulative impact on the underrepresentation of these groups has been minimal. Award statistics offer further evidence of this underrepresentation. In FY 2012, when the Foundation made 11,524 awards, people of color from underrepresented groups in STEM were the PIs of 699 awards. In FY2012, female PIs of all races/ethnicities were 24 percent of awardees, Hispanics were 4 percent, African Americans were 2 percent, American Indians/Alaska Natives were 0.2 percent, and Native Hawaiians/other Pacific Islanders were less than 1 percent of awardees. Persons with disabilities received approximately 1 percent of awards.[1]

CEOSE Activities and Future Plans

Given the urgent need for action, CEOSE devoted its activities in FY2011 and FY2012 to the identification of a strategy or combination of strategies that would have a large significant impact on broadening participation. At its five formal meetings, CEOSE held discussions with the NSF Director and Deputy Director, with NSF Staff, with liaisons from other Federal agencies as well as with outside experts with expertise in broadening participation programs. Key elements of these discussions included the need for systematic collection, analysis and dissemination of longitudinal data for use in identifying the most successful strategies, the success of partnerships between Minority-serving Institutions (MSIs) and Research 1 (R1) institutions and of multi-institutional partnerships such as the Louis Stokes Alliances for Minority Participation (LSAMP), and the need for institutional transformation at R1 institutions[2] such as the systemic changes achieved by the NSF ADVANCE program.

CEOSE's future activities will be guided by Vannevar Bush's goal of a fully inclusive, fully diverse workforce.[3] More specifically, CEOSE plans to:

- Review the broadening participation efforts of NSF's Centers portfolio as well as the broadening participation data and strategic plans of NSF directorates.
- Continue engagement with Federal Liaisons for leveraging opportunities to coordinate and be more systemic in addressing diversity and equity issues in STEM.
- Continue CEOSE's emphasis on broadening participation accountability activities, including monitoring, assessment and evaluation.
- Explore and document the contributions of MSIs and programs in broadening participation to inform recommendations to NSF.
- Examine graduate admissions practices to inform recommendations for improved STEM graduate level workforce outcomes and for improved broadening participation of underrepresented groups in STEM graduate education and training.
- Explore the significance of financial wherewithal and student debt as factors influencing persistence to the doctoral degree in STEM fields.
- Investigate the potential uses of data-intensive scientific approaches and methods for better informing the Committee and its recommendations to NSF on the condition of underrepresented groups and identifying barriers to and potential strategies to enhance their

access, retention, completion and advancement, that is, pathways to meaningful careers and contributions to science and engineering.

- Explore with NSF and others about hosting mini-symposia or other similar broad expert discussions focused on the condition in STEM of Hispanics and Hispanic serving Institutions, their institutional mechanisms, strategies, approaches and programs, as well as their significance and roles within U.S. higher education for broadening participation of Hispanics and other minority groups, in order to inform recommendations to NSF.

- Work with NSF to explore hosting mini-symposia or other similar broad expert discussions on the science of broadening participation.

These planned activities are important, but an enhanced effort to broaden participation in science and engineering education and employment must begin now. To emphasize the urgency for bold action, CEOSE departs from its past practice and makes only one recommendation in the Biennial Report.

CEOSE's Recommendation for a Bold New Initiative at NSF

The changing nature of STEM, challenges to U.S. competitiveness, the creative advantages of achieving workforce diversity, concerns about global leadership and domestic security, and the drive to realize America's democratic principles by achieving America's promise of equal opportunity for all call for more innovative, transformative work, engaging scholars from multiple disciplines, in order to yield satisfactory inclusion of all Americans in STEM education and in the STEM workforce. To better address emerging challenges and the limited progress being made in improving broadening participation in STEM, as well as the findings in this report and other national reports, the Committee on Equal Opportunities in Science and Engineering recommends that

> **NSF implement a bold new initiative, focused on broadening participation of underrepresented groups in STEM, similar in concept and scale to NSF's centers, that emphasizes institutional transformation and system change; collects and makes accessible longitudinal data; defines clear benchmarks for success; supports the translation, replication and expansion of successful broadening participation efforts; and provides significant financial support to individuals who represent the very broadened participation that we seek.**

Through both providing direct support for individuals (students, postdoctoral fellows, faculty, practitioners) and coupling dissemination of broadening participation efforts with catalyzing innovative adaptations of successful initiatives, NSF and the nation will significantly "move the needle" toward developing a strong, highly educated, and highly trained domestic STEM workforce that reflects and represents the U.S. population. Equally important will be research and training activities that shift the paradigm of broadening participation in global science. We seek game-changers to reach the interdisciplinary coordination needed for the seamless preK-20+ scope of broadening participation.

The "boldness" of this initiative rests in its focus on institutional transformation and systemic change in addition to basic research on broadening participation. The "boldness" comes from making a long-term commitment to sufficient resources, to new resources, to alter the current trajectory in STEM employment.

In sum, the nature of the economy has changed and is changing, and so have the demographics of our nation. A democratic society in which large and rapidly growing population subgroups are unable to participate and contribute to scientific and technological advances faces a grave economic, intellectual and scientific disadvantage in an increasingly globalized competition for talent and innovation. Corrective and effective action must be taken now.

ACRONYMS

ADVANCE	Increasing the Participation and Advancement of Women in Academic Science and Engineering program
AGEP	Alliances for Graduate Education and the Professoriate program
AIR	American Institute for Research
ARRA	American Recovery and Reinvestment Act
BIO	Biological Sciences Directorate
BP	Broadening Participation
BPC	Broadening Participation in Computing program
BPC-A	Broadening Participation in Computing Alliance program
BPS	Beginning Postsecondary Students, Longitudinal Study
CAREER	Faculty Early Career Development program
CEOSE	Committee on Equal Opportunities in Science and Engineering
CE21	Computing Education for the 21st Century program
CISE	Computer and Information Science and Engineering Directorate
CLB	Career-Life Balance Initiative
COMPETES	Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (as in the America COMPETES Act)
CREST	Center for Research Excellence in Science and Technology program
DHS	Department of Homeland Security
DOC/ESA	Department of Commerce, Economics and Statistics Administration
DOD	Department of Defense
DOE	Department of Energy
DOL	Department of Labor
DOI	Department of Interior
ED	Department of Education
EHR	Education and Human Resources Directorate

ACRONYMS (cont'd)

ENG	Engineering Directorate
EPA	Environmental Protection Agency
EPSCoR	Experimental Program to Stimulate Competitive Research
EREV	Engineering Research Experiences for Veterans program
GARDE	General and Age-related Disabilities Engineering program
GEO	Geosciences Directorate
GRFP	Graduate Research Fellowship Program
GSE	Research on Gender in Science and Engineering program
HBCU	Historically Black Colleges and Universities
HBCU-UP	Historically Black Colleges and Universities-Undergraduate Program
HHEI	High Hispanic Enrollment Institution
HRD	Division of Human Resource Development
HSI	Hispanic Serving Institution
I^3	Innovation through Institutional Integration activity
IGERT	Integrative Graduate and Research Traineeship program
IPEDS	Integrated Postsecondary Education Data System
LSAMP	Louis Stokes Alliances for Minority Participation program
MPS	Mathematical and Physical Sciences Directorate
MSI	Minority-serving Institution
NASA	National Aeronautics and Space Administration
NCES	National Center for Education Statistics
NCSES	National Center for Science and Engineering Statistics
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration

ACRONYMS (cont'd)

NSB	National Science Board
NSF	National Science Foundation
NSTC	National Science and Technology Council
OCI	Office of Cyberinfrastructure[1]
OEDG	Opportunities for Enhancing Diversity in the Geosciences program
OIA	Office of Integrative Activities[2]
OISE	Office of International Science and Engineering[3]
OPP	Office of Polar Programs[4]
OSTP	White House Office of Science and Technology Policy
PAARE	Partnership in Astronomy and Astrophysics Research and Education program
PCAST	President's Council of Advisors on Science and Technology
PI	Principal Investigator
PIRE	Partnership for International Research and Education program
PREM	Partnership for Research and Education in Material program
RDE	Research in Disabilities Education program
REAL	Research on Education and Learning
REESE	Research and Evaluation on Education in Science and Engineering program
SBE	Social, Behavioral, and Economic Sciences Directorate
SBP	Science of Broadening Participation
SED	Survey of Earned Doctorates
S&E	Science and Engineering
SEH	Science, Engineering, and Health
SESTAT	Scientists and Engineers Statistical Data System
SI	Smithsonian Institution

[1] As of 2013, OCI became the Advanced Cyberinfrastructure (ACI) division within the CISE Directorate.
[2] As of 2013, OIA was changed to OIIA, Office of Integrated and International Activities.
[3] As of 2013, OISE became ISE (International of Science & Engineering) a part of OIIA.
[4] As of 2013, OPP became a division within the Geosciences Directorate.

ACRONYMS (cont'd)

SOARS	Significant Opportunities in Atmospheric Research and Science program
STEM	Science, Technology, Engineering, and Mathematics
TCUP	Tribal Colleges and Universities Program
URM	Underrepresented Minority
USDA	United States Department of Agriculture

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1. INTRODUCTION

CEOSE joins members of Congress, the President, and other national leaders in the political, corporate, and academic communities in urgently warning that the American way of life is threatened, because we are falling behind other countries in science, technology, engineering, and mathematics **(**STEM).[4] We are not adequately developing our next generation of scientists and engineers. To retain the Nation's tradition of STEM leadership and to help solve America's competitiveness dilemma, the country must increase its investments in STEM research and education and efforts toward successfully educating those groups within the Nation that are not being sufficiently tapped for the STEM workforce, particularly African Americans, American Indians, Hispanics, women, and persons with disabilities. Full utilization of this labor pool would address the need for greater numbers and preparation in STEM and eliminate the inequity of underrepresentation, and greater diversity in the STEM workforce would facilitate scientific and economic innovation (e.g., National Academy of Sciences, 2011; and Page, 2007). Tapping this pool of talent is ***urgent*** to the well being of our country! This message has been stated multiple times before, and repeated, persuasively, in the recent report *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*[5]. The more time that passes without taking action, the more urgent the problem becomes. CEOSE has delivered this message time and again, including in each of its last three *Biennial Reports to Congress*.[6]

An enhanced effort to broaden participation in science and engineering education and employment must begin now. The current financial climate is no excuse for not making a greater investment in this effort. If we fail to make a sufficient investment now, the economic problems of today will be perpetuated into the future.

The National Science Foundation (NSF) and other institutions have invested in efforts to increase the involvement of African Americans, Hispanics, Native Americans (American Indians, Alaska Natives, Native Hawaiians and other Pacific Islanders), women, and persons with disabilities in the academic community and in the broader STEM workforce; and NSF has implemented many of the recommendations that CEOSE has made in prior reports. However, as the data in *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2013* show, the cumulative impact of these investments on the overall participation of minorities and persons with disabilities in STEM has been minimal. Clearly, we need to take bolder steps and make bigger investments to improve the national condition of diversity and inclusion in science and engineering.

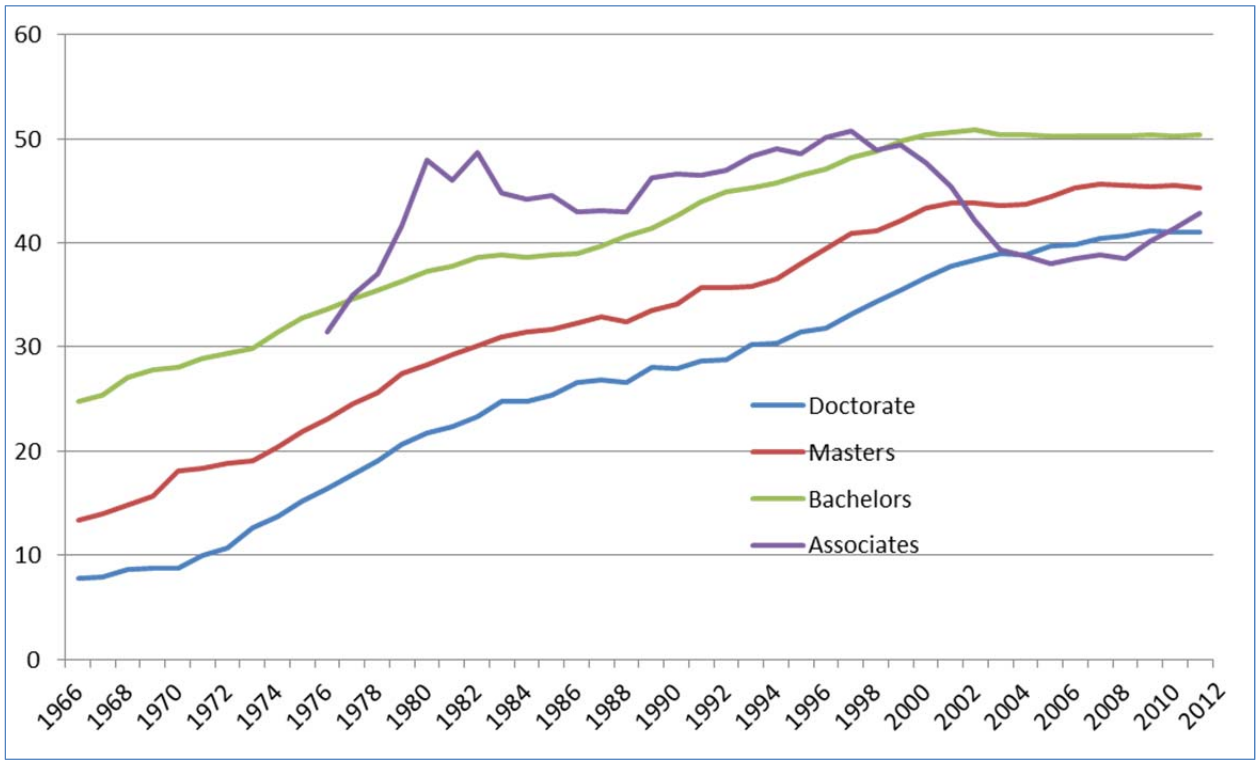
So in section five of this report, in contrast to its past practice, CEOSE makes only one recommendation:

NSF should implement a bold new initiative, focused on broadening participation of underrepresented groups in STEM, similar in concept and scale to NSF's centers, that emphasizes institutional transformation and system change; collects and makes accessible longitudinal data; defines clear benchmarks for success; supports the translation, replication and expansion of successful broadening participation efforts; and provides significant financial support to individuals who represent the very broadened participation that we seek.

2. PROGRESS AND CHALLENGES

Efforts to broaden the participation of underrepresented groups in STEM are succeeding only to a limited extent, and for the most part they must be strengthened and expanded. There has been progress, especially with respect to the participation of women. *Figure 1* below reflects the rising trend in women attaining bachelor's, master's, and doctoral degrees in science and engineering.

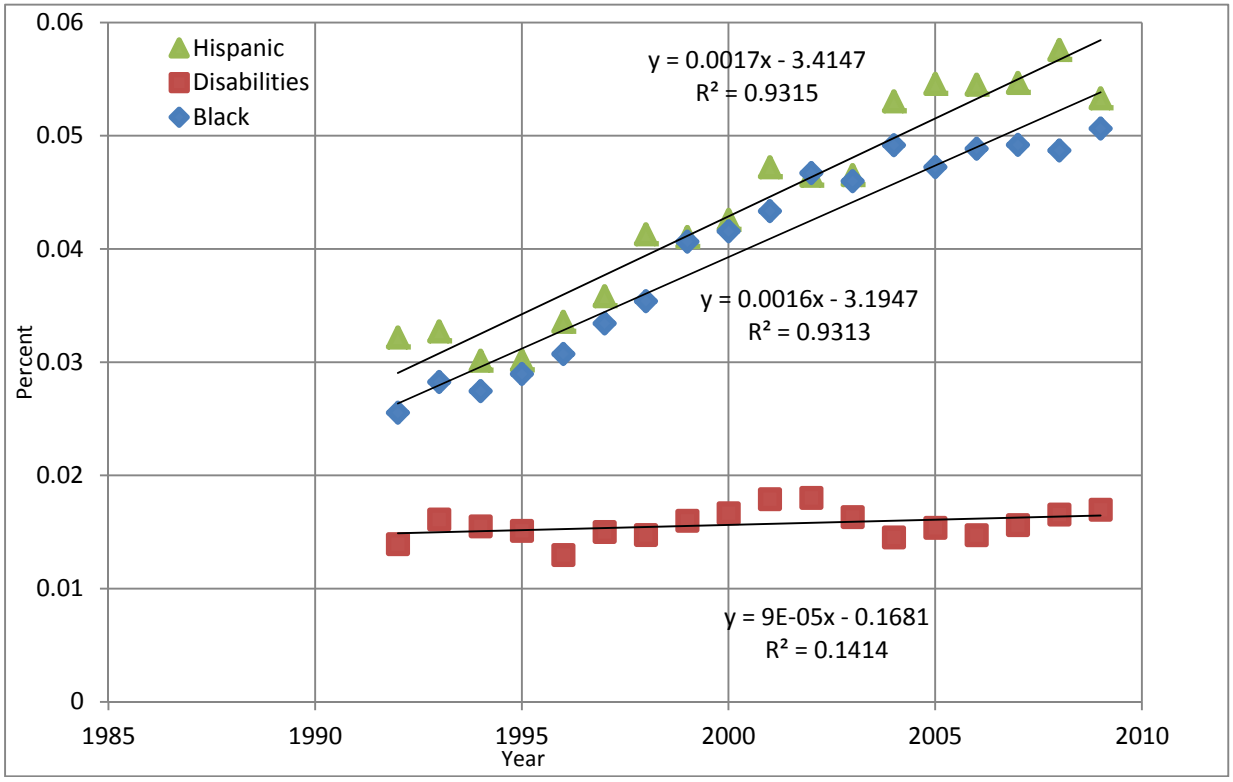
Figure 1. Women as a percentage of science and engineering associate's, bachelor's, master's, and doctoral degrees: 1966 - 2011



Note: Data not shown for associate's degrees prior to 1976, because of changes in the survey form pertaining to associate's degrees and certificates make the data in the early 1970s not comparable to later data.
Source: National Center for Education Statistics, IPEDS Completions Survey.

As *Figure 2* shows, African Americans (Blacks) and Hispanics are earning an increasing share of doctoral degrees in science and engineering. This is progress. However, as *Figure 2* also shows, the share of STEM degrees earned by persons with disabilities is not growing. Yet, despite the achievements of individual programs, the collective impact on the aggregate statistics for African Americans, Hispanics, Native Americans, women of color, and persons with disabilities remains disheartening.

Figure 2. Science and engineering doctorate degrees, by race/ethnicity and disability status: 1985 - 2009



Source: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Earned Doctorates.

Despite some progress, each of the underrepresented demographic groups constitutes a smaller share of STEM employment than their U.S. populations at large. Women represented 51 percent of the U.S. population and 45 percent of employed scientists and engineers in 2010. African Americans, Hispanics, and American Indians as a combined group were about 28 percent of the U.S. population, but only 12 percent of employed scientists and engineers in 2010. Persons with disabilities were 19 percent of the U.S. population but less than 10 percent of employed scientists and engineers.

Women

- Women who represented 51 percent of the U.S. population in 2010 earned half or more of all bachelor's degrees in psychology (77 percent), biological sciences (60 percent), social sciences (54 percent), agricultural sciences (52 percent), and chemistry (49 percent). However, women remain underrepresented in engineering (19 percent), computer sciences (18 percent), physics (19 percent), and mathematics (43 percent).

- Fewer women than men, regardless of race/ethnicity, are full and associate professors. Even in fields where women earn half or more of all doctoral degrees, fewer than half of full-time associate and full professors are women. Issues such as the challenges of balancing career and the family and the persistence of gender bias continue to impede access to the top academic

positions (e.g., Mason, Goulen, and Frasch, 2010; Etzkowitz, Kemelgor, and Uzzi, 1994; Marcus, 2013; and Moss-Racusin, Dovidio, Brescoll, Graham, and Handelsman, 2012).

African Americans, Hispanics, and Native Americans

- African Americans, Hispanics, and Native Americans as a group were about 28 percent of the U.S. population, but only 12 percent of employed scientists and engineers in 2010. Part of the reason some minorities are underrepresented in science and engineering is that these occupations typically require at least a bachelor's degree and members of underrepresented minority groups are less likely than Whites and Asians to attend or graduate from college with a bachelor's degree.

- The underrepresentation of African Americans, Hispanics, and American Indians in science and engineering employment is also the result of losses along STEM pathways, resulting in lower proportions of African Americans, Hispanics, and American Indians completing bachelor's degrees (DOC/ESA, 2011 and NSB, 2012). This is partly due to fewer completing high school and fewer completing at least some college; but the racial/ethnic gaps in educational attainment are greatest for completion of a bachelor's or higher degree. In 2011, 39 percent of White and 56 percent of Asian 25 to 29 years old had completed a bachelor's or higher degree compared to 20 percent of African American, 13 percent of Hispanic, and 17 percent of American Indian 25 to 29 years old (NCES, 2012a).

- Of those who attend college, African Americans, Hispanics, American Indians, and Pacific Islanders are more likely than Whites and Asians to leave without finishing a degree (NCES, 2012b). Financial reasons were given by about a third of postsecondary students leaving without completing a degree or certificate; family responsibilities accounted for another 21 percent and personal reasons accounted for 53 percent. Only 13 percent cited academic problems and eight percent cited scheduling problems. Hispanics (35 percent), Whites (30.7 percent), and African Americans (28.7 percent) are more likely to leave college for financial reasons, while Asians (18.6 percent) are least likely to leave because of finances. Asians (28.9 percent) and African Americans (24.7 percent) are more likely to leave for family reasons, while Whites (19.3 percent) and Hispanics (19.1 percent) are comparatively less likely to leave due to family matters. Hispanic students (26.0 percent) are more likely to leave college without finishing because of academic problems, compared to White (11.2 percent) and African American (10.3 percent) students (NCES, 2012b).[7] Data on academic problems were not reported for Asians. These are self-reported data, and therefore do not show the full picture; such as the unintended negative effects of institutional policy and climate or built-in systematic bias, explicit or implicit.

- In addition to the non-completion of degrees, there are other factors that co-contribute to the underrepresentation of minorities in STEM; and these include lack of educational preparation, few visible role models, lack of mentors, poorly equipped elementary and secondary schools in science, as well as systemic racial/ethnic biases among others (e.g., *Expanding Underrepresented Minority Participation*, National Academies, 2011).

- Despite relatively small student bodies and limited financial resources, Historically Black Colleges and Universities (HBCUs) comprised the top ten producers of African American undergraduates who ultimately earned STEM PhDs between 2002 and 2011. One non-HBCU was included in these 10 and that was the University of Maryland-Baltimore County, which tied for tenth place (http://www.nsf.gov/statistics/infbrief/nsf13323.pdf). At the graduate level, minority-serving institutions (MSIs) are leaders in providing pathways to the PhD (http://www.nsf.gov/statistics/wmpd/ 201 3/pd f/tab7-16.pdf).

- High Hispanic enrollment institutions eligible for Hispanic- Serving Institutions (HSIs) designation by the Department of Education are less than 10 percent of all institutions of higher education, but produce 30 percent of all Hispanic undergraduate science and engineering degrees (http://www.nsf.gov/statistics/wmpd/2013/pdf/tab5-9.pdf) and are among the top baccalaureate institutions for Hispanic science and engineering doctorate recipients (http://www.nsf.gov/statistics/wmpd/2013/pdf/tab7-11.pdf).

- While African Americans, Hispanics, and Native Americans are increasing among faculty in most STEM fields, they still remain an extremely small percentage of STEM faculty, especially in mathematics and computer sciences.

Persons with Disabilities

- Persons with disabilities are more underrepresented in science and engineering compared with the population as a whole. In 2010, they were a smaller proportion of all employed persons in the United States and of employed scientists and engineers than of their representation in the total population. In 2009, students with disabilities were only 1 percent of all science and engineering doctorate recipients.

- The proportion of undergraduates with disabilities who major in science and engineering fields (22 percent) is similar to the proportion of undergraduates without disabilities (23 percent) who major in these fields.

- The incidence of disability increases with age. But even among younger scientists and engineers, those with disabilities are still more likely than those without disabilities to be unemployed. For example, among those between the ages of 30 and 39, 15 percent of scientists and engineers with disabilities are unemployed or out of the labor force compared with 9 percent of those without disabilities.

- Although some improvements have been made, underreporting of data on persons with disabilities in STEM still remains a major challenge in determining the actual size of this underrepresented group and the types of interventions needed (CEOSE, 2007-2008). Another major challenge in regard to increasing and retaining more persons with disabilities in STEM is the dearth of good or even passable data on how and why students with disabilities do not advance as far as their peers without disabilities—especially in science and engineering (Bowman-James, Benson, and Mallouk, 2009). Also, a major problem faced by persons with

disabilities in science and engineering fields is how best to teach this group on the secondary and post-secondary levels, i.e., mainstreaming approaches versus more individualized and assisted approaches (Moon, Todd, Morton, and Ivey, 2012).

3. NSF INVESTMENT IN BROADENING PARTICIPATION

NSF has invested in Broadening Participation (BP) efforts to increase the involvement of underrepresented minorities, women, and persons with disabilities in the academic community and in the STEM workforce through its grant making, through its staffing decisions, and through its engagement in outreach and related activities. NSF's dedicated support for broadening participation within STEM has been reflected in its financial investments in a broad range of programs over the years. In FY2011, the Foundation spent $754.05 million dollars on these programs, and in FY2012 it spent $911.90 million on these programs. For FY 2013, the Foundation requested $703.31 million in its budget request to Congress for a standard set of broadening participation programs, and requested $962.62 million in its FY 2014 budget to Congress. (See Appendix for FY 2013 and FY 2014 budget requests to Congress.)

Funding of Broadening Participation within NSF

In 2012, the NSF reorganized the categories employed to classify broadening participation programs. The reclassification was performed to better enable tracking and to assess distribution of funds dedicated to broadening participation goals. Currently, the BP programs are sorted into one of three categories:

- ***Focused***—program has an explicit broadening participation goal and the majority of each award's budget goes to broadening participation activities [e.g., Increasing the Participation and Advancement of Women in Academic Science and Engineering (ADVANCE) or Louis Stokes Alliances for Minority Participation (LSAMP)];
- ***Emphasis***—program emphasizes broadening participation through components such as a project diversity plan and other components not necessarily related to diversity (e.g., Science and Technology Centers or Robert Noyce Scholarships) , but lacks an explicit BP goal; and
- ***Geographic***[8]—program has an explicit geographic diversity goal.[9] This category is associated with the Experimental Program to Stimulate Competitive Research (EPSCoR).

Using these three program categories, the FY2012 BP investment was $911.90 million. In 2012, the NSF supported 18 programs that *Focused* on broadening participation of women, underrepresented minorities, and persons with disabilities and 21 programs with an *Emphasis* on broadening participation of women, underrepresented minorities, and persons with disabilities. Additionally, 18 Dear Colleague Letters were active in 2012 that expressed interest in specific aspects of broadening participation. (See Appendix Tables 4, 5 and 6 for full listing of broadening participation opportunities that were posted on the NSF Broadening Participation website in 2012.)

The majority of funding in the *Focused* programs is explicitly dedicated to programs that are aligned with the CEOSE mandate of broadening participation of women, African Americans, Hispanics, Native Americans, and persons with disabilities. In contrast, the *Geographic* programs largely consist of other programs centered on NSF's more expansive definition of broadening participation to include strengthening research and education in science and engineering throughout the United States.

NSF has maintained a commitment to its flagship *Focused* programs. However, difficult budget times have resulted in a steady reduction in total funding for these programs since FY2010. *(Table 1* presents an 8 year trend.) For these long-standing programs, in FY2012, approximately 78 percent of the funds

were allocated to programs focusing on underrepresented racial/ethnic minorities, 18 percent targeted broadening participation of women, and the remaining 4 percent supported participation and inclusion of persons with disabilities in STEM fields.

Table 1. NSF Funding of Illustrative Focused Broadening Participation (BP) Programs (in millions)

Program	Focus	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12
ADVANCE	Women	19.9	19.5	16.6	20.1	21.7	21.0	19.8	17.8
AGEP	URM	15.0	14.6	15.3	15.9	17.2	16.7	16.7	7.8
BPC	URM	3.7	14.2	13.5	14.0	14.0	14.0	8.0	n/a
CREST	URM	15.6	17.8	18.8	25.0	35.4	30.3	30.4	24.2
HBCU-UP	URM	25.3	25.7	27.9	29.7	31.1	32.1	31.9	31.9
LSAMP	URM	35.6	36.1	38.1	40.5	42.5	44.6	45.6	45.5
RDE	Disab.	5.0	5.3	5.4	5.9	6.9	6.9	6.5	6.5
GSE	Women	9.9	9.7	9.9	10.1	11.4	11.6	10.4	10.6
TCUP	URM	9.2	10.8	10.4	12.8	13.4	13.4	13.3	13.4
TOTAL		**139.2**	**153.7**	**155.9**	**174.0**	**193.6**	**190.6**	**182.6**	**157.7**

Note: FY09 and FY10 include ARRA funding. URM refers to underrepresented minorities and Disab. refers to persons with disabilities.
Source: NSF Budget Requests to Congress, FY 2007-2014.

The impact of the NSF *Focused* programs is far greater than the summed dollar value of the individual awards. These flagship programs implicitly reflect the core values of the Foundation. For example, the NSF ADVANCE program for improving the inclusion of female faculty has been adapted and replicated far beyond the direct reach of NSF funds. Programs such as Alliances for Graduate Education and the Professoriate (AGEP) and LSAMP have raised awareness of the importance of including underrepresented minorities in postsecondary education; and best practices from these programs are being implemented for student recruitment and retention at institutions without links to AGEP or LSAMP funds.

The above reported expenditures represent a conservative estimate of NSF investments in broadening participation. Activities by grantees, fostered by the broader impacts criterion for project funding, may go unrecognized or unclassified. CEOSE encourages efforts to assemble a portfolio of broadening participation projects that reside outside of *Focused* and *Emphasis* programs. This would provide the opportunity to promote the most successful projects as models for replication. The NSF report, *Framework for Evaluating Impacts of Broadening Participation Programs: Report from NSF Workshop,* describes some of the challenges of capturing and evaluating these activities.

Programs with a primary focus or special emphasis on broadening participation can be found in every NSF directorate. NSF directorates also directly engage in other activities that aim to broaden participation. CEOSE routinely hears reports from the directorates about these activities. Examples of these activities include: implicit bias training for Program Officers (CISE); a working group to diversify staff and funded research scientists (BIO); a veterans' science and engineering initiative to help address the development and use of STEM talent among the growing number of veterans with disabilities (ENG);[10] projects to enhance outreach to minority-serving institutions (GEO, SBE, MPS); and core research support in EHR to provide funding in foundational research focused on synthesizing, building and expanding research foundations in STEM learning, STEM learning environments, workforce development, and broadening participation in STEM. Also, in response to a CEOSE recommendation,

NSF provides more guidance to the Committees of Visitors (COVs) on the assessment of broadening participation.

A significant new effort dealing with a major barrier to the advancement of both women and men in science and engineering, but especially women advancing in the academic ranks, is the Career-Life Balance (CLB) initiative, which was launched by NSF as part of a White House event in which the First Lady announced the new "Workforce Flexibility Policies to Support America's Scientists and Their Families" on September 26, 2011. The CLB is aimed at reducing the number of women and men who depart from the STEM workforce due to family responsibilities, by expanding agency-wide family-friendly and other practices (e.g., flexible start dates for grants, no-cost extensions, and virtual panel participation) that are responsive to dependent care issues, such as birth, adoption, and elder care.[11]

Broadening Participation and Proposal Review

The NSF seeks to create an environment free of bias during the review process. Each review panel is designed to be broadly inclusive of race, gender, and disability status to the extent possible, given the pool of subject experts. Prior to reviewing the proposals, the panel is provided with materials on identifying and eliminating 'hidden biases' in the review process.

NSF reviews submitted proposals on the basis of two criteria: Intellectual Merit and Broader Impacts. Broadening Participation is just one of the multiple facets NSF considers in reviewing the Broader Impacts of proposed projects. NSF does not make funding decisions based on the PI demographics. Using these merit review criteria, proposals are reviewed by a minimum of three independent reviewers of scientists, engineers, and educators who do not work at NSF or for the institutions that employ the proposing researchers. Approximately 37,969 individuals served on review panel, conducted a mail review for one or more proposals, or served in both functions in FY2012.

Most reviewers opt not to provide demographic information about themselves. During the period from FY2008 to FY2012, approximately 68 percent of reviewers did not report their gender; 90 percent did not report their race/ethnicity; and 98 percent did not report disability status (see *Table 2).* Of those who reported demographic information in FY2012, 68 percent identified as male and 32 percent as female; 8.2 percent reported being from an underrepresented minority group; and 1.8 percent reported having a disability.[12] Because reporting of demographic data by reviewers is voluntary, attempts to increase the low response rates have been challenging.

Table 2. Underrepresented Persons among NSF Proposal Reviewers: FY2008 - FY2012

	FY2008	FY2009	FY2010	FY2011	FY2012
Total Reviewers Percent Reporting	42,035 30%	41,911 32%	46,055 34%	42,343 36%	37,969 36%
Female: Number (Percent)	n/r	4,091 (31%)	4,875 (31%)	4,811 (32%)	4,364 (32%)
Underrepresented Minorities: Number (Percent)	1,440 (4%)	1,383 (10%)	1,607 (10%)	1,584 (11%)	1,134 (8%)
American Indian/ Alaskan Native: Number (Percent)	n/r	71 (.5%)	72 (.5%)	52 (.3%)	51 (.4%)
Black/African American: Number (Percent)	n/r	518 (4%)	606 (4%)	595 (4%)	508 (4%)
Hispanic: Number (Percent)	n/r	781 (6%)	946 (6%)	945 (6%)	815 (6%)
Native Hawaiian/ Pacific Islander: Number (Percent)	n/r	13 (.1%)	9 (.1%)	10 (.1%)	7 (.1%)
Persons with Disabilities: Number (Percent)	n/r	253 (2%)	311 (2%)	297 (2%)	250 (2%)

Data Source: Merit Review Reports: NSB-09-43 (2008); NSB-10-27 (2009); NSB-11-41 (2010); NSB-12-28 (2011); and NSB-13-33 (2012). Note: n/r = not reported.

Demographic Diversity of Principal Investigators Submitting Proposals

As displayed in *Table 3,* the number of proposals submitted by women, African American, and Hispanic PIs increased significantly between FY2005 and FY2012. While the number of proposals submitted by Native Hawaiians/Pacific Islanders PIs also increased, the number of proposals remained much smaller than that of other racial/ethnic groups. The number of proposals submitted by American Indian/Alaskan Native PIs showed more inter-year decreases than increases. The number of proposals from PIs self-identifying as having a disability increased from FY2005 to FY2011 and decreased between FY2011 and FY2012. However, there are inherent difficulties in assessing the relative trends in proposal submissions from underrepresented groups: the proportion of principal investigators not reporting race, ethnicity, or gender has steadily increased over the last decade. In FY2012, 12 percent of PIs were of unreported gender and 13 percent did not report race or ethnicity.[13] The majority of proposals submitted in FY2012 were not submitted by members of underrepresented groups in STEM: women (22 percent), Hispanic (4 percent), African American (2 percent), American Indian/Alaska Native (.2 percent), and persons with disabilities (1 percent). Overall and based on the PI demographic data available, the number of proposals from female, African American, and Hispanic PIs did increase over the eight years.

Table 3. Number of Principal Investigator (PI) Proposals to NSF, Awards and Funding Rates, by Gender, Race/Ethnicity and Disability Status: FY2005 - FY2012

Group		FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12
All PIs	Proposals	41,722	42,352	44,577	44,428	45,181	55,542	51,562	48,613
	Awards	9,757	10,425	11,463	11,149	14,595	12,996	11,192	11,524
	Omnibus					(9,975)	(12,547)		
	ARRA					(4,620)	(449)		
	Funding Rate	**23%**	**25%**	**26%**	**25%**	**32%**	**23%**	**22%**	**24%**
Female	Proposals	8,266	8,510	9,197	9,431	9,727	11,903	11,488	10,795
	Awards	2,107	2,233	2,493	2,556	3,297	2,982	2,602	2,775
	Omnibus					(2,247)	(2,887)		
	ARRA					(1,050)	(95)		
	Funding Rate	**25%**	**26%**	**27%**	**27%**	**34%**	**25%**	**23%**	**26%**
Male	Proposals	31,456	31,482	32,650	32,074	32,091	38,695	35,211	32,932
	Awards	7,305	7,765	8,451	7,986	10,437	9,080	7,739	7,816
	Omnibus					(7,169)	(8,760)		
	ARRA					(3,268)	(320)		
	Funding Rate	**23%**	**25%**	**26%**	**25%**	**33%**	**23%**	**22%**	**24%**
American Indian-Alaska Native	Proposals	112	112	97	91	88	118	129	83
	Awards	30	32	32	23	29	28	36	18
	Omnibus					(20)	(28)		
	ARRA					(9)	(0)		
	Funding Rate	**27%**	**29%**	**33%**	**25%**	**33%**	**24%**	**28%**	**22%**
African American	Proposals	842	915	1,034	997	1,022	1,280	1,201	1,154
	Awards	199	201	240	246	298	270	243	263
	Omnibus					(233)	(262)		
	ARRA					(65)	(8)		
	Funding Rate	**24%**	**22%**	**23%**	**25%**	**29%**	**21%**	**20%**	**23%**
Hispanic	Proposals	1,471	1,525	1,639	1,611	1,755	2,092	2,019	1,934
	Awards	324	378	433	382	533	476	438	412
	Omnibus					(373)	(465)		
	ARRA					(160)	(11)		
	Funding Rate	**22%**	**25%**	**26%**	**24%**	**30%**	**23%**	**22%**	**21%**
Native Hawaiian-Pacific Islander	Proposals	27	28	26	30	23	38	42	40
	Awards	5	9	6	8	8	10	11	6
	Omnibus					(5)	(8)		
	ARRA					(3)	(2)		
	Funding Rate	**19%**	32%	**23%**	**27%**	**35%**	**26%**	**26%**	**15%**
Asian	Proposals	7,368	7,916	8,801	8,952	9,550	11,626	10,829	10,382
	Awards	1,302	1,530	1,801	1,780	2,465	2,124	1,907	1,914
	Omnibus					(1,691)	(2,071)		
	ARRA					(774)	(53)		
	Funding Rate	**18%**	**19%**	**20%**	**20%**	**26%**	**18%**	**18%**	**18%**
White	Proposals	29,928	29,861	30,676	30,217	29,975	36,153	33,200	30,596
	Awards	7,564	7,885	8,499	8,153	10,499	9,306	7,826	8,020
	Omnibus					(7,144)	(8,958)		
	ARRA					(3,355)	(348)		
	Funding Rate	**25%**	**26%**	**28%**	**27%**	**35%**	**26%**	**24%**	**26%**
Multiracial	Proposals	322	301	279	284	337	512	433	448
	Awards	87	78	81	76	112	118	99	113
	Omnibus					(80)	(112)		
	ARRA					(32)	(6)		
	Funding Rate	**27%**	**26%**	**29%**	**27%**	**33%**	**23%**	**23%**	**25%**
Persons with Disabilities	Proposals	454	434	448	448	470	545	543	483
	Awards	95	107	104	109	149	108	107	134
	Omnibus					(105)	(105)		
	ARRA					(44)	(3)		
	Funding Rate	**21%**	**25%**	**23%**	**24%**	**32%**	**20%**	**20%**	**28%**

Source: Report to the National Science Board on the National Foundation's Merit Review Process Fiscal Year 2012 (May 2013).
Figures in parentheses for FY 09 and FY 10 are included in the total awards figures.

The Foundation's overall funding rate ranged between 22 percent and 32 percent during the period from FY2005 to FY2012. The funding rates for women, African Americans, Hispanics, and persons with disabilities generally fall within this range. In FY2012, when the Foundation made 11,524 awards, PIs from underrepresented minority groups in STEM received 699 awards and women PIs received 2,775 awards. In FY2012, female PIs of all races/ethnicities were 24.1 percent of awardees, Hispanics were 3.6 percent, African Americans were 2.3 percent of the awardees, and American Indians/Alaska Natives and Native Hawaiians/other Pacific Islanders collectively accounted for less than 1 percent of the awardees. Persons with disabilities received 1.2 percent of the awards in FY2012. There is one notable exception to these statistics and that is in relation to NSF's premiere Graduate Research Fellowship Program (GRFP). In this program, applications rather than full research proposals are submitted for funding consideration and the award rates are higher for underrepresented groups in this program compared with other NSF programs. The following section is, therefore, presented to highlight this unique program.

The Graduate Research Fellowship Program

The Graduate Research Fellowship Program (GRFP) is the Foundation's flagship program for direct support to students pursuing graduate education in STEM. The program made 2000 awards each year from FY2010 to FY2012. The GRFP is an *Emphasis* program in that broadening participation is a key component but not the primary goal. It is a unique program in that reviewers are informed of the applicant's gender, race/ethnicity, and disability status during the review process, that is, should the applicant choose to disclose this information. The gender, race/ethnicity, and disability status may thus be considered by the reviewers as part of their broader impacts considerations. In the GRFP, underrepresented groups are funded at a slightly higher rate than majority applicants, with the exception of Pacific Islanders.

Table 4. Funding Rate (Percent) for NSF Graduate Research Fellowship Program (GRFP)

Group	FY08	FY09	FY10	FY11	FY12	5-Year Total
All	10.6	13.2	16.5	15.7	15.8	14.7
Female	12.6	16.0	18.4	18.1	18.1	16.9
American Indian	19.6	26.2	25.8	20.0	16.5	21.8
African American	12.2	14.1	17.9	17.3	18.3	16.3
Hispanic	14.4	17.1	19.6	20.7	22.0	19.4
Pacific Islander	5.0	12.0	21.4	13.6	15.0	13.9
Persons with Disabilities	12.2	11.8	15.5	16.4	17.0	14.9
% Female Applicants	45.3	45.9	43.9	44.9	44.4	44.8
% Awards to Females	53.7	55.5	48.9	51.7	51.0	51.6
% URM Applicants	11.9	12.4	12.6	13.2	14.0	12.9
% Awards to URM	14.6	15.9	14.8	16.6	18.2	16.2
% Disability Applicants	3.0	2.8	2.7	3.0	2.7	2.8
% Awards to Disability Group	3.4	2.5	2.6	3.2	2.9	2.9

* URM refers to underrepresented minorities.

From the perspective of broadening participation in STEM, the GRFP data offer a mixture of encouraging and disheartening trends. The percentage of applicants who are URM and the percentage of GRFP recipients who are URM have generally increased over the past 5 years averaging 12.9 percent and 16.2 percent, respectively. While the above 5-year average percentage of URM applicants (12.9 percent) is less than the 15.9 percent of URM U.S. citizen and permanent residents enrolled in STEM graduate school, the average percentage of URM awards (16.2 percent) is near proportional to the representation of URMs in the U.S. population (NCES, 2010). But, the data show no evidence that students with disabilities receive a tangible benefit through the broadening participation considerations. Persons with disabilities constitute just under 3 percent of the applicant pool and awards received despite accounting for 12 percent of the U.S. citizens enrolled in STEM graduate school (ED, 2008).

Diversity within NSF Staff

The importance of broadening participation at NSF is reflected in the composition among the ranks of scientists and engineers at all levels of the Foundation's grant-making process: grant policy, proposal review, approval, and post-award assessment. At each level, NSF staff or reviewers help shape the current and future demographics of practicing scientists and engineers across the United States and the world. To increase awareness of and sensitivity to the potential impact of gender and racial bias in their decision making, regular training sessions are provided by the Foundation for both staff and reviewers.

Table 5. Gender and Racial/Ethnic Diversity of NSF's Scientists and Engineers: FY2004 - FY2012

	FY04	**FY05**	**FY06**	**FY07**	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**
Total S&E Staff	(463)	(477)	(468)	(454)	(467)	(509)	(494)	(489)	(481)
African American:									
Female	17 *(3.7%)*	19 *(4.3%)*	18 *(3.8%)*	19 *(4.2%)*	22 *(4.7%)*	23 *(4.5%)*	22 *(4.5%)*	19 *(3.9%)*	18 *(3.7%)*
Male	12 *(2.6%)*	10 *(2.2%)*	12 *(2.6%)*	11 *(2.4%)*	7 *(1.5%)*	10 *(2.0%)*	10 *(2.0%)*	8 *(1.6%)*	8 *(1.7%)*
Amer. Indian:									
Female	0	0	0	0	1 *(0.2%)*	0	0	1 *(0.2%)*	1 *(0.2%)*
Male	2 *(0.4%)*	1 *(0.2%)*	1 *(0.2%)*	1 *(0.2%)*	1 *(0.2%)*	1 *(0.2%)*	1 *(0.2%)*	2 *(0.4%)*	1 *(0.2%)*
Asian:									
Female	14 *(3.0%)*	12 *(2.7%)*	12 *(2.6%)*	14 *(3.1%)*	16 *(3.4%)*	19 *(3.7%)*	20 *(4.0%)*	23 *(4.7%)*	25 *(5.2%)*
Male	25 *(5.4%)*	18 *(4.0%)*	29 *(6.2%)*	25 *(5.5%)*	26 *(5.6%)*	25 *(4.9%)*	24 *(4.9%)*	24 *(4.9%)*	23 *(4.8%)*
Hispanic:									
Female	6 *(1.3%)*	8 *(1.8%)*	9 *(1.9%)*	10 *(2.2%)*	9 *(1.9%)*	10 *(2.0%)*	12 *(2.4%)*	10 *(2.0%)*	11 *(2.3%)*
Male	11 *(2.4%)*	11 *(2.5%)*	9 *(1.9%)*	8 *(1.8%)*	10 *(2.1%)*	12 *(2.4%)*	10 *(2.0%)*	10 *(2.9%)*	14 *(2.9%)*
White:									
Female	148 *(32.0%)*	142 *(31.8%)*	138 *(29.5%)*	136 *(30.0%)*	142 *(30.4%)*	154 *(30.3%)*	153 *(31.0%)*	154 *(31.5%)*	151 *(31.4%)*
Male	228 *(49.2%)*	226 *(50.6%)*	240 *(51.3%)*	230 *(50.7%)*	233 *(49.9%)*	255 *(50.1%)*	242 *(49.0%)*	238 *(48.7%)*	229 *(47.6%)*

Source: NSF Division of Human Resources Management. Data represent permanent staff only.

Over the period FY2004 - FY2012, NSF staff became more diverse through net increases in staff scientists and engineers from certain demographic groups. Several directorates contributed to this increase — notably BIO, CISE, MPS and GEO. The proportion of those who are Asian females and Hispanic males and females increased. However, the percentage of scientists and engineers who are African American females remained virtually unchanged; and the percentage of those who are African American males declined between FY2004 and FY2012. For most of the period under analysis, the proportion of American Indian/Alaska Native scientists and engineers at the Foundation remained woefully low, with only 1 female and 1 male as of FY2012. The percentage of NSF's scientists and engineers who are White males decreased over the period FY2004 - FY2012 and that for White females increased (see *Table 5*).

Table 6. Number of NSF Scientists and Engineers with Disabilities: FY2004 - FY2012

	FY04	**FY05**	**FY06**	**FY07**	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**
Number	38	46	45	47	49	51	48	48	53
Percent	8.2	10.3	9.6	10.4	10.5	10.0	9.7	9.8	11.0

Finally, as shown in *Table 6*, the percentage of NSF scientists and engineers with disabilities increased during the period from FY2004 to FY2012. Data were not available on the types of disabilities experienced by these staff members.

4. CEOSE Activities, Outcomes, and Plans for the Future

Updates for 2009 - 10 CEOSE Recommendations

CEOSE requested updates or improvements to NSF's responses to the Committee's 2009 - 2010 recommendations. Appendix Table 3 summarizes the recommendations and outcomes. Selected outcomes from these recommendations are presented below:

- In its 2009 - 2010 Biennial Report, CEOSE requested that NSF address recommendations from the Mini-Symposium on Women of Color in STEM. The ADVANCE program has taken major responsibility for addressing these recommendations with some support from Historically Black Colleges and Universities Undergraduate Program (HBCU-UP). For example, NSF is supporting the STEM Women of Color Conclave, a national forum in which women of color in institutions of higher education can form the collective intelligence necessary for building a national network, harness a centralized body of knowledge and best practices related to women of color and promote the personal and professional development of women of color in the STEM academy. The participants at the annual conclave have the opportunity to address the unique challenges facing women of color in the academy in STEM fields where they are underrepresented at every faculty level.[14]

- CEOSE has long pushed for a study of the Science of Broadening Participation (SBP) that would inform the Committee, NSF and other agencies, and the broader community about this approach, perspective and discipline specialty. Today, the Science of Broadening Participation has gained attention throughout NSF. SBE released a Dear Colleague Letter: Stimulating Research Related to the Science of Broadening Participation (NSF 11-023 and NSF 12-037). Representatives from SBE have kept CEOSE updated on the progress being made in developing SBP and funding opportunities for research. CEOSE had planned to hold a Mini-Symposium on the Science of Broadening Participation in November 2012. Unfortunately, the mini-symposium had to be postponed due to lack of funds.

- CEOSE recommended to NSF that it establish a HSI program, as authorized in the America COMPETES Act. Although a separate program has not been established, a Dear Colleague Letter Announcement of Efforts to Increase Hispanic Participation in STEM Fields (NSF 12-081) was issued, albeit with no specific funding for HSIs.

- CEOSE has emphasized the role of MSIs in helping to solve the problems of underrepresentation. CEOSE was among a number of key stakeholders who recommended that funding for HBCU-UP, Tribal Colleges and Universities Program (TCUP) and LSAMP be augmented and not consolidated. The Congressional response was not to consolidate these programs and NSF has been able to maintain steady support for these programs. Funds were augmented in 2011 - 12 through co-funding by the EPSCoR program.

CEOSE ACTIVITIES 2011-2012

Five regularly scheduled meetings were convened by CEOSE at the National Science Foundation between February 2011 and October 2012. Highlights of presentations and discussions include the following:

- In 2011, the National Science Board completed its review, community-wide surveys, other data collection, and analysis of the merit review criteria and decision process. Unfortunately from the CEOSE's perspective, the Board decided not to make any specific recommendations regarding broadening participation, but did recommend that NSF better define the two criteria for the benefit of the science community. In so doing, the Board urged NSF to make clearer the meaning of the two review criteria and to connect these meanings to the core principles of the Foundation—one of which is to support broadening participation in the STEM fields.[15]

- In early 2011, CEOSE raised concerns about the consolidation of three programs to create the Comprehensive Broadening Participation Program. NSF received our concerns as well as the recommendations of the National Academies of Science report which stated that the NSF/HRD programs should not be combined. Further action was specified in the America COMPETES Reauthorization Act (H.R. 5116 on January 4, 2011) that the programs (LSAMP, HBCU-UP, and TCUP and the yet to be established HSI program) shall remain separate.

- The Office of Science and Technology Policy (OSTP) advises the President and others in the Executive Branch on the effects of science and technology on domestic and international affairs. One of the strategic goals of OSTP is to energize and nurture the processes by which government programs in science and technology are resourced, evaluated, and coordinated. In June 2011, CEOSE met with the staff of the OSTP Science Committee. Areas of mutual interest were development of a common language and definitions of broadening participation, development of metrics that are clearly understood and used across agencies, and strategies to manage how certain issues or targeted groups can be efficiently addressed through collaborative funding of programs.

- The National Science and Technology Council (NSTC) coordinates science and technology policy across the Federal research and development enterprise aimed at achieving national STEM goals. One of its five primary committees, the NSTC Committee on STEM Education (CoSTEM), focuses on education and workforce policy issues. CoSTEM was tasked to create an inventory of Federal STEM education activities and develop a five-year strategic Federal STEM education plan. At the February 27, 2012 CEOSE meeting, a representative from OSTP discussed the Federal STEM Education Inventory Initiative, which is a study of 11 STEM-related federal agencies and 252 educational programs. The findings were that (1) a total of $3.4 billion dollars was spent in FY 2010 on these programs which amounted to less than 1 percent of the total annual funding for education in the US in FY2010; (2) one-third of the $3.4 billion was spent on programs targeting underrepresented groups in STEM; (3) there was no duplication and only moderate overlap among the 252 investments; and (4) multiple methods have been employed to evaluate the programs, with pre-post methods being the most widely used.

- In addition, CEOSE has continued to strengthen its advisory role to promote inter-agency collaborations on broadening participation through the engagement of Federal Liaisons. CEOSE increasingly interacts with other federal agencies through its regular meetings. The number of agencies that participated in the CEOSE meetings grew from five in 2009-2010 to 12 in 2011-2012. The Federal Agency Liaisons who attended the CEOSE meetings regularly shared snapshots of their agencies' broadening participation programs and activities. Examples of these practices include online STEM courses/programs for teacher training (SI), early research/laboratory experiences (DOI), support for MSIs in STEM workforce development (ED, DHS, EPA), focused support for technician education in STEM (DOL), development of curriculum in agriculture for K-12 students (USDA), promoting partnerships between minority-serving institutions and universities receiving University Centers for Excellence awards (DHS), summer institute for middle school teachers in science (NIST), and a program that allows students from minority-serving institutions to complete their STEM studies and gain employment in the science and technology offices of the agency (NASA).

- Renewed interest in veterans' education in engineering and science occurred in 2009 when the Department of Veterans Affairs implemented new legislation to expand post-secondary educational benefits for veterans who served in the armed forces after 2001. The benefits created an opportunity to expand the U.S. technical workforce. In April of 2009, NSF's Engineering Directorate sponsored a workshop to facilitate collaborative efforts involving academia, business and government agencies to assist with the entry of veterans into the engineering and scientific fields (NSF, 2009). Significant numbers of U.S. veterans are underrepresented persons within science and engineering. Women comprise 15 percent of all veterans, and minorities, 30 percent. Not only do they encounter gender and racial/ethnic barriers in obtaining entry to STEM fields, but many experience disabilities due to their service and face these additional barriers. In early 2012, CEOSE had a presentation and updates about how NSF is providing support to veterans, and particularly, veterans with disabilities, since the 17 awards made in 2009 and 2010 to engage veterans in engineering degree programs. In a Dear Colleague letter issued in 2012, the Engineering Directorate announced the Engineering Research Experiences for Veterans (EREV), a pilot supplement program designed to support veterans attending universities under the GI Bill for education in engineering.[16] There are other efforts being undertaken by other directorates of NSF, including a grant to Virginia Tech to facilitate the recruitment, retention, and transition of veterans to successful careers; a research project to build a collaborative model for youth and veterans with disabilities at the University of Missouri; and a CISE Dear Colleague Letter: CISE Encourages Research Experiences for Veterans Through REU Supplements (NSF 13-080). Also, in 2011, NSF sponsored "Transition STEM: A Wounded Warriors Think Tank" that addressed transition issues and identified recommendations for improved programs, policy, and funding (http://www.nsf.gov /discoveries/discsumm.jsp?cntn_id=121660).

- CEOSE expressed concern about the transfer of the Foundation's Research on Gender in Science and Engineering (GSE) and Research in Disabilities Education (RDE) programs to the Division of Research on Learning and these programs' merger with the Research and Evaluation on Education in Science and Engineering (REESE) program in a new program, Research on Education and Learning (REAL). The rationale for the merger was to create a more diversified STEM education research portfolio. However, CEOSE is very concerned about potential loss of the

human resource development foci of the alliance component of the RDE program as the emphasis becomes more focused on STEM education research, which is a smaller component within the RDE award portfolio. The capacity building and implementation components of the RDE program should remain as the research and development coordination efforts move forward. Further, CEOSE is concerned that REAL's emphasis on research will diminish NSF's support for STEM implementation/intervention programs for girls and women, previously supported by GSE, that have had such strong and lasting impact over the years.

- As the National Center for Science and Engineering Statistics (NCSES) takes on increasing responsibilities as outlined in the America COMPETES Act, the Committee will continue to pursue concerns related to data suppression, confidentiality of survey respondents, changes in methodologies and terminology in data reporting, and the impact of such changes on the ability to conduct data trend analyses, to track federal resources to MSIs to determine the impact on the production of science and engineering professionals, and several other issues with implications for broadening participation. More specifically, CEOSE is concerned about the following changes: the Survey of Earned Doctorates (SED) data suppression in published tables, the inability to obtain data beyond 2006 on baccalaureate origins from WebCaspar, the removal of race, citizenship and gender data from webcaspar and the suppression of these data on the new SED tab engine, such that one cannot get data by detailed field (especially for joint gender and race) or by academic institution or baccalaureate origin. There are changes in the disability definition in the SED — in 2010 and again in 2012 that have destroyed the time trends. (CEOSE does understand the some of these changes are needed to protect confidentiality of respondents.)

- CEOSE held several discussions with the NSF Director and Deputy Director focused on identifying a strategy or combination of strategies that would "move the needle" on broadening participation. Key elements of this discussion included the following:

    - While NSF has funded a number of programs and individuals that have been successful in recruiting members of underrepresented groups to STEM, the specifics and degree of success remain unclear because of the lack of systematic collection, analysis and dissemination of longitudinal data.

    - Partnerships linking R1 institutions with leading Minority-serving institutions are crucial to leveraging both the research resources of the R1 partners and the expertise of the MSI partners in retention of underrepresented groups in STEM. One powerfully successful example is the Fisk-Vanderbilt Master's to PhD Bridge Program, which received funding from the former Innovation through Institutional Integration (I^3) activity.

    - Multi-institutional alliances such as LSAMP have been successful in encouraging participants to pursue and complete graduate degrees (Clewell, Cosentino de Cohen, Tsui, and Deterding, 2006).

    - Research I institutions, which receive the bulk of financial support from NSF, must be transformed into inclusive educators of STEM undergraduates and future STEM scientists. The NSF ADVANCE program has had success in achieving demonstrable institutional transformations (http://www.nsf.gov/crssprgm/advance/index.jsp).

Future Directions

The ongoing and future work of CEOSE is guided by Vannevar Bush's goal of a fully inclusive, fully diverse STEM workforce and the goal delineated in the 2009 NSF GRPA Report:

> *"If ability, and not the circumstances of family fortune, determines who shall receive higher education in science, then we shall be assured of constantly improving quality at every level of scientific activity."* (*Science-The Endless Frontier,* 1945 report to the President)
>
> *"The goal of broadening participation is not only an issue of fairness and equal opportunity, but is the means of bringing diversity and intellectual breadth to the transformation of science itself. … Cultivating a world-class, broadly inclusive science and engineering workforce and expanding the scientific literacy of all citizens are crucial to the future of science and democracy itself."*
> *(NSF GRPA Report, 2009).*

More specifically, in the next reporting cycle, CEOSE plans to:

- Review the broadening participation efforts of NSF's Centers portfolio as well as the broadening participation data and strategic plans of NSF directorates.
- Continue engagement with Federal Liaisons for leveraging opportunities to coordinate and be more systemic in addressing diversity and equity issues in STEM.
- Continue CEOSE's emphasis on broaden participation accountability activities, including monitoring, assessment and evaluation.
- Explore and document the contributions of minority-serving institutions and programs in broadening participation to inform recommendations to NSF.
- Examine graduate admissions practices to inform recommendations for improved STEM graduate level workforce outcomes and for improved broadening participation of underrepresented groups in STEM graduate education and training.
- Explore the significance of financial wherewithal and student debt as factors influencing persistence to the doctoral degree in STEM fields.
- Investigate the potential uses of data-intensive scientific approaches and methods for better informing the Committee and its recommendations to NSF on the condition of underrepresented groups and identifying barriers to and potential strategies to enhance their access, retention, completion, and advancement, that is, pathways to meaningful careers and contributions to science and engineering.
- Explore with NSF and others about hosting a mini-symposium, or other similar broad expert discussions, focused on the condition in STEM of Hispanics and Hispanic-serving Institutions, examining HSI's institutional mechanisms, strategies, approaches and programs, as well as, their

significance and roles within U.S. higher education for broadening participation of Hispanics and other minority groups, in order to inform recommendations to NSF.

- Work with NSF to explore hosting a mini-symposium or other similar broad expert discussions on the science of broadening participation.

5. Recommendation for a Bold New NSF Initiative for Broadening Participation

NSF should be commended for its outstanding leadership in broadening participation in STEM throughout the government and throughout America's scientific community, working toward full inclusion of persons from underrepresented racial and ethnic minority groups (African Americans, Hispanics, and Native Americans), persons with disabilities, and women. Indeed, broadening STEM participation constitutes an important thrust across the Foundation. Yet the changing nature of STEM, challenges to U.S. competitiveness, the creative advantages of achieving workforce diversity, concerns about global leadership and domestic security, and the drive to realize America's democratic principles by achieving America's promise of equal opportunity for all call for more innovative and transformative intellectual work, engaging scholars from multiple disciplines, in order to yield satisfactory inclusion of all Americans in STEM education and in the STEM workforce.

To better address emerging challenges and opportunities and the limited progress being made in improving broadening participation in STEM, the Committee on Equal Opportunities in Science and Engineering recommends that NSF implement a coordinated initiative that would create Centers, similar in concept and scale to the NSF's Science and Technology Centers, dedicated to transforming U.S. educational institutions into inclusive STEM institutions. These transformations will come from recognizing, adapting, and expanding successful strategies, coupled with stringent analysis and widespread dissemination of results. NSF could immediately leverage the existing Centers model[17] as a way to (a) invest major, long-term support and (b) mandate connections across multiple tiers and stakeholders. Dissemination of results by NSF as well as by the awardees of this new initiative will create a feedback loop whereby both successes and failures educate NSF and the broader STEM communities, allowing the scaling of and further improvements to proven broadening participation strategies. Only through this positive feedback mechanism will the goals of diversity, inclusion and parity in STEM be achieved.

Critical features of this initiative would include:

1. An emphasis on institutional transformation and systemic change to address challenges cited in this report (e.g., poor graduation rates, low grant participation rates, human capital needs in the federal and academic STEM workforce).
2. Development of novel, innovative analysis mechanisms that will provide for ready access to longitudinal data and allow for recognition and reporting of successful broadening participation efforts.
3. Identification of clear benchmarks for success in all aspects of broadening participation.
4. Support for translation, replication, and expansion of successful broadening participation strategies.

This initiative might include several multisite, geographically-based, national experiments of foundational and implementation research involving universities, schools, and communities. The ongoing research experiments would be inclusive of all underrepresented populations and would be designed to significantly advance broadening participation across all levels of schooling, resulting in sustainable pathways preK-20+.

We envision this initiative as including direct support for individuals (students, postdoctoral fellows, faculty, practitioners) as investigators in broadening participation initiatives. Through coupling dissemination of broadening participation efforts with catalyzing innovative adaptations of successful initiatives, NSF and the nation will significantly "move the needle" toward developing a strong, highly educated, and highly trained domestic STEM workforce that reflects and represents the U.S. population. Equally important will be high-risk and transformative research and training activities that shift the paradigm of broadening participation in global science. We seek game-changers to reach the coordinated coherence and collaboration needed for a seamless preK-20+ scope of broadening participation.

Interagency and private sector partnerships will also be key to accomplishing transformative, positive change in STEM inclusion across the nation. NSF currently assumes and should continue a leadership role in sharing best practices in broadening STEM participation with other federal agencies, welcoming substantive participation by federal agency representatives at all CEOSE meetings.

The "boldness" of this initiative rests in its focus on institutional transformation and systemic change in addition to basic research on broadening participation. The "boldness" comes from making a long-term commitment to sufficient resources to alter the current trajectory in STEM employment.

In sum, the nature of the economy has changed and is changing, and so have the demographics of our nation.[18] Effective action must be taken now to ensure that the large and rapidly growing population subgroups are empowered to participate and contribute to scientific and technological advances. If not, our democratic society faces a grave economic, intellectual and scientific disadvantage in an increasingly globalized competition for talent and innovation. So in this report, in contrast to its past practice, CEOSE makes only one main recommendation:

NSF should implement a bold new initiative, focused on broadening participation of underrepresented groups in STEM that emphasizes institutional transformation and system change; collects and makes accessible longitudinal data; defines clear benchmarks for success; supports the translation, replication and expansion of successful broadening participation efforts; and provides significant financial support to individuals who represent the very broadened participation that we seek.

ENDNOTES

[1] Source: Report to the National Science Board on the National Foundation's Merit Review Process Fiscal Year 2012 (May 2013), and also refer to page 11 of this report.

[2] R1 refers to research 1 universities, which was a category of the Carnegie Classification system of institutions of higher learning that engage in extensive research activities.

[3] Bush, Vannervar Science-*The Endless Frontier,* 1945 report to the President.

[4] These views have been expressed in the President's 2013 State of the Union Address; in America COMPETES Reauthorization Act, passed by Congress on January 5, 2010; by the National Academies the "Gathering Storm" report; and by the U.S. Chamber of Commerce in *The Case of Being Bold: A New Agenda for Business in Improving STEM Education*, posted April 13, 2011.

[5] Henderson, Peter H. *Expanding Minority Participation: America's Science and Technology Talent at the Crossroads.* Presentation to CEOSE on October 25, 2010, National Science Foundation, Arlington, VA: National Academies in 2011.

[6] CEOSE Biennial Reports to Congress: 2009-2010, 2007-2008 and 2005-2006.

[7] Respondents were able to choose more than one reason for leaving school.

[8] NSF includes geographic diversity under the definition of broadening participation. CEOSE's enabling legislation mandates that it focus on women, persons with disabilities, and underrepresented minorities.

[9] See NSF Broadening Participation Budget Table Framework in the Appendix.

[10] A total of 3.5 million veterans had a disability or 16% of all veterans in 2011, compared to 10 percent disabled adults in the U.S. population; and 45 percent of military veterans from the Iraq and Afghanistan wars have a disability, which is doubled the 21 percent disabled veterans from the Gulf wars in the 1900s. Source: 2011 American Community Survey, U.S. Census Bureau.

[11] NSF 12-065, Dear Colleague Letter: Career-Life Balance (CLB) Initiative.

[12] *Report to the National Science Board on the National Science Foundation's Merit Review Process, Fiscal Year* 2012.

[13] Ibid., p. 8.

[14] STEM Women of Color Conclave, NSF Award # 1220582, April 1, 2012.

[15] *Report to the National Science Board on the National Science Foundation's Merit Review Process, Fiscal Year 2012*, pp.10-11.

[16] NSF 12-074, Dear Colleague Letter: Engineering Research Experiences for Veterans (EREV).

[17] Our objective is similar to that defined for the NSF Science and Technology Centers Program when it was established in 1987 "to mount an innovative, interdisciplinary campaign" of research and training activities to discover and disseminate approaches to broadening participation in STEM. Like the Centers model, the investments proposed here should be large-scale and long-term and should involve partnerships across institutions.

[18] The U.S. Census Bureau projects that the non-Hispanic White share of the under 18 population will decrease from 64% in 2012 to 33% in 2060. (Jennifer Ortman, U.S. Census Bureau Presentation to Committee on Equal Opportunity in Science and Engineering, National Science Foundation, February 25, 2013).

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APPENDIX

Appendix Table 1

NSF Programs to Broaden Participation
FY 2013 Request to Congress
(Dollars in Millions)

				FY 2013 Request change over:			
				FY 2011 Actual		FY 2012 Estimate	
	FY 2011 Actual	FY 2012 Estimate	FY 2013 Request	Amount	Percent	Amount	Percent
ADVANCE	$19.79	$17.95	$17.06	-$2.73	-13.8%	-$0.89	-5.0%
ADVANCE - R&RA	*18.27*	*16.42*	*15.53*	*-2.74*	*-15.0%*	*-0.89*	*-5.4%*
ADVANCE - EHR	*1.52*	*1.53*	*1.53*	*0.01*	*0.8%*	-	-
Advanced Technological Education (ATE)	64.35	64.00	64.00	-0.35	-0.5%	-	-
Alliances for Graduate Education and the Profession (AGEP)[1]	16.69	7.84	7.84	-8.85	-53.0%	-	-
Alliances for Graduate Education and the Profession (AGEP) Graduate Research Supplements[1,2]	-	2.00	2.00	2.00	N/A	-	-
Broadening Participation in Computing (BPC)	8.00	-	-	-8.00	-100.0%	-	N/A
Centers of Research Excellence in Science and Technology (CREST)	30.43	24.24	24.24	-6.19	-20.3%	-	-
Computing Education for the 21st Century (CE21)	13.14	12.50	16.00	2.86	21.8%	3.50	28.0%
CE21 - R&RA	*13.14*	*12.50*	*16.00*	*2.86*	*21.8%*	*3.50*	*28.0%*
CE21 - EHR	-	-	-	-	*N/A*	-	*N/A*
Transforming Broadening Participation through STEM (TBPS)	-	-	-	-	N/A	-	N/A
Cyberinfrastructure Training, Education, Advancement and Mentoring (CI-TEAM)	5.12	4.00	-	-5.12	-100.0%	-4.00	-100.0%
Experimental Program to Stimulate Competitive Research (EPSCoR)	146.82	150.90	158.19	11.37	7.7%	7.29	4.8%
GEO LSAMP Linkages	1.00	1.00	1.00	-	-	-	-
Graduate Research Diversity Supplements (GRDS) - ENG	1.57	1.50	1.50	-0.07	-4.3%	-	-
H-1B Nonimmigrant Petitioner Fee programs	96.30	100.00	100.00	3.70	3.8%	-	-
Historically-Black Colleges and Universities-Undergraduate Program (HBCU-UP)	31.93	31.94	31.94	0.01	0.0%	-	-
Advancing Informal STEM Learning (AISL)[1]	64.21	61.40	47.82	-16.39	-25.5%	-13.58	-22.1%
Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM)	2.74	-	-	-2.74	-100.0%	-	N/A
Louis Stokes Alliances for Minority Participation (LSAMP)	45.63	45.62	45.62	-0.01	0.0%	-	-
Math and Science Partnership (MSP)	57.12	57.08	57.08	-0.04	-0.1%	-	-
Minority Post-Docs	3.86	3.50	3.60	-0.26	-6.7%	0.10	2.9%
BIO Minority Post-Docs	*2.91*	*2.50*	*2.50*	*-0.41*	*-14.0%*	-	-
SBE Minority Post-Docs	*0.95*	*1.00*	*1.10*	*0.15*	*15.7%*	*0.10*	*10.0%*
Noyce Scholarships	54.90	54.89	54.89	-0.01	0.0%	-	-
Ocean Sciences Postdoctoral Fellowship[3]	-	1.90	1.90	1.90	N/A	-	-
Ocean Sciences Research Initiation Grants (OCE-RIG)[4]	-	0.60	0.60	0.60	N/A	-	-
Opportunities to Enhance Diversity in the Geosciences (OEDG)	3.65	3.60	3.60	-0.05	-1.3%	-	-
Partnerships for Innovation (PFI)	7.67	8.00	8.20	0.53	6.8%	0.20	2.5%
Partnerships in AST & Astrophysics Rsch Educ (PAARE)[5]	0.99	1.00	1.00	0.01	1.2%	-	-
Partnerships for Research and Education in Materials (PREM) - MPS	2.66	5.58	6.00	3.34	125.6%	0.42	7.5%
Pre-Engineering Education Collaboratives (PEEC)[6]	1.00	1.00	1.00	-	-	-	-
Research in Disabilities Education (RDE)[1,7]	6.53	6.50	6.50	-0.03	-0.5%	-	-
Research Initiation Grants in Biology (RIG)	0.56	-	-	-0.56	-100.0%	-	N/A
Research on Gender in Science and Engineering (GSE)[1,7]	10.42	10.50	10.50	0.08	0.8%	-	-
Science, Technology, Engineering and Math Talent Expansion Program (STEP)	33.23	25.30	17.30	-15.93	-47.9%	-8.00	-31.6%
STEP - R&RA	*1.00*	*1.00*	*1.00*	-	-	-	-
STEP - EHR	*32.23*	*24.30*	*16.30*	*-15.93*	*-49.4%*	*-8.00*	*-32.9%*
Significant Opportunities in Atmospheric Research and Science (SOARS) - GEO	0.60	0.62	0.62	0.02	3.3%	-	-
Tribal Colleges and Universities Program (TCUP)	13.33	13.31	13.31	-0.02	-0.1%	-	-
Undergraduate Research Mentoring in Biology (URM)	9.81	-	-	-9.81	-100.0%	-	N/A
Subtotal, R&RA	**$228.45**	**$215.12**	**$221.74**	**-$6.71**	**-2.9%**	**$6.62**	**3.1%**
Subtotal, EHR	**$429.31**	**$403.15**	**$381.57**	**-$47.74**	**-11.1%**	**-$21.58**	**-5.4%**
Subtotal, H-1B Nonimmigrant Petitioner Fees	**$96.30**	**$100.00**	**$100.00**	**$3.70**	**3.8%**	**$0.00**	**0.0%**
TOTAL, NSF	**$754.05**	**$718.27**	**$703.31**	**-$50.74**	**-6.7%**	**-$14.96**	**-2.1%**

Please note that this table displays a subset of the overall Broadening Participation portfolio. This list comprises the standard set of programs that have been historically tracked as Broadening Participation for budget purposes.

[1] In FY 2013, new program names are proposed: Advancing Informal STEM Learning (AISL), for Informal Science Education (ISE); Research on Educa ion and Learning (REAL), for Research & Evaluat-ion on Education in S&E (REESE), including Research on Disabilities in Education (RDE) and Research on Gender in Science and Engineering (GSE); and Alliances for Graduate Education and the Profession (AGEP), for Alliances for Graduate Education and the Professoriate (AGEP).

[2] Alliances for Graduate Education and the Profession (AGEP) Graduate Research Supplements is a new MPS program beginning in FY 2012.

[3] The Ocean Sciences Postdoctoral Fellowship is a new program beginning in FY 2012.

[4] Ocean Sciences Research Initiation Grants is a new program beginning in FY 2012.

[5] Partnerships in Astronomy and Astrophysics Research Education (PAARE) replaces Research Partnerships for Diversity (RPD).

[6] Pre-Engineering Education Collaboratives (PEEC) replaces Tribal College Pathways in ENG.

[7] Funding for Research in Disabilities Education (RDE) and Research on Gender in Science and Engineering (GSE) is proposed to reside in the Research on Education and Learning (REAL) program(formerly Research & Evaluation on Education in S&E (REESE) in EHR.

Appendix Table 2

NSF Programs to Broaden Participation
FY 2014 Request to Congress

(Dollars in Millions)

Group/Program	Amount Funding Captured	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Focused Programs		**$200.51**	**$194.32**	**$183.08**	**-$11.24**	**-5.8%**
ADVANCE	100%	17.78	17.95	16.63	-1.32	-7.4%
Alliances for Graduate Education and the Professoriate (AGEP)	100%	7.84	7.84	7.84	-	-
AGEP-Graduate Research Supplements	100%	1.50	2.00	2.00	-	-
Broadening Participation Research Initiation Grants in Engineering (BRIGE)	100%	4.99	5.00	5.00	-	-
Cyberinfrastructure Training, Education, Advancement & Mentoring (CI-TEAM)[1]	100%	2.63	4.00	-	-4.00	-100.0%
Centers of Research Excellence in Science and Technology (CREST)	100%	24.21	24.24	20.24	-4.00	-16.5%
ENG Graduate Research Diversity Supplements (GRDS)	100%	2.17	1.50	1.50	-	-
Geoscience Postdoctoral Fellowships	100%	5.42	3.09	3.82	0.73	23.6%
Research on Gender in Science and Engineering (GSE)[2]	100%	10.57	10.50	10.50	-	-
Historically-Black Colleges and Universities-Undergraduate Program (HBCU-UP)	100%	31.85	31.94	31.94	-	-
Louis Stokes Alliances for Minority Participation (LSAMP)	100%	45.48	45.62	45.62	-	-
Opportunities to Enhance Diversity in the Geosciences (OEDG)[3]	100%	8.02	3.60	-	-3.60	-100.0%
Partnerships in AST & Astrophysics Research Education (PAARE)	100%	1.00	1.00	1.00	-	-
Partnerships for Research and Education in Materials (PREM)	100%	5.84	5.58	5.86	0.28	5.0%
Pre-Engineering Education Collaboratives (PEEC)	100%	1.00	1.00	1.00	-	-
Excellence Awards in Science and Engineering (EASE)[4]	100%	5.14	5.15	4.82	-0.33	-6.4%
BIO Minority Postdoctoral Fellowships	100%	3.19	2.50	2.50	-	-
Research in Disabilities Education (RDE)[2]	100%	6.50	6.50	6.50	-	-
SBE Postdoctoral Research Fellowships-Broadening Participation [formerly SBE Minority Postdoctoral Fellowships]	100%	0.99	1.00	1.50	0.50	50.0%
SBE Science of Broadening Participation	100%	1.00	1.00	1.50	0.50	50.0%
Tribal Colleges and Universities Program (TCUP)	100%	13.39	13.31	13.31	-	-
Emphasis Programs		**$560.54**	**$543.47**	**$615.96**	**$72.49**	**13.3%**
Advancing Informal STEM Learning (AISL)	60%	37.46	36.84	28.69	-8.15	-22.1%
CAREER	51%	118.57	105.24	114.10	8.86	8.4%
Centers for Ocean Sciences Education Excellence (COSEE)[5]	68%	2.88	2.88	0.59	-2.29	-79.5%
Discovery Research K-12 (DR-K12)	76%	75.67	75.41	77.92	2.51	3.3%
Geoscience Education[3]	70%	1.08	1.05	-	-1.05	-100.0%
National Graduate Research Fellowship (NGRF)	59%	116.78	116.90	191.83	74.93	64.1%
International Research Experiences for Students (IRES)	73%	0.01	2.30	1.64	-0.66	-28.6%
Innovative Technology Experiences for Students and Teachers (ITEST)[6]	65%	14.03	16.25	16.25	-	-
NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM)[6]	55%	39.91	41.25	41.25	-	-
Noyce Scholarships	65%	35.68	35.68	39.58	3.90	10.9%
Research Experiences for Undergradates (REU) - Sites and Supplements	72%	57.28	47.51	57.01	9.50	20.0%
Science, Technology, Engineering and Math Talent Expansion Program (STEP)[3]	62%	15.69	15.69	-	-15.69	-100.0%
Science, Technology, Engineering, Mathematics, including Computing Partnerships (STEM-C Partnerships)[7]	64%	45.51	46.46	47.09	0.63	1.3%
Computing Education for the 21st Century (CE21)	*51%*	*6.71*	*7.65*	-		
Math Science Partnership (MSP)	*68%*	*38.81*	*38.81*	-		
Total, Focused and Emphasis Programs		**$761.05**	**$737.79**	**$799.04**	**$61.25**	**8.3%**

(Table continued on next page)

Appendix Table 2 (Continued)

NSF Programs to Broaden Participation
FY 2014 Request to Congress

Group/Program	Amount Funding Captured	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Geographic Diversity Program		**$150.85**	**$150.90**	**$163.58**	**$12.68**	**8.4%**
EPSCoR	100%	150.85	150.90	163.58	12.68	8.4%
Total, NSF		**$911.90**	**$888.69**	**$962.62**	**$73.93**	**8.3%**

Totals may not add due to rounding.

[1] The CI-TEAM program terminated and has no funding commitments in FY 2014.

[2] Research on Gender in Science and Engineering (GSE) and Research in Disabilities Education (RDE) are components of the Research on Education and Learning (REAL) program in EHR.

[3] In FY 2014, Opportunities to Enhance Diversity in the Geosciences (OEDG), Geoscience Education, and the Science, Technology, Engineering and Math Talent Expansion Program (STEP) are consolidated into the new NSF-wide program Catalyzing Advances in Undergraduate STEM Education (CAUSE). The combined program does not meet the criteria for inclusion.

[4] The Excellence Awards in Science and Engineering (EASE) program is comprised of both Presidential Awards for Excellence in Science, Math and Engineering Mentoring (PAESMEM) and Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST).

[5] The COSEE program terminates in FY 2014.

[6] NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) and Innovative Technology Experiences for Students and Teachers (ITEST) are H1B Visa funded programs.

[7] In FY 2014, Computing Education for the 21st Century (CE21) and Math Science Partnership (MSP) are merged into Science, Technology, Engineering and Mathematics and Computing Partnerships (STEM-C Partnerships).

Appendix Table 3
CEOSE 2009-2010 Recommendations and NSF Outcomes

Recommendation	Outcome
Augment support to HBCU-UP, LSAMP, and TCUP.	Co-funding from R&RAs has augmented HBCU-UP, LSAMP and TCUP support. For example, in FY 2011 and/or FY 2012, EPSCoR co-funded HBCU-UP, TCUP, and LSAMP awards (as well as awards in the CREST program).
Establish an HSI Program.	Although a separate HSI Program has not been established, a Dear Colleague Letter, NSF 12-081, *Announcement of Efforts to Increase Hispanic Participation in STEM Fields*, was issued.
Increase MSI/BP funding across the Foundation.	The NSF investment in programs to broaden participation, based on the summary table in annual budget request, increased from $717.61M in 2009 to $866.39M in FY 2012.
Provide better guidance to COVs on how to assess broadening participation.	Broadening participation is discussed during COV training of the COV monitors and more relevant diversity documentation is provided during COV orientation of individual programs. The template that CEOSE developed for the Directorate's BP presentation has contributed to the Foundation's response to this recommendation.
Develop a science of broadening participation program.	SBE released the *Dear Colleague Letter: Stimulating Research Related to the Science of Broadening Participation* (NSF 11-023 and NSF 12-037).
Commission the National Academies to conduct a study on the Science of Broadening Participation.	NSF was already supporting the Academy's study of the underrepresentation challenge of minority participation in science and technology. The report, *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*, was released in 2011.
Initiate collaboration among CISE, SBE and OCI on developments regarding the social aspects of computing.	In December 2012, NSF issued a relevant Dear Colleague Letter: *SaTC EAGERs Enabling New Collaboration Between Computer and Social Scientists (NSF 13-037).*
Provide additional resources to NCSES for data and analyses requested by CEOSE	OIIA has an expert who works closely with NCSES and HRM to respond directly to CEOSE's requests for data and BP-related analyses.

Appendix Table 3 (Continued)
CEOSE 2009-2010 Recommendations and NSF Outcomes

Recommendation	Outcome
Establish accountability goals and metrics for broadening participation in science and engineering.	BP programs that are also in the education and workforce development portfolio established program metrics and several programs have program-specific annual data collection systems. Most recently, CLB identified annual performance metrics and milestones.
Facilitate collaborative efforts to broaden participation with other agencies.	CEOSE Federal Liaisons continue to be actively engaged in CEOSE meetings. Interagency sharing of best practices is occurring with several interagency working groups, formally and informally.
Address the 10 recommendations from the Mini-Symposium on Women of Color in STEM	The ADVANCE Program has taken major responsibility for addressing these recommendations with some support from HBCU-UP. Specific projects include: -Creating a Mentoring-Focused Web Community for Women of Color in STEM -Women of Color in STEM Disciplines: Building on Success -STEM Women of Color Conclave -Howard University ADVANCE-IT: Women of Color Faculty in STEM as Change Agents. Additionally, NSF addresses issues of women of color through the Career-Life Balance Initiative. Further, at least eight publications have resulted from the Mini-Symposium.

Appendix Table 4
Portfolio of NSF Broadening Participation Focused Programs

	Title	Pub. No.	Directorate
1	ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers	12-584	All
2	Alliances for Graduate Education and the Professoriate	12-554	EHR, MPS
3	Broadening Participation Research Initiation Grants in Engineering 2013	13-534	ENG
4	Centers of Research Excellence in Science and Technology (CREST) and HBCU Research Infrastructure for Science and Engineering (RISE)	13-533	EHR
5	EPSCoR Research Infrastructure Improvement Program: Inter-Campus and Intra-Campus Cyber Connectivity	10-598	All
6	Experimental Program to Stimulate Competitive Research: Workshop Opportunities (EPS-WO)	12-588	All
7	General & Age-Related Disabilities Engineering (GARDE)		ENG
8	Historically Black Colleges and Universities Undergraduate Program	13-516	EHR
9	Louis Stokes Alliances for Minority Participation (LSAMP)	12-564	EHR
10	Ocean Sciences Postdoctoral Research Fellowships	13-504	GEO
11	Ocean Sciences Research Initiation Grants	13-505	GEO
12	Opportunities for Enhancing Diversity in the Geosciences (OEDG)	10-599	GEO
13	Partnerships for Research and Education in Materials	11-562	MPS
14	Partnerships in Astronomy & Astrophysics Research and Education	08-562	MPS
15	Postdoctoral Research Fellowships in Biology	12-497	BIO
16	Research in Disabilities Education	12-542	EHR
17	Research on Gender in Science and Engineering	10-516	EHR
18	SBE Postdoctoral Research Fellowships	12-591	SBE

Appendix Table 5
Portfolio of NSF Broadening Participation Emphasis Programs

	Title	Pub. No.	Directorate
1	Advancing Informal STEM Learning	12-560	EHR
2	American Competitiveness in Chemistry-Fellowship	10-535	MPS
3	Centers for Chemical Innovation	12-572	MPS
4	Computing Education for the 21st Century	12-609	CISE, EHR, OCI
5	Emerging Frontiers in Research and Innovation 2013	12-583	BIO, ENG, MPS
6	Engineering Research Centers	11-537	ENG
7	Graduate Research Fellowship Program	12-599	All
8	Innovative Technology Experiences for Students and Teachers	12-597	EHR
9	Integrative Graduate Education and Research Traineeship Program	11-533	All
10	Integrative Graduate Education and Research Traineeship Program-CIF21 Track	12-555	BIO, CISE, EHR, ENG, GEO, MPS, OCI, OIA, OISE, OPP, SBE
11	International Research Experiences for Students	12-551	All
12	Major Research Instrumentation Program:	13-517	All
13	Materials Research Centers and Teams	10-568	MPS
14	Math and Science Partnership	12-518	EHR
15	Mentoring Through Critical Transition Points in the Mathematical Sciences	11-542	MPS
16	NSF Scholarships in Science, Technology, Engineering, and Mathematics	12-529	EHR
17	Postdoctoral Fellowships in Polar Regions Research	09-612	OPP
18	Research Experiences for Undergraduates	12-569	All
19	Research Training Groups in the Mathematical Sciences	11-540	MPS
20	Science and Technology Centers: Integrative Partnerships	11-522	All
21	Science of Learning Centers	07-7278	All

Appendix Table 6

Dear Colleague Letters from NSF Expressing Interest in Broadening Participation Goals

	Title	Pub. No.	Directorate
1	Research Assistantships for High School Students (RAHSS) - SBIR/STTR Phase II Supplements	DCL 06-003	ENG
2	Research Assistantships for High School Students (RAHSS) - BIO supplements	DCL 06-027	BIO
3	SBIR/STTR Supplemental Funding for Community College Research Teams	DCL 08-029	ENG, EHR
4	Supplemental Opportunity for SBIR/STTR Mentoring	DCL 09-004	ENG
5	Broadening Participation in Computing Alliance Program (BPC-A)	N/A	CISE
6	MPS Alliances for Graduate Education and the Professoriate - Graduate Research Supplements	DCL 12-021	MPS
7	Stimulating Research Related to the Science of Broadening Participation	DCL 12-037	SBE
8	Prepare, Engage, and Motivate a Diverse STEM Workforce	DCL 12-034	EHR
9	Balancing the Scale: NSF's Career-Life Balance (CLB) Initiative	N/A	All
10	Career-Life Balance (CLB) Initiative	DCL 12-065	All
11	Supplemental Opportunity for Small Business Innovation Research and Small Business Innovation Research/Small Business Technology Transfer for CREST/HBCU-RISE Collaborations	DCL 12-069	ENG, EHR
12	Research Experiences for Veterans/Teachers	DCL 12-073	ENG
13	Engineering Research Experiences for Veterans	DCL 12-074	ENG
14	Research Experience for Teachers (RET): Funding Opportunity in the Biological Sciences	DCL 12-075	BIO
15	Research Assistantships for High School Students (RAHSS): Funding to Broaden Participation in the Biological Sciences	DCL 12-078	BIO
16	Announcement of Efforts to Increase Hispanic Participation in STEM Fields	DCL 12-081	BIO, CISE, EHR, ENG
17	Alliances for Graduate Education and the Professoriate (AGEP) Program	DCL 12-088	MPS
18	Broadening Participation in Engineering (BPE)	N/A	ENG

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Broadening Participation in America's STEM Workforce

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