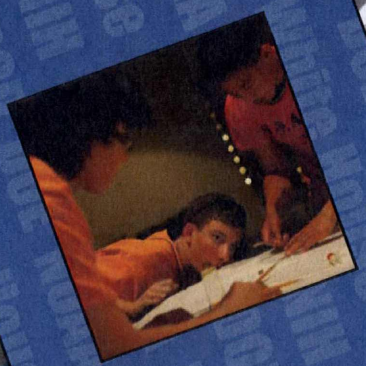
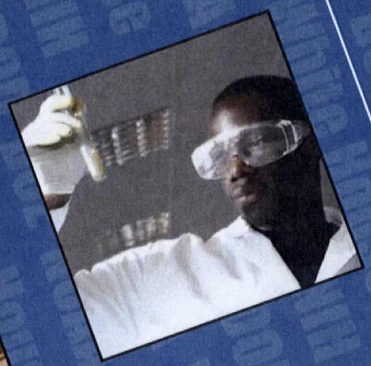
Joining Forces to Broaden Participation in Science and Engineering

Strategies for Inter-Agency Collaborations





A Report to the Committee on Equal Opportunities in Science and Engineering (CEOSE)
National Science Foundation

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Joining Forces to Broaden Participation in Science and Engineering

Strategies for Inter-Agency Collaborations

Comprehensive Report

for

The Committee on Equal Opportunities in Science and Engineering
National Science Foundation

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ACRONYMS

ACC	Academic Competitiveness Council
CEOSE	Committee on Equal Opportunities in Science and Engineering
DHS	Department of Homeland Security
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
ED	U.S. Department of Education
EPA	U.S. Environmental Protection Agency
GAO	Government Accountability Office
HUD	U.S. Department of Housing and Urban Development
MSI	Minority-serving institutions
MSICPC	Minority-Serving Institutions Community of Partners Council
NASA	National Aeronautics and Space Administration
NCRR	National Center for Research Resources (NIH)
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NOBChE	National Organization of Black Chemists and Chemical Engineers
NSF	National Science Foundation
ORWH	Office of Research on Women's Health
OSTP	White House Office of Science and Technology Policy
SACNAS	Society for Advancement of Chicanos and Native Americans
SBA	U.S. Small Business Administration
STEM	Science, Technology, Engineering, and Mathematics
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VA	U.S. Department of Veterans Administration
WHI-HBCU	White House Initiative on Historically Black Colleges and Universities

EXECUTIVE SUMMARY

With a shrinking pool of American scientists and engineers, the nation needs to invest more time, energy, and money into the training of new talent, and especially from traditionally under-utilized groups in the science, technology, engineering, and mathematics (STEM) professions. Since the 1980s, the Congressionally-mandated Committee on Equal Opportunities in Science and Engineering (CEOSE) of the National Science Foundation (NSF) has taken a proactive role in promoting greater inclusion of women, underrepresented minorities, and persons with disabilities in the sciences and technology fields. Recently, CEOSE commissioned a study of the activities of other federal agencies aimed at increasing inclusiveness within their science related missions. This report presents the findings of the study along with recommendations from the agencies for CEOSE to consider in developing strategies for increased federal inter-agency collaborations to broaden participation of all Americans in the country's STEM workforce.

To what extent are STEM-related federal agencies devoted to broadening participation of women, underrepresented minorities, and persons with disabilities in the nation's science and engineering workforce? Do these agencies have policies that promote and support broadening participation? Do these agencies provide STEM education and employment programs aimed at the underrepresented groups? Do these agencies currently collaborate with one another in supporting initiatives to broaden participation? Would the agencies be receptive to further partnering with one another to support broadening participation in STEM? What recommendations would the agencies make to establish or enhance a government-wide broadening participation network of programs? These and related questions provided the specific framework for the CEOSE inter-agency study.

Results in Brief

- All of the agencies focus on inclusiveness, specifically defined in terms of groups that they target for STEM education and employment opportunity programs. The term, *broadening participation,* is unique to NSF and refers to increasing educational and employment opportunities in STEM for women, underrepresented minorities (African Americans, Hispanics, American Indians, Alaska Natives, and Native Hawaiians), and persons with disabilities. DOD targets the same groups that NSF does, while the other agencies could be best described as focusing on a broader spectrum of demographic groups—except the WHI-HBCU, which focuses exclusively on underrepresented minorities.

- All of the agencies have been addressing the issue of broadening participation/diversity in STEM areas to varying degrees for varying lengths of time. The USDA has the longest history in broadening participation in STEM, dating back to 1890 with the establishment of the land-grant colleges predominantly for African Americans. A majority of the agencies began work in

broadening participation during the 1970s. The USGS has the youngest history with broadening participation beginning in 2001.

- Ten of the eleven agencies have broadening participation programs that target minority-serving institutions. Four of the agencies have programs that target research universities, and four target K-12 schools. **Only two agencies, NSF and DOE, have partnered with industry to increase employment of underrepresented persons in STEM.** This is particularly noteworthy, because industry employs far more STEM professionals than do academia, government, and the non-profit sector. According to the *2002 Science and Engineering Indicators* report from NSF, approximately 74 percent of scientists and engineers with a bachelor's degree and 62 percent of those with a master's degree are employed in private, for-profit companies. While 48 percent of those with a Ph.D. are employed in academia, the majority are employed outside of academia—with an estimated 4.4 percent growth rate of Ph.D. holders in the private corporate sector.

- Broadening participation/diversity in STEM is a priority in all of the agencies, as evidenced by the high-level positioning of broadening participation/diversity in their enabling legislation, Congressional mandates, and strategic plans. The DOL is the one exception. While DOL places a high priority on diversity in the workforce, it does not do so specifically for STEM occupations. Seven of the agencies have policies that specifically address broadening participation/diversity in regard to providing STEM-related education, training or employment programs for underrepresented groups (i.e., NASA, NIH, NIST, DOE, DOD, NSF, and USDA). **Only five of the eleven agencies include broadening participation/ diversity requirements in their merit review or grant award policies (i.e., NSF, NIH, NASA, USDA, and NOAA).**

- Executive leaders in all of the agencies demonstrate strong commitment to broadening participation/diversity, as reflected in directives and other internal documents. **Mechanisms for managing initiatives to broaden participation/ diversity are also present and operational in all eleven agencies.**

- **All of the agencies currently offer STEM education programs for underrepresented groups through grants to educational institutions, including scholarships, internships, faculty development, and institutional capacity enhancement grants.** Eight of the eleven agencies also offer pre-employment training programs, such as temporary laboratory appointments.

- More than one-half of the agencies (DOE, NASA, NIH, NSF, NIST, and DOL) provide STEM programs for women. Only three of the agencies (NSF, NIH, and NASA) provide STEM programs for persons with disabilities. All of them provide STEM programs for underrepresented minorities. Finally, only three

(NSF, NIH, and NASA) provide STEM programs for all three underrepresented groups, i.e., women, minorities, and persons with disabilities.

- Collection of financial data from the agencies was unfortunately incomplete. Program budget figures were not available for all of the sub-units of DOD, DOE, and NIST. Nevertheless, the data obtained provide at least an illustration of how much money the agencies invest in broadening participation/diversity programs. **During 2007, they invested a combined estimated total of $709.9 million in these programs—which amounts to a little over one percent of their combined total science and technology budgets.** The level of investment in broadening participation/diversity varied widely across the agencies during the 2007 fiscal period. Discounting the missing data from DOD, DOE and NIST, the USDA allocated 7.6 percent of its budget to broadening participation/diversity efforts, followed by 4.2 percent for NSF and NOAA. DOD allocated 1.7 percent and DOE, NASA, NIST, NIH, and USGS allocated less than 1 percent of their total 2007 science and technology budgets for broadening participation/diversity programs and related activities. The WHI-HBCU was excluded from this analysis, because the agency does not fund diversity programs, but rather encourages other federal agencies to allocate funds for minority-serving institutions.

- With the exception of the WHI-HBCU, all of the agencies conduct evaluations of their agency-wide broadening participation/diversity programs. Four sub-units of DOE and NIST have yet to evaluate their local broadening participation/diversity programs. Two of these four are, however, planning to implement an evaluation in 2008.

- The agencies use a variety of evaluation approaches to assess their broadening participation/diversity programs and activities. **There is, however, no uniformity of evaluation approaches across agencies, making it difficult to compare results for similar programs.** Also, the agencies typically employ non-experimental methodologies that are not as robust as the experimental (or gold standard) designs, and therefore leave uncertainties as to the actual effectiveness of the programs. The reported reasons for not using experimental designs are lack of financial resources, or ethical concerns about denying underrepresented students access to program opportunities. Two of the eleven agencies (NSF and NIH) have employed quasi-experimental designs that involve the use of comparison groups. The agencies more typically use program exit surveys, post-program follow-up studies, and descriptive analysis of program participants. Several of the agencies and their sub-units noted that they encounter difficulties in tracking undergraduates and graduate students who participate in agency-based internship and fellowship programs.

- The metrics typically employed by the agencies in the program evaluations include number and description of program participants, number and description

of students who complete undergraduate and graduate degrees in STEM areas, and number and description of students who become employed at the agencies. Other metrics used by the agencies include success of graduate students and post-docs in publishing in refereed research journals, agency-trained research investigators who are successful in getting subsequent research awards, number of requests from organizations for outreach events such as science fairs, public exhibits, and satisfaction of participants with outreach events sponsored by the agencies.

- **A recurring theme among the agencies is the lack of adequate funding for program evaluation.** In most instances, there is no separate budget for evaluation; monies needed to retain evaluation consultants are usually squeezed out of research budgets or administrative overhead.

- As a result of developing and implementing broadening participation and diversity programs, the federal agencies have learned numerous lessons. They include: funding for broadening participation and diversity programs has not kept pace with the growing demand for these programs; HBCU faculty have difficulties in getting release time to conduct research on grant projects; community college students work well in laboratories; programs need flexibility to address personal needs of underrepresented students; recruiting minority students without relationship building is not effective in sustaining their interest in STEM careers; ongoing communication with academic institutions about the value of broadening participation is necessary for real institutional transformation to take place; and agency leadership commitment to broadening participation and diversity is absolutely essential to support funding for internships, fellowships, and other program opportunities for underrepresented groups.

- Best practices noted by the agencies included that hands-on research experiences attract and sustain the interest of students; aligning a new program with an existing successful program helps to ensure success of the new program; providing a "personal touch" with lots of mentoring and attention to personal needs of the student helps sustain student interest in STEM education programs; providing incentive credits to laboratory researchers helps motivate staff and students in broadening participation activities; and having personnel dedicated to tracking students helps to ensure successful follow-up studies.

- **All of the agencies have expressed an interest in collaborating with other STEM-related federal agencies to support and improve the government's efforts to open STEM enterprises to all U.S. citizens.** With the exception of DOL, all of the agencies have been or are currently involved in collaborations with other federal agencies to broaden participation.

- Finally, during the course of the conversations, the agency representatives made a number of recommendations for forming and implementing inter-agency collaborations to specifically increase the numbers and retention of women, underrepresented minorities, and persons with disabilities in the STEM pipeline and workforce. The recommendations were grouped into three major themes: (1) ***information-sharing***, e.g., sharing of best practices and other information on broadening participation efforts; (2) ***joint funding of programs,*** e.g., jointly funding student education, pre-employment training, institutional infrastructure-enhancement, faculty development, and student outreach and recruitment programs; and (3) ***program coordination***, e.g., coordinating similar education and research experience programs to maximize the efficiency of agency resources and program impacts.

Some Next Steps

CEOSE should meet with the Science Committee of the White House Office of Science and Technology Policy (OSTP) to present the report's findings and to solicit the Committee's support in moving forward with an inter-agency collaboration agenda.

CEOSE should then host a special meeting with the heads of the agencies that participated in the study to secure their buy-in for the collaborations.

Next, CEOSE should meet with the agency representatives to discuss and decide on the formation and function of the inter-agency collaboration alliance, ground rules, and prioritization of the recommendations. Long-range steps should include development of a strategic plan and an evaluation to assess the process and outcomes of the alliance.

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TABLES and FIGURES

INTRODUCTION

With a shrinking pool of American scientists and engineers, the nation needs to invest more time, energy, and money into the training of new talent, and especially from traditionally under-utilized groups in the science, technology, engineering, and mathematics (STEM) professions. Since the 1980s, the Congressionally-mandated Committee on Equal Opportunities in Science and Engineering (CEOSE) of the National Science Foundation (NSF) has taken a proactive role in promoting greater inclusion of women, underrepresented minorities, and persons with disabilities in the sciences and technology fields. Recently, CEOSE commissioned a study of the activities of other federal agencies aimed at increasing inclusiveness within their science related missions. This report presents the findings of the study along with recommendations from the agencies for CEOSE to consider in developing strategies for increased federal inter-agency collaborations to broaden participation of all Americans in the country's STEM workforce.

Background

In a white paper presented to the Director and Deputy Director of the National Science Foundation, the Committee on Equal Opportunities in Science and Engineering proposed that federal agencies engaged in the sciences and technology collaborate with one another to increase the number and retention of women, underrepresented minorities, and persons with disabilities in the nation's STEM enterprises.[1] Inter-agency efforts to widen access to educational and employment opportunities for these groups holds a much greater promise for increasing workforce diversity than do efforts on the part of any single federal agency. NSF is already engaged in collaborations with some of the other federal agencies in broadening participation. But, the need for more and systematic inter-agency collaboration has taken on an even greater sense of urgency following the release of a 2004 NSF report, entitled *Broadening Participation in America's Science and Engineering Workforce.* The report concluded categorically that, while the National Science Foundation has been mandated by Congress since 1980 to promote and increase diversity in STEM, the agency by itself has been unable to make more than marginal gains in increasing and retaining African Americans, Hispanics, American Indians, Alaska Natives, Native Hawaiians, and persons with disabilities in the STEM enterprise.[2] The report noted, however, that relatively greater success has been achieved in increasing the number of women in STEM careers since the 1980s.

Discussions about the need for expanded inter-agency collaborations have also begun to take place at the highest levels of the federal government. On December 20, 2005, the White House Office of Science and Technology Policy (OSTP) hosted a meeting of 15

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[1] Dr. Samuel Myers, Dr. Willie Pearson, Jr. and Dr. Wesley L. Harris, A white paper prepared by CEOSE for discussion with the NSF director and deputy director regarding a request to the National Research Council for a panel on evaluation and assessment of federal programs on broadening participation in the STEM workforce, May 31, 2006.

[2] "Broadening Participation in America's Science and Engineering Workforce, CEOSE 1994—2003 Decennial and 2004 Biennial Reports to Congress.

federal agencies which focused on those agencies' activities that promote and support initiatives to broaden participation.[3] Following this meeting, the OSTP Science Committee prompted CEOSE to take the lead in developing and implementing a strategy for federal agencies that are directly involved in the STEM enterprise to partner with one another to increase and retain greater numbers of individuals from underrepresented groups within the STEM professions.

On August 23, 2006, Dr. Kathie Olsen, Deputy Director of NSF, sent a message to the OSTP Science Committee requesting that a representative from each of the committee-member agencies participate in a special CEOSE symposium on inter-agency collaboration. The symposium was held on October 17-18, 2006. Representatives from the National Aeronautics and Space Administration, Department of Defense, Department of Energy, Department of Labor, National Oceanic and Atmospheric Administration, the U.S. Geological Survey, and the National Institute of Standards and Technology attended. The agency presentations were informative about efforts to broaden participation in STEM. A more in-depth understanding of the agencies' initiatives and outcomes was needed, however. In light of this, CEOSE commissioned an independent study of STEM-related federal agencies' policies and programs to broaden participation in order to better inform the committee's strategies for forging systematic inter-agency partnerships.[4]

Benefits of Collaboration

There are several benefits that can be derived from federal agencies working together to broaden participation in STEM. They include:

- Expanded and coordinated outreach initiatives aimed at minority-serving and other institutions of education to increase student awareness of and recruitment into STEM careers.

- Inter-disciplinary STEM education and training programs—based on complimentary missions of multiple agencies—that are designed to provide research experiences for students and faculty that no one agency can provide.

- Sharing of information, such as lessons learned in developing and implementing programs or policies to broaden participation.

- Sharing of resources, for example, materials, facilities, or funds to enhance the broadening participation initiatives of agencies with limited resources.

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[3] OSTP-and NSF-Sponsored Multi-Federal Agency Briefing by the Committee on Equal Opportunities in Science and Engineering, held at the White House Conference Center on December 20, 2005. Participants were Dr. John H. Marburger, III, Director of OSTP; Dr. Sharon Hays, Chief of Staff, OSTP; Dr. Kathie L. Olsen, Deputy Director, NSF; Dr. Robert Lichter, CEOSE Chair; and Dr. Samuel L. Myers, Jr., Vice CEOSE Chair.

[4] C&A Technologies, Inc. was awarded a contract to conduct the CEOSE federal inter-agency study in January 2007. Dr. Walter V. Collier of C&A served as the principal investigator.

- Improved internal broadening participation policies and programs of individual agencies that result from adopting best practices of other agencies.

- Improved knowledge base of *what works* from cooperative evaluation studies of broadening participation programs involving multiple agencies with standardized assessment approaches and metrics.

- Broadened impact of overall federal thrust to increase the number of American women, underrepresented minorities, and persons with disabilities in science and engineering.

Concurrent Studies and Other Initiatives

The CEOSE inter-agency study took place within the context of some related events that may influence how CEOSE and others view and use the study's findings. In 2005, the Government Accountability Office (GAO) conducted a study on best practices in managing diversity within federal agencies.[5] The GAO investigators identified seven factors associated with successful diversity management. Some of the same factors were identified in the present CEOSE study as being associated with agency practices in broadening participation. One example is the absolute necessity that top leadership be firmly committed in order for the agencies to receive funding support and thus sustained. The GAO findings are further discussed later in the report. Also, in 2005, the Deficit Reduction Act established the Academic Competitiveness Council (ACC) within the Department of Education to review and offer recommendations to improve coordination of STEM education programs across federal agencies. The ACC formed three working groups to study and inventory federal STEM education programs at the K—12 and post-secondary levels, and in education outreach. Attention was also given to the funding and evaluation of programs that target women and minority-serving institutions. In a recent report to the Secretary of Education, ACC rendered a number of recommendations based on its findings to improve the operation and evaluation of these programs. Better coordination of similar STEM education programs across agencies and the need for agencies to agree on a common set of metrics for use in rigorous evaluations of these programs were among the chief recommendations.[6] Although the ACC and the present CEOSE study address STEM education, the CEOSE inter-agency study focuses on STEM training and employment as well as STEM education policies and programs for particular demographic groups that have been traditionally underrepresented within the professional STEM community.

In December 2006, a group of federal employees who manage programs that provide funding for minority-serving institutions formed the Minority-Serving Institutions Community of Partners Council (MSICPC). The mission of this organization is to increase collaborations among federal agencies to enhance the operation and capacity of

[5] Diversity Management. Expert-Identified Leading Practices and Agency Examples, Government Accountability Office, January 2005.

[6] *Report of the Academic Competitiveness Council.* U. S. Department of Education, May 2007.

minority-serving institutions—which enroll a significant number of minority STEM students. The eleven agencies included in the present study are represented on the Council. As such, this extra-agency initiative provides another possible venue for inter-agency collaboration that CEOSE may want to consider in developing its trans-agency strategies for broadening participation.

Study Purpose

The purpose of the CEOSE study was not to evaluate the broadening participation activities of the agencies, but rather to gather descriptive information that would help CEOSE develop strategies for federal inter-agency collaborations specifically aimed at increasing demographic diversity in STEM. The proposed strategies would, in turn, be recommended to NSF for consideration and implementation. Another goal of the study was to share the findings with the participating agencies as well as others, so that they would be more aware of each other's efforts to bring about greater inclusiveness in the STEM workforce. This information-sharing would, it is hoped, stimulate ideas for further inter-agency partnerships. CEOSE anticipated that next steps after distributing the report to the participating agencies would include holding meetings with key stakeholders to discuss the report, deciding on the appropriate structure and ground rules for the collaboration activities, prioritizing the recommendations, and developing strategic and evaluation plans to respectively guide and assess the outcomes of the inter-agency collaborations.

Guiding Questions

To what extent are STEM-related federal agencies devoted to broadening participation of women, underrepresented minorities, and persons with disabilities in the nation's science and engineering workforce? Do these agencies have policies that promote and support broadening participation? Do these agencies provide STEM education and employment programs aimed at the underrepresented groups? Do these agencies currently collaborate with one another in supporting initiatives to broaden participation? Would the agencies be receptive to further partnering with one another to support broadening participation in STEM? What recommendations would the agencies make to establish or enhance a government-wide broadening participation network of programs? These and related questions provided the specific framework for the CEOSE inter-agency study.

Methodology

To address the study's guiding questions, face-to-face conversations were held with key informants from eleven federal agencies. These individuals were designated as knowledgeable about initiatives to broaden participation in their respective agencies, and were recommended for contact by members of the OSTP Science Committee as well as by other staff members of the agencies. The one exception to this was that the key informant from the White House Initiative on HBCUs was recommended for contact by CEOSE. The sample of key informants consisted of 55 persons who were division directors, program managers, and senior agency management personnel with responsibilities for STEM education and employment programs, and for administration of agency diversity policies and initiatives. The eleven agencies were:

National Aeronautics and Space Administration (NASA)
U.S. Geological Survey (USGS)
Department of Energy (DOE)
Department of Defense (DOD)
National Oceanic and Atmospheric Administration (NOAA)
National Institute of Standards and Technology (NIST)
U.S. Department of Agriculture (USDA)
National Institutes of Health (NIH)
Department of Labor (DOL)
White House Initiative on Historically Black Colleges and Universities (WHI-HBCU)
National Science Foundation (NSF)

Collectively, the agencies, excluding DOL and the WHI-HBCU, accounted for 96 percent of the $59.8 billion spent by the federal government in FY 2007 on science and technology projects.[7] The sample of agencies was, therefore, considered to be well representative of the population of federal STEM-related agencies. The rationale for including the WHI-HBCU was that this agency plays a key role in supporting minority-serving institutions of higher education that educate a large number of African American students in STEM as well as other disciplines. DOL was selected as part of the study's sample, because of its mission to help satisfy, through various programs and policies, the demands of the country's overall employment sector.

The on-site conversations were guided by a list of specific topics that included: agency history and legislative background in broadening participation, the priority status given to broadening participation policies, education and employment programs for underrepresented groups, programmatic best practices, lessons learned, program evaluation approaches and metrics, financial investments in diversity programs, management and leadership commitment to diversity, current collaborations, and recommendations for future collaborations. See Appendix A for the Conversation Guide. To facilitate the conversations, a copy of the Guide was sent to the agency representatives in advance of the site visit. The conversation format and content was pre-tested with a senior advisor in NSF's Office of Integrative Activities who was not a part of the study. Following this pre-test and a critical review of the Guide by CEOSE, the approach to the conversations was finalized.

The agency conversations took place in two stages. First, in-person meetings were held with the OSTP-designated contact persons to gather information about agency-wide policies and programs; and second, subsequent telephone conversations were held with staff members from those agencies with multiple semi-autonomous institutes, centers or laboratories who could elaborate on their sub-unit's broadening participation activities. These sub-units included the five armed service branches of DOD, the ten laboratories

[7] Office of Science and Technology Policy: http://www.ostp.gov/html/budget07.html

and institutes of NIST, the seventeen laboratories of DOE, and the twenty-seven institutes and centers of NIH.

The agency conversations were arranged through the Office of CEOSE's Executive Liaison, Dr. Margaret E.M. Tolbert. Between January and May of 2007, the study's investigators met with representatives from each agency separately to discuss broadening participation and inter-agency collaborations. In addition to the initial conversations, supporting documentation on broadening participation policies, programs, funding, program evaluations, agency strategic plans, and diversity plans were obtained, reviewed and also used to validate the contents of the conversations. Following each agency conversation, the principal investigator prepared a summary of the conversation for the agency's review and comments. This was done to ensure that the record of the conversation reflected what was actually said by the agency representatives and also to provide an opportunity for the representatives to add to or amend any comments they made during the site visit.

Presented next is a summary of the findings, followed by a detailed profile of each agency in terms of its broadening participation history, policies, programs, program evaluation approaches, best practices, financial investments, and management mechanisms to ensure oversight and accountability for activities aimed at increasing diversity in STEM.

STUDY RESULTS

Results in Brief

- All of the agencies focus on inclusiveness, specifically defined in terms of groups that they target for STEM education and employment opportunity programs. The term, *broadening participation,* is unique to NSF and refers to increasing educational and employment opportunities in STEM for women, underrepresented minorities (African Americans, Hispanics, American Indians, Alaska Natives, and Native Hawaiians), and persons with disabilities. DOD targets the same groups that NSF does, while the other agencies could be best described as focusing on a broader spectrum of demographic groups—except the WHI-HBCU, which focuses exclusively on underrepresented minorities (see Table 1).

Table 1

Summary of Agency Definitions of Broadening Participation and Diversity

Agency	Education and Employment Opportunity Target Groups
DOD	Women, minorities, and persons with disabilities interested in all professions.
DOE	Women, underrepresented minorities, persons with disabilities, and persons from lower socio-economic groups interested in the STEM professions.
DOL	All groups interested in all professions, with a focus on persons from disadvantaged socio-economic backgrounds.
NASA	Men, women, persons of diverse races, ethnicities, cultures, disability status, expertise, and knowledge interested in the STEM professions.
NIH	Men, women, underrepresented minorities, persons from different cultures, and persons with disabilities interested in the biomedical and behavioral science professions.
NIST	Women, underrepresented minorities, persons with disabilities, and persons from lower socio-economic groups interested in the STEM professions.
NOAA	All groups, with a focus on underrepresented minorities, interested in the earth science professions.
NSF	Women, underrepresented minorities, and persons with disabilities interested in the STEM professions.
USDA	All groups interested in the food and agricultural sciences, with a focus on underrepresented minorities.
USGS	Agency has no specific policy for targeting particular groups for the STEM professions.
WHI-HBCU	Underrepresented minority groups interested in all professions.

- All of the agencies included in the sample have been addressing the issue of broadening participation/diversity in STEM areas to varying degrees for varying lengths of time. The USDA has the longest history in broadening participation in STEM, dating back to 1890 with the establishment of the land-grant colleges predominantly for African Americans. A majority of the agencies began work in broadening participation during the 1970s. The USGS has the youngest history with broadening participation beginning in 2001.

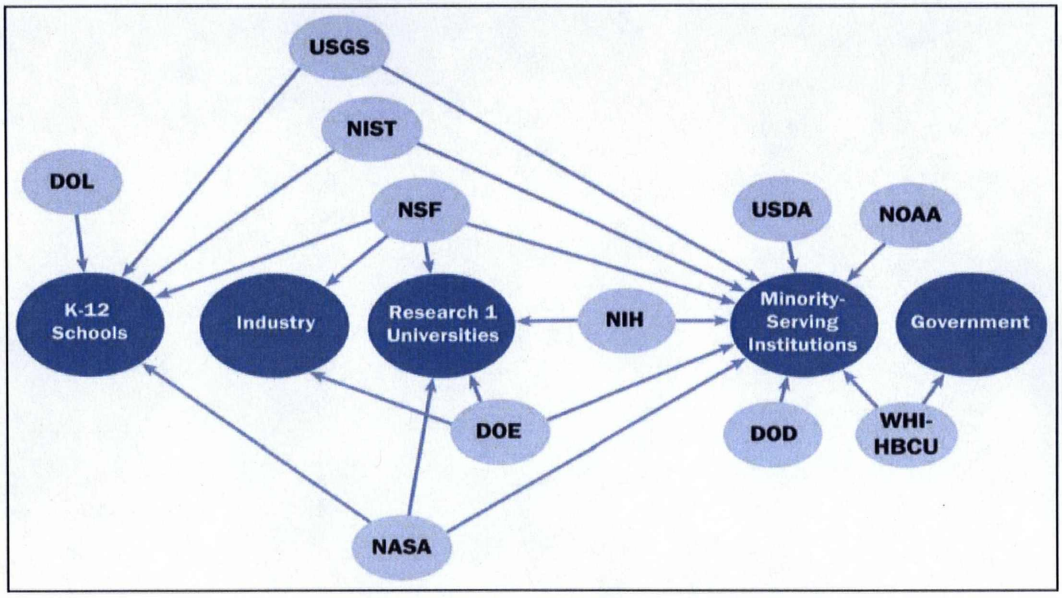

Figure 1. Targets of Major Federal Agency Broadening Participation Programs in STEM.

Figure 1 shows ten of the eleven agencies have broadening participation programs that target minority-serving institutions. Four of the agencies have programs that target research universities, and four target K—12 schools. What stands out in the *Figure* is that only two agencies, NSF and DOE, have partnered with industry to increase employment of underrepresented persons in STEM. This is particularly noteworthy, because industry employs far more STEM professionals than do academia, government, and the non-profit sector. According to the *2002 Science and Engineering Indicators* report from NSF, approximately 74 percent of scientists and engineers with a bachelor's degree and 62 percent of those with a master's degree are employed in private, for-profit companies. While 48 percent of those with a Ph.D. are employed in academia, the majority are employed outside of academia—with an estimated 4.4 percent growth rate of Ph.D. holders in the private corporate sector.

- Broadening participation/diversity in STEM is a priority in all of the agencies, as evidenced by the high-level positioning of broadening participation/diversity in their enabling legislation, Congressional mandates, and strategic plans. The DOL is the one exception. While DOL places a high priority on diversity in the workforce, it does not do so specifically for STEM occupations. Seven of the agencies have policies that specifically address broadening participation/diversity in regard to providing STEM-related education, training or employment programs for underrepresented groups (i.e., NASA, NIH, NIST, DOE, DOD, NSF, and USDA). Only five of the eleven agencies include broadening participation/ diversity requirements in their merit review or grant award policies (i.e., NSF, NIH, NASA, USDA, and NOAA).

- Executive leaders in all of the agencies demonstrate strong commitment to broadening participation/diversity, as reflected in directives and other internal documents. Mechanisms for managing initiatives to broaden participation/ diversity are also present and operational in all eleven agencies.

- All of the agencies currently offer STEM education programs for underrepresented groups through grants to educational institutions, including scholarships, internships, faculty development, and institutional capacity enhancement grants. Eight of the eleven agencies also offer pre-employment training programs, such as temporary laboratory appointments.

- More than one-half of the agencies (DOE, NASA, NIH, NSF, NIST, and DOL) provide STEM programs for women. Only three of the agencies (NSF, NIH, and NASA) provide STEM programs for persons with disabilities. All of them provide STEM programs for underrepresented minorities. Finally, only three (NSF, NIH, and NASA) provide STEM programs for all three underrepresented groups, i.e., women, minorities, and persons with disabilities.

- Collection of financial data from the agencies was unfortunately incomplete. Program budget figures were not available for all of the sub-units of DOD, DOE, and NIST. Nevertheless, *Table 2* provides at least an illustration of how much money the agencies invest in broadening participation/diversity programs. During 2007, they invested a combined estimated total of $709.9 million in these programs—which amounts to a little over one percent of their combined total science and technology budgets. The level of investment in broadening participation/diversity varied widely across the agencies during the 2007 fiscal period. Discounting the missing data from DOD, DOE and NIST, the USDA allocated 7.6 percent of its budget to broadening participation/diversity efforts, followed by 4.2 percent for NSF and NOAA. DOD allocated 1.7 percent and DOE, NASA, NIST, NIH, and USGS allocated less than 1 percent of their total 2007 science and technology budgets for broadening participation/diversity programs and related activities. The WHI-HBCU is excluded from the *Table*, because the agency does not fund diversity programs, but rather encourages other federal agencies to allocate funds for minority-serving institutions.

Table 2

Total Science and Technology Budgets and Estimated Budgets for STEM Broadening Participation/Diversity (PB/D) Programs in Federal Agencies FY 2007

Agency	Total FY 2007 S&T Budget[1]	Estimated FY 2007 Budget for BP/D STEM Programs	Percent of BP/D Budget of Total S&T Budget
DOD	5,900,000,000	99,600,000[2]	1.69
DOE	6,155,000,000	28,209,000[3]	0.46
NASA	7,073,000,000	21,526,000	0.30
NIH	28,428,000,000	142,050,809[4]	0.50
NIST	535,000,000	2,129,051[5]	0.40
NOAA	338,000,000	14,200,000	4.20
NSF	6,020,000,000	254,700,000	4.20
USDA	1,921,000,000	146,900,000	7.60
USGS	945,000,000	658,374	0.70
Total	57,315,000,000	709,973,234	1.24

1. Budget figures obtained from the Office of Science, Technology and Policy.

2. Funds for agency-wide DOD and Air Force broadening participation programs. Other armed service branches did not respond to NSF data request.

3. Figure based on 11 of DOE's 17 national laboratories. The other 6 did not respond to the survey.

4. Figure is based on selected programs of NIH's 27 Institutes and Centers, but excludes FY 2007 funding for the Research Supplements to Promote Diversity program.

5. Figure is based on 8 of NIST's 10 laboratories. The other 2 did not respond to the survey.

- With the exception of the WHI-HBCU, all of the agencies conduct evaluations of their agency-wide broadening participation/diversity programs. Four sub-units of DOE and NIST have yet to evaluate their local broadening participation/diversity programs. Two of these four are, however, planning to implement an evaluation in 2008.

- The agencies use a variety of evaluation approaches to assess their broadening participation/diversity programs and activities. None of the agencies utilizes the so-called *gold standard* methodology involving random assignment to program and no-program groups. The reported reasons for this are lack of financial resources, or ethical concerns about denying underrepresented students access to program opportunities. Two of the eleven agencies (NSF and NIH) have employed quasi-experimental designs that involved the use of comparison groups. As can be seen in *Table 3,* the agencies more typically use program exit surveys, post-program follow-up studies, and descriptive analysis of program participants. Several of the agencies and their sub-units noted that they encounter difficulties in tracking undergraduates and graduate students who participate in agency-based internship and fellowship programs.

Table 3
Methods Typically Used by Federal Agencies to Evaluate Broadening Participation/Diversity Programs

Evaluation Method	Percent (n=30)*
Quasi-experimental design (comparison groups)	6.7
Pre-and-post program participant survey	6.7
Program participant exit survey	63.3
Post-program participant follow-up survey	26.7
Participant focus group study	6.7
Descriptive profiles of program Participants	66.7
Do not perform program evaluations	13.3

** Data were obtained from a total of 30 units, which consisted of the 11 agency headquarters for agency-wide programs plus 19 agency sub-units (e.g., laboratories). Each responding unit gave multiple answers, so the percents do not add to 100%.*

- The metrics typically employed by the agencies in the program evaluations include number and description of program participants, number and description of students who complete undergraduate and graduate degrees in STEM areas, and number and description of students who become employed at the agencies. Other metrics used by the agencies include success of graduate students and post-docs in publishing in refereed research journals, agency-trained research investigators who are successful in getting subsequent research awards, number of requests from organizations for outreach events such as science fairs, public exhibits, and satisfaction of participants with outreach events sponsored by the agencies.

- A recurring theme among the agencies is the lack of adequate funding for program evaluation. In most instances, there is no separate budget for evaluation; monies needed to retain evaluation consultants are usually squeezed out of research budgets or administrative overhead.

- As a result of developing and implementing broadening participation and diversity programs, the federal agencies have learned numerous lessons. They include: funding for broadening participation and diversity programs has not kept pace with the growing demand for these programs; HBCU faculty have difficulties in getting release time to conduct research on grant projects; community college students work well in laboratories; programs need flexibility to address personal needs of underrepresented students; recruiting minority students without relationship building is not effective in sustaining student interest in STEM careers; ongoing communication with academic institutions about the value of broadening participation is necessary for real institutional transformation to take place; and agency leadership commitment to broadening participation and

diversity is absolutely essential to support funding for internships, fellowships, and other program opportunities for underrepresented groups.

- In many instances, best practices stem from lessons learned. *Table 4* illustrates some of the major best practices reported by the agencies.

Table 4
Illustrations of Federal Agency Best Practices in Broadening Participation/ Diversity Programs

Providing hands-on research experience attracts and sustains student interest in STEM.
Strategic partnerships with other federal agencies help to expand training opportunities.
While cooperative agreements are more labor-intensive than regular grants, the former are useful because they are understood to be a partnership in which the institution has clear-cut goals and objectives for which it is held accountable.
A diversity council or other body within an agency that promotes opportunities for underrepresented groups greatly facilitates the existence of broadening participation programs.
Aligning a new agency program with a successful broadening participation program, such as NSF's *LSAMP* or *HBCU-UP*, helps to ensure success of the new program.
Providing a "personal touch" with lots of mentoring and attention to personal needs of the student helps to sustain student interest in STEM.
Having personnel dedicated to tracking students helps to ensure successful follow-up studies.
Providing incentive credits to laboratory researchers who work closely with students helps to motivate staff involvement in broadening participation.
Workshops that demonstrate the effects of gender/race bias provide a stimulus for institutional transformation of colleges and universities.
Providing technical assistance to minority-serving institutions in the post-grant administrative process, including post-grant audits, helps to improve the grant management practices and competitiveness of these institutions.

- All of the agencies have expressed an interest in collaborating with other STEM-related federal agencies to support and improve the government's efforts to open STEM enterprises to all U.S. citizens. With the exception of DOL, all of the agencies have been or are currently involved in collaborations with other federal agencies to broaden participation. See *Figure 2.*

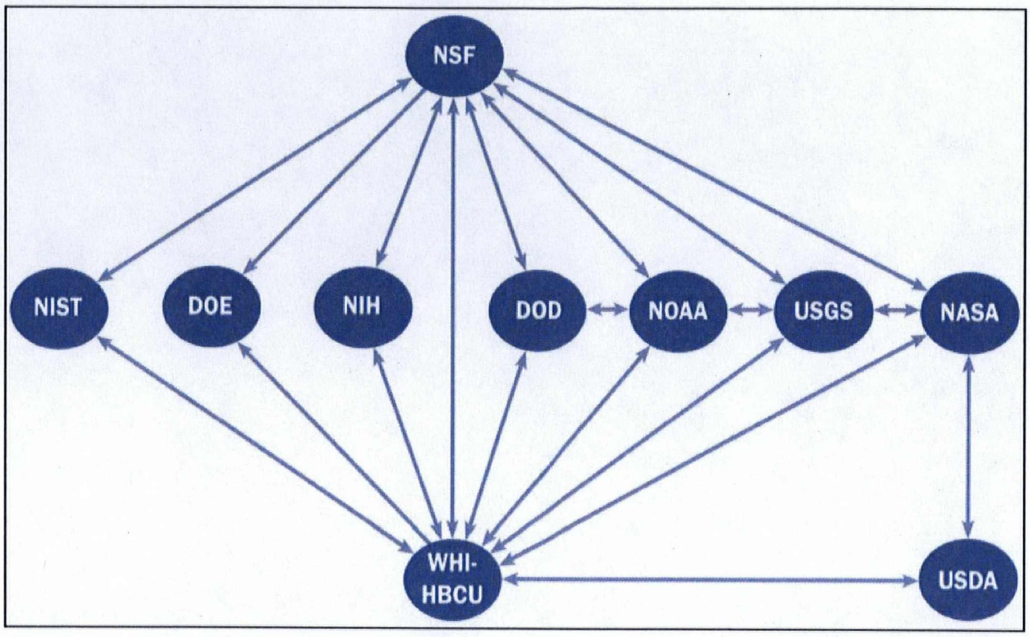

Figure 2. Current Inter-agency Collaborations for Broadening Participation in STEM.

- Finally, during the course of the conversations, the agency representatives made a number of recommendations for forming and implementing inter-agency collaborations to specifically increase the numbers and retention of women, underrepresented minorities, and persons with disabilities in the STEM pipeline and workforce. The representatives also made some recommendations related to areas in which the agencies themselves need to make internal changes to better broaden participation. The recommendations are included with the specific findings for each agency, and are also summarized in the Discussion section of this report.

National Aeronautics and Space Administration

Agency Participants in the Conversation

Dr. Bernice G. Alston, Deputy Assistant Administrator of the Office of Education
Dr. Julie A. Pollitt, Program Analyst of the Office of Program Analysis and Evaluation
Dr. Carl S. Person, Director of Minority University Research and Education Programs

Agency Background in Broadening Participation

- According to Dr. Alston, NASA's history with broadening participation in STEM for traditionally underrepresented groups began in the 1980s. The agency wanted better relationships with minority-serving institutions (MSIs) and began to accomplish this aim through the Executive Orders that mandated that federal agencies engage MSIs in their research and career development programs.[8]

- Diversity is defined by NASA in a broad sense that includes a person's knowledge, expertise, gender, race, ethnicity, and cultural identity.[9]

Priority Status of Broadening Participation within NASA

- The elevated status of ensuring diversity among NASA's workforce is exemplified in a goal statement in the agency's strategic plan for education: *"NASA will identify and develop the critical skills and capabilities needed to ensure achievement of the Vision for Space Exploration. To help meet this demand, NASA will continue contributing to the development of the Nation's... [STEM] workforce of the future through a diverse portfolio of education initiatives that target America's students at all levels, especially those in traditionally underserved and underrepresented communities."*[10]

- Also stated in its education strategic plan, *"NASA will continue to focus on enhancing the capabilities of Minority-Serving Institutions to contribute to the needs of the agency"*[11]

Policies and Procedures

- Drs. Alston and Pollitt indicated that diversity is an embedded element in NASA's approach to planning, policies, and management strategies.

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[8] For example, Executive Order #13256 for HBCUs, February 12, 1992. Executive Order #12900 for HSIs, February 2, 1994; and Executive Order #13021 for TCUs, October 19, 1998.
[9] National Aeronautics and Space Administration Policy Statement on Diversity, March 20, 2006.
[10] NASA Education Strategic Coordination Framework: A Portfolio Approach. Washington, DC: National Aeronautics and Space Administration, NP-2007-01-456-HQ, page 4.
[11] Ibid., page 8.

- Dr. Michael Griffin, the agency's Administrator, has stated that "*Diversity is integral to mission success at NASA...To design the most effective systems, NASA must have diversity of views, ideas and perspectives.*"

- The primary mission of the agency's Office of Diversity and Equal Opportunity (ODEO) is to assist the agency in ensuring that education, research, and employment opportunities are open to all demographic groups.

- Dr. Alston said that broadening participation is emphasized in NASA's grant application policies and procedures to ensure that underrepresented minorities and minority-serving institutions are given opportunities to compete for grants.[12]

- Under a Congressional mandate, NASA provides specific education program opportunities for minority-serving institutions, which include Historically Black Colleges and Universities, Hispanic-serving Institutions, Tribal Colleges and Universities, Alaska Native-serving Institutions, and Native Hawaiian-serving Institutions.[13]

Broadening Participation Programs

- Drs. Alston and Pollitt said that NASA strives to ensure that women, underrepresented minorities, and persons with disabilities have the opportunity to participate in NASA-related research and education programs, which include K—12 education, undergraduate scholarships, graduate student fellowships, institutional infrastructure enhancement, and university partnership research and development projects.

- NASA offers a portfolio of education programs targeted to underrepresented and underserved groups in STEM. Each Mission Directorate of NASA financially supports the NASA portfolio of education programs to attract, train, and retain the next generation of STEM professionals in the NASA workforce. These targeted programs are multi-year grants awarded to minority-serving institutions for student education, faculty development, and research related to NASA's missions.[14] Some examples include the following programs:

  Curriculum Improvement Partnership Award for the Integration of Research into the Undergraduate Curriculum—a 3-year undergraduate program for minority-serving institutions.

[12] See, for example, NASA Research Announcement: Research Opportunities in Aeronautics, 2005 (Solicitation #NNH06ZNH001).
[13] Public Law 109-155, December 30, 2005, Title VI, Subtitle B, Section 611.
[14] See Learning in a Whole New Light. 2006 NASA Education Highlights (EP-2006-12-441-HQ- 2006), pages 10-13.

Faculty Awards for Research NASA Administrator's Fellowship Program—provides faculty at minority-serving institutions with an opportunity to spend a year conducting research at a NASA center.

The Harriett G. Jenkins Pre-doctoral Fellowship Program—provides support to women, underrepresented minorities, and persons with disabilities who seek advanced degrees in NASA-related fields of science, technology, engineering, and mathematics.

The NASA Science and Technology Institute for Minority Institutions Research Academy—provides leading-edge research opportunities for faculty and students at minority-serving institutions that complement NASA's research programs.

University Research Centers—a project designed to achieve a broad-based, competitive aerospace research capability among the nation's minority-serving institutions that foster new aerospace science and technology development; increase the participation of faculty and students from MSIs in mainstream research; and increase the number of underserved and underrepresented students at MSIs who obtain advanced degrees in STEM.

The Dr. Mae C. Jemison Grant Program—is a Congressionally-mandated program designed to work with minority-serving institutions to recruit, retain, and train more women of color into the field of space and aeronautics.[15]

Best Practices

- NASA has been able to attract and engage students in mission-related sciences by providing hands-on research experiences.
- Strategic partnerships between federal agencies and educational institutions have proven to be an effective way to widen the agency's outreach and educational activities for underrepresented groups in STEM.

Lessons Learned

- With demand for NASA's programs exceeding available funding, program managers have to limit their activities while seeking creative ways to attract students into STEM fields.

[15] Public Law 109-155, December 30, 2005, Title VI, Subtitle B, Section 615(c), Equal Access to NASA's Education Programs.

Financial Investments in Broadening Participation

- Dr. Alston indicated that while there is a high demand for NASA's education programs, the agency has limited dollars for these programs, including those aimed at underrepresented groups.

- NASA funded its *Minority University Research and Education Programs* (MUREP):

  FY 2005: $41,870,000
  FY 2006: $19,740,000
  FY 2007: $21,530,000 (projected)[16]

Assessment of NASA's Broadening Participation Programs

- All of NASA's education portfolio programs, projects, and other initiatives, including those aimed at underrepresented groups are evaluated using performance metrics. The evaluation process occurs first, at the activity, project, and program levels by the participant Directorates and external partners, and then by the Education Coordinating Council (ECC), an intra-agency body that collects and aggregates evaluation feedback to assess agency-wide education goals and objectives.

- NASA is also required to report to Congress on the agency's efforts to ensure equal access to STEM education for minority and economically disadvantaged students.[17]

Evaluation Approaches and Metrics

- NASA typically employs program exit surveys to assess participant satisfaction and other feedback; and tracking studies to find out if students remained in the STEM pipeline and enter the STEM workforce.

- NASA's broadening participation program metrics include number of program participants from underrepresented groups in STEM; and number of program participants who attain a STEM degree and enter the STEM workforce.

Management of Broadening Participation Efforts

- NASA's education programs aimed at underrepresented groups are administered through and managed by the Office of Education. The Assistant Administrator for

[16] NASA Office of Education Funding by Program and Project for FYs 2004 through 2007.
[17] Public Law 109-155, Subtitle B, Section 615(b).

Education reports directly to NASA's Administrator on all activities and accomplishments of the Office of Education.

- The internal Education Coordinating Council (ECC) plans, monitors, and evaluates the implementation of the agency's education portfolio.

- The Mission Directorates and Centers that fund education efforts are responsible for embedding programs, including those targeting underrepresented groups, within their research and flight mission programs.

- The Office of Diversity and Equal Opportunity also oversees the activities and reviews the results of the education programs.

Inter-Agency Collaborations

- NASA collaborates with several other federal agencies, and majority- and minority-serving institutions in outreach, education, and research endeavors. A recent example is a Memorandum of Understanding between NASA and NSF to coordinate education efforts. The goals of this effort are to jointly support exemplary projects that advance STEM excellence; to improve the knowledge base regarding scientific literacy, workforce development and competitiveness; and to contribute to the production of a scientific workforce that reflects the nation's demographic diversity.[18]

Recommendations from Drs. Alston and Pollitt

- NASA needs to identify the specific mutual benefits from collaborating with NSF as well as other agencies.

- Agencies should jointly identify STEM talent in a strategic way to help satisfy the needs of the STEM workforce.

- Agencies should share best practices in working with Historically Black Colleges and Universities, Tribal Colleges and Universities, and other minority-serving institutions.

[18] Memorandum of Understanding for Science, Technology, Engineering and Mathematics (STEM) Education Cooperation Between the National Science Foundation and the National Aeronautics and Space Administration, February 2, 2007.

U. S. Geological Survey

Department of Interior

Agency Participants in the Conversation

Dr. Robert W. Ridky, National Education Coordinator
Mrs. Alesia J. Pierre-Louis, Chief, Office of Equal Opportunity.

Agency Background in Broadening Participation

- Under Presidential Executive Orders, the Department of Interior (DOI) is mandated to encourage its departments and agencies to engage minority-serving institutions, their students and faculty in DOI's funded educational and training programs.[19]

- According to Dr. Ridky and a review of governing laws of the agency, USGS does not have any Congressional mandates to offer broadening participation programs for underrepresented groups in science, engineering or technology. In addition, there is no language in any of the agency's legislative acts that pertains to women colleges or minority-serving institutions.

Priority Status of Broadening Participation within USGS

- The Assistant Secretary for Policy, Management and Budget has stated that a diverse department workforce is a top priority.[20]

- The Department of Interior has a diversity plan that covers all of its components, including USGS. The plan details strategies and actions for recruiting, retaining, and advancing a "highly skilled and diverse workforce."[21] However, the plan does not specifically address how to provide educational and training opportunities for people from underrepresented groups who may want to pursue a career in the earth sciences.

Policies and Procedures

- USGS functions under the DOI's Equal Employment Opportunity and diversity policies for employee recruitment and retention, but USGS does not have policies

[19] Executive Orders #13256 for Historically Black Colleges and Universities; #13230 for Educational Excellence for Hispanic Americans; and #13021 for Tribal Colleges and Universities.
[20] Memorandum from Assistant Secretary of Policy, Management and Budget to All Employees, February 17, 2005.
[21] *U.S. Department of Interior Strategic Plan for Achieving and Maintaining a Highly Skilled and Diverse Workforce FY 2005-2009.*

that specifically address broadening opportunities in STEM. According to Ms. Pierre-Louis, USGS procurement policies lack language that would allow for funding of programs to broaden participation.

- USGS established in 2001 the Special Emphasis Program Advisory Committee (SEPAC), whose overall purpose is to improve recruitment, retention, and career advancement opportunities for women, minorities, and persons with disabilities in the USGS workforce.[22] In October 2006, the USGS launched the Diversity Council. The mission of the Council is to promote "diversity within the USGS that is reflective of the nation's citizens and addresses issues affecting quality of work life. The Diversity Council works in conjunction with the Office of Equal Opportunity (OEO) and regional and central management to achieve the goals and objectives of the *DOI Strategic Plan for Achieving and Maintaining a Highly Skilled and Diverse Workforce*. The Council also assists management to identify and remove barriers to equal employment in the workplace and to create an environment that supports and advances the goal of science excellence."

Broadening Participation Programs

- DOI offers department-wide programs to broaden participation. Examples of these programs include the *Diversity Intern Program,* which offers paid internships for students from minority-serving institutions in the earth sciences. This program is administered through the Hispanic Association of Colleges and Universities, Minority Access, Inc., Student Conservation Association, and the National Association for Equal Opportunity in Higher Education, as partner organizations.[23] Another is the *Minority Higher Education Institutions* program in which USGS partners with minority-serving institutions in the earth sciences.[24] Located at Fort Valley State University in Georgia is an exemplary HBCU program that provides a summer camp in the geosciences. This program model has also been adapted by the University of Texas at Austin, a Hispanic-serving Institution.

- USGS also provides a series of workshops and short courses to American Indians and Alaska Natives in a variety of earth science areas, including hydrology, geo-chemistry and geo-mapping technology. These educational programs target both adults and children in K—12 grades.[25]

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[22] www.usgs.gov/usgs-manual/300/308-59.html.
[23] U.S. Department of Interior Office of Educational Partnerships: Diversity Intern Program
[24] U.S. Department of Interior Office of Educational Partnerships: Minority Higher Education Institutions.
[25] *U.S. Geological Survey Activities Related to American Indians and Alaska Natives. Fiscal Year 2004.*

- The 2,400 operating locations of DOI also provide to varying degrees their own broadening participation opportunities.

- According to Dr. Ridky and Mrs. Pierre-Louis, USGS does not have line-item funding authority or funds for programs to broaden minority participation in the earth and related sciences.

Best Practices

- A memorandum of agreement between USGS and minority-serving institutions has proven to be an effective vehicle for specifying roles and responsibilities of the parties involved, and it also helps to align program activities with the goals of USGS and the academic institutions.

- The agency's Diversity Council, which advises USGS leadership on diversity issues, helps to promote attention to broadening participation of underrepresented groups in the earth sciences.

Lessons Learned

- Providing hands-on research experience and mentoring are key elements to keeping the educational programs attractive and viable.

- The agency needs to stay energized about working with HBCUs, in order to sustain the HBCU programs.

- The agency's recruitment efforts could be enhanced by a greater understanding of the cultures of African American, American Indian, and Hispanic students and institutions.

Financial Investment in Broadening Participation

- USGS has invested the following amounts in minority-serving institution programs. Data were not available (n/a) for FY 2005 at the time this report was prepared.

FY 2005:	n/a
FY 2006:	$1,210,000
FY 2007:	$ 658,374

Assessment of USGS Broadening Participation Programs

- Dr. Ridky indicated that their broadening participation programs are evaluated either by internal or external sources.

Evaluation Approaches and Metrics

- Program participant surveys and profile descriptions of participants are typically used to assess the broadening participation programs of USGS.

- The primary metrics used are the number of program participants and their demographic diversity.

Management of Broadening Participation Efforts

- Department-wide broadening participation efforts are managed by the Deputy Assistant Secretary for Performance, Accountability and Human Resources, in conjunction with the newly established Diversity Task Force and DOI's Diversity Council. The Deputy Assistant Secretary, in turn, reports to the Secretary of DOI on the department's diversity activities.

- Evaluation of personnel performance is linked to performance in the department's goal areas, including diversity initiatives.[26] This adds incentive for staff to work toward broadening participation. Dr. Ridky, however, noted that more needs to be done to keep the USGS staff energized about the broadening participation programs. Ms. Pierre-Louis said that with uncertainty about sufficient funding for research and information technology projects, sometimes the scientists are guarded about funds being used for purposes other than research and technology.

Inter-Agency Collaborations

- USGS has collaborated with NOAA, NASA, NSF and other federal agencies to promote earth science literacy through public education workshops and exhibits for the general population.

Recommendations from Dr. Ridky and Ms. Pierrre-Louis

- USGS is interested in collaborating with NSF on efforts to broaden participation.

- Increasing culturally-based information on the USGS web site would help to stimulate minority K—12 students' and teachers' interest in the earth sciences.

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[26] *U.S. Department of Interior Strategic Plan for Achieving and Maintaining a Highly Skilled and Diverse Workforce FY 2005-2009*, page 26.

- USGS should collaborate more with women colleges and minority-serving institutions to train faculty, provide student access to USGS laboratories, and conduct joint research.

- USGS should partner further with NASA, NOAA and NSF to promote interest in earth sciences among undergraduates.

- Dr. Ridky would like to see Congressional funding mandates for broadening participation programs at USGS. The Science Committee of the Office of Science and Technology Policy—of which USGS is a member—could be very instrumental in facilitating the realization of such mandates, which would provide authoritative language for the agency's procurement policies.

- As a leader in broadening participation for underrepresented groups in STEM, NSF should consider developing a funding program to assist other federal agencies to establish and support broadening participation programs.

Department of Energy

Agency Participants in the Conversation

Dr. Joseph V. Martinez, Senior Advisor for Scientific Institutional Outreach, Office of Science
DOE Laboratory Staff: William Hempfling, Human Resources Director, Ken White, Manager of Education Office, Shirley Kendall, Diversity Manager (Brookhaven); Cindy Spence, EEO Specialist (Oak Ridge); Nina Farrish, Human Resources Consultant (Jefferson); Sue Von Gee, Diversity Officer (Stanford); Dr. John DeLooper, Scientist (Princeton); Dr. Karen Wieda, Scientist (Pacific Northwest); Michael Nowak, Technical Advisor and Nancy Vargas, EEO/Diversity Officer (Energy Technology); Tommy Smith, Director of Affirmative Action and Diversity Program (Livermore); Dr. Vera Potapenko, Chief Human Resources Officer, Kamalla Green, EEO Officer, Harry Reed, Head of Office of Workforce Diversity, and Laura Egenberger, Manager of College and University Programs (Berkeley); Eve Gohouré, Manager of Diversity Programs (Argonne); and Toni Vandel, Employee Relations Diversity Specialist (Idaho).

Agency Background in Broadening Participation

- According to a statement from Mr. Clay Sell, Deputy Secretary of DOE, the department "*...has a long history of support for minority educational institutions (MEIs). Support includes research and development funding, fellowships, scholarships, internships, direct institutional support, infrastructure support, and private sector partnerships.*"[27]

- In 1979, DOE's Office of Economic Impact and Diversity was established to ensure the participation of minority-serving institutions in the department's science and technology programs.[28]

- In 1990, the Department of Energy Education Enhancement Act authorized the Secretary of DOE to support graduate and undergraduate students pursuing scientific and technical careers, with a particular focus on recruitment of minority students.[29]

- Executive Orders have been issued by the President, directing DOE as well as other federal agencies to develop plans for supporting Historically Black Colleges and Universities (HBCU), Hispanic-Serving Institutions (HIS), and Tribal Colleges and Universities (TCU).[30]

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[27] Memorandum from Deputy Secretary, Clay Sell, to the Under Secretaries for Nuclear Security and for Science, regarding Department of Energy Support for Minority Educational Institutions, September 6, 2006.
[28] Public Law 95-619, September 9, 1978.
[29] Department of Energy Science Education Enhancement Act, 1990.
[30] Executive Order #13256 for HBCUs, February 12, 1992; Executive Order #12900 for HSIs, February 2, 1994; and Executive Order #13021 for TCUs, October 19, 1998.

- Through the Energy Policy Act of 2005, Congress required the Secretary of DOE to give priority to activities that are designed to encourage students from underrepresented groups to pursue science and technical careers. The Act also requires each DOE laboratory and science facility to increase participation of HBCUs, HSIs, and TCUs in activities that increase their science and engineering educational capacities.[31]

Priority Status of Broadening Participation within DOE

- The importance of having a skilled and diverse workforce is highlighted in DOE's latest strategic plan.[32]

- Achieving and maintaining workforce diversity within DOE is a priority for the department. The Deputy Secretary, for instance, recently underscored the need for DOE to support minority-serving institutions, and directed the Under Secretaries for Nuclear Security and for Science to work with the Director of the Office of Economic Impact and Diversity to develop and execute plans to increase funding for minority-serving institutions.[33]

Policies and Procedures

- DOE's grant-giving and contract-letting guidelines do not specify any grantee/contractor requirements or provisions for inclusion of underrepresented groups in STEM within DOE projects.[34]

- DOE has a diversity plan for Equal Employment Opportunity, as well as for Small Business Acquisitions.

Broadening Participation Programs

- Dr. Martinez said that DOE does not have an extensive portfolio of department-wide programs to broaden participation of underrepresented groups in STEM areas. The department does provide internships through its department-wide *Minority Education Program,* which is funded by the various components of DOE. The Office of Fossil Energy supports the *Historically Black Colleges and Universities Education Training Program,* which is designed to enhance research methods and capabilities of minority-serving institutions through activities that expand learning opportunities and increase collaborative efforts between the nation's minority students and the fossil fuel industry.[35] The *Nuclear Engineering University Partnership Program* is another vehicle used by DOE to foster

[31] Public law 109-58, August 8, 2005, 42USC, 2015c.
[32] "Mission. U.S. Department of Energy Strategic Plan" (DOE/CF0010), page 24, Goal 5.2 Human Capital.
[33] See Footnote 3.
[34] For example, SC Grant Application Guidelines. 10 CFR #605.
[35] http://fossil.energy.gov/programs/powersystems/advresearch/advresearch-university.html.

collaborations between minority-serving institutions and Research 1 institutions. A recent example was a 2005 award made by DOE to Clark Atlanta University and Georgia Institute of Technology which enabled Clark Atlanta to establish an undergraduate minor in nuclear engineering.[36]

- DOE's Office of Science oversees and supports 17 national laboratories that are operated by independent contractors. Of the 17 laboratories, 11 reported on their broadening participation education, training and infrastructure-enhancement programs:

  Brookhaven National Laboratory
  Minority High School Apprenticeship Summer Program
  High School Cooperative Program (girls and minorities)
  Professional Associates Internships (minority holders of bachelor's and master's)
  College Science and Technology Entry Program (women and minorities)
  Undergraduate and Faculty Mentoring Program (minority students)
  Engineering and Math Consortium (all students)
  Math and Science Partnership Program (all students)

  Oak Ridge National Laboratory
  Appalachian Regional Commission Summer Institute (disadvantaged high school students)
  DOE Faculty and Student Teams Program (minority colleges and universities)
  DOE Faculty Sabbatical Program (minority institutional faculty)
  Nuclear Regulatory Commission HBCU Program (minority faculty and students)
  ORNL also offers several other research experience programs for all students and faculty, including those from underrepresented groups.

  Thomas Jefferson National Accelerator Facility
  Becoming Enthusiastic About Math and Science (minority public school students)
  Cooperating Hampton Roads Organizations for Minorities in Engineering (minority and female students, and teachers)
  Academies Creating Teacher Scientists (5th and 8th grade teachers)

  Stanford Linear Accelerator Center
  Graduate Engineering for Minorities
  Summer Undergraduate Laboratory Internship (women and minorities)
  Youth Opportunity Summer Lab Program (girls and minorities)
  Post-Bachelor's and Master's Program (women and minorities)

  Princeton Plasma Physics Laboratory
  National Undergraduate Fellowship (all students)
  Student Undergraduate Laboratory Program (all high school students)
  Plus, various community programs are offered (e.g., teacher workshops).

[36] http://www.energy.gov/news/2312.htm.

Pacific Northwest National Laboratory
Student Research Apprenticeship Program (minority high school students)
Mickey Leland Energy Fellowship (minority undergraduate and graduate students)
Young Women in Science (high school girls)
HBCU Faculty and Student Grant Program
DOE Community College Institute of Science and Technology

National Energy Technology Laboratory
Mickey Leland Energy Fellowship Program (minorities)
Minority Mentoring Internship Program
Minority-Serving Institutions Program
Oak Ridge Institute for Science and Education (all students)

Lawrence Livermore National Laboratory
K-12 Outreach Programs (girls and minorities)
Undergraduate and Graduate Outreach Programs (women and minorities)

Argonne National Laboratory
Hispanic Education Outreach Day
Introducing Engineering to Girls Day
Women in Science Conference
Faculty and Student Teams Fellowship (women and minorities)

Idaho National Laboratory
Summer Teacher Internship (public school teachers)
Student Internship (women and minority undergraduates)
Science and Technology Expo
Hispanic Youth Symposium (high school graduates)

Berkeley National Laboratory
Community College Initiative (all students)
Faculty and Student Teams (women and minorities)
Fifth Grade Laboratory Tours (minority students)
High School Research Participation (minority students)
Lawrence Post-Doc (all groups)

Best Practices

- Aligning DOE programs with successful programs, such as NSF's LSAMP and HBCU-Up, is an effective strategy.
- Providing lots of mentoring to students helps motivate students.
- Hiring post-docs to assist with broadening participation programs is effective.
- Utilizing time-honored personal recruitment networks to reach out to students interested in a STEM profession is productive.

- Partnering with professional societies with a focus on minorities helps a lot.
- Working directly with teachers in low-income minority schools helps to improve math and science instruction.
- Exposing students to many different lab professionals helps to stimulate student interests in the sciences.
- Staff-level persistence, despite no real commitment on part of leadership for broadening participation, helps to maintain some focus at least on diversity.
- Using the "personal touch" in relating to individual students and making them feel a part of the lab team works wonders in keeping students involved.
- Going to conferences to recruit students and staying in contact with them yields good results.
- Paying attention to pre-college students with an interest in sciences, because by the time they enter college, it may be too late.
- Working closely with HBCUs produces good results for schools and lab.
- The Flagstaff in S&E Alliance, a consortium of HBCUs begun in 1991, has proven very effective.
- Hispanic Youth Symposium provides multiple services to students, e.g., mentoring, assist high school graduates with college applications, and help obtain scholarships.
- Having personnel dedicated to student tracking greatly facilitates follow-up studies.
- Targeted recruiting from minority-serving institutions works better than recruiting minorities from all institutions.
- Employing a variety of outreach activities, including public demonstrations of science directed at parents as well as students.
- Lots of interaction between students and lab staff is essential to keep students motivated.

<u>Lessons Learned</u>

- HBCU faculty who are awarded DOE grants have difficulty in getting release time to work on grant projects.
- Senior agency leaders must be engaged in broadening participation to ensure year-to-year funding.
- Need flexibility in programs to individualize student assistance and support.
- It is difficult to recruit American Indian students to distant labs.
- Community college students do well in lab environment.
- Unpredictable federal budgets make it hard to plan for programs.
- Staff is expected to produce, even though resources for diversity programs are scarce.
- Labs with limited funds are discouraged from seeking outside funds for diversity programs, because it competes with principal investigators who also seek outside funds, e.g., from NSF.
- You have to constantly reach out to the students to encourage them, especially middle and high school students.

- There is a need for dedicated and centralized funding for broadening participation programs.
- Minority professional role models are needed to enhance recruitment and efforts to sustain student interest in science programs.
- Sustained efforts to promote and financially support diversity programs are critical.
- Underrepresented groups can fulfill in large measure the future needs of the STEM workforce and will allow better footing in competition with foreign nationals.

Financial Investments in Broadening Participation

- Total funding for broadening participation and diversity programs located at the above 11 DOE laboratories is as follows:

  FY 2005: $28,207,440
  FY 2006: $29,258,000
  FY 2007: $28,209,000

Assessment of DOE's Broadening Participation Programs

- Nine of the eleven surveyed laboratories evaluate their broadening participation programs, and the remaining two plan to conduct evaluations of their programs. The laboratories utilize internal staff and external consultants to carryout the evaluations. In addition, DOE headquarters also conducts performance evaluations of the local programs.

Evaluation Approaches and Metrics

- The surveyed laboratories typically use non-experimental methods to evaluate their broadening participation programs. Two of the laboratories use the focus group approach, seven employ exit surveys to obtain participant feedback, two conduct post-program follow-up interviews, six prepare demographic profiles of participants, and four utilize other methods such as student abstracts of assigned research projects to assess student performance and satisfaction with programs.

- The metrics employed by the DOE laboratories include number and diversity of program participants, student satisfaction with programs, and number of graduate students and post-docs who become employed by the laboratories. Across all of the laboratories is a desire to conduct more follow-up studies of the undergraduate and graduate students who were involved in the internship and fellowship programs, but staff finds tracking of students to be very labor-intensive and difficult to do given the limited resources allocated for evaluation.

Management of Broadening Participation Efforts

- Dr. Martinez indicated that the department's leaders are very committed to broadening participation of underrepresented minority groups in STEM, as exemplified in the staff memorandum cited in Footnote 21.

- As indicated previously, the Office of Economic Impact and Diversity has department-wide responsibility for overseeing the diversity education and university-industry partnerships programs. This office reports directly to the Secretary of DOE.

- A link between staff performance and awards for achievement of department goals and objectives, including broadening participation, has been established and serves as a staff incentive to promote diversity throughout the DOE complex.

- The laboratory-based programs are managed by the laboratory's diversity or equal employment opportunity manager, who reports directly to the laboratory director. DOE's Office of Science also oversees the performance of the individual laboratory programs.

Inter-Agency Collaborations

- DOE and NSF have recently collaborated in providing minority undergraduates in NSF's broadening participation programs with opportunities for hands-on experience in DOE laboratories during the summer. These NSF programs include *LSAMP, CREST, HBCU-UP,* and *ATE.* (see http://www.scied.science.DOE.gov).

- DOD and DOE are jointly conducting a study on the skill needs of the future STEM workforce.

Recommendations from Dr. Martinez

- There needs to be greater sensitivity among the department's professionals to enhance the department's broadening participation efforts. It was his opinion that EEO training is not sufficient. More needs to be done.

- DOE is very interested in collaborating with other federal agencies to widen access to STEM education and employment opportunities for underrepresented groups.

- The OSTP should push agencies towards more collective action to bring about changes across the agency level in broadening participation in STEM. Agencies tend to perceive one another as competitors and this attitude can thwart efforts towards collective action.

- The concept of a "CEOSE" effort should be instituted in each of the agencies represented on the OSTP Science Committee. This would be very helpful in moving the diversity agenda and would greatly facilitate trans-agency collaborations.

- CEOSE should discuss and develop guidance on increasing diversity in an agency's review panels, external advisory bodies, visiting committees, etc.

- Organizations with predominantly underrepresented membership known for having a historical interest in broadening participation in STEM should be invited to discuss their work with CEOSE.

Department of Defense

Agency Participants in the Conversation

Mrs. Evelyn Kent, Staff Specialist for Basic Sciences in the Office of the Director of Defense Research and Engineering/Basic Sciences. The Office is a part of the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics (AT&L).
Mr. Clarence A. Johnson, Principal Director, Office of Diversity Management and Equal Opportunity Policy
Pamela Swann, Chief of Workforce Development, Air Force
Jacqueline Toussaint, Senior Education and Outreach Researcher, Air Force

Agency Background in Broadening Participation

- Mrs. Kent noted that DOD does not have a department-wide history in broadening participation. Rather, its legislative history in broadening participation in science and engineering stems from congressional mandates related to specific programs within the individual armed service branches that are aimed at underrepresented groups in STEM fields.
- DOD, as with other federal agencies, is mandated under Executive Orders to reach out to and include minority-serving institutions in the department's education and employment recruitment programs. These programs have not been limited to STEM fields.[37]

Priority Status of Broadening Participation within DOD

- Mrs. Kent indicated that the department's top leaders are committed to broadening participation in STEM within its civilian and military workforce.
- Based on the department's efforts to provide career advancement opportunities for women and minorities, diversity is seen as a priority at DOD.[38] DOD's most recent strategic and implementation plan underscores education and training of the defense workforce.[39] However, the plan does not have specific objectives that address STEM programs specifically for women, underrepresented minorities, or persons with disabilities.

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[37] For example, Executive Order #13256 for HBCUs, February 12, 1992; Executive Order #12900 for HSIs, February 2, 1994; and Executive Order #13021 for TCUs, October 19, 1998.
[38] An illustration of this priority has been articulated in numerous department publications. See, for example, *Diversity Remains A Priority AT DOD, Official Says.* American Forces Press Service, February 23, 2007.
[39] *Under Secretary of Defense for Acquisition, Technology and Logistics Strategic Goals and Implementation Plan.* Department of Defense, FY 2007, pages 8-10.

Policies and Procedures

- A directive from the Deputy Secretary of Defense was issued in 1995 directing all DOD divisions to focus on the importance of broadening participation of women, minorities, and persons with disabilities in the DOD civilian workforce.[40] While STEM occupations were included, the directive did not specifically emphasize STEM or any other particular occupational groups.

- Mrs. Kent said that DOD's general science and engineering grant-making policies do not contain any references to or provisions for broadening participation of underrepresented groups in STEM. The investigator reviewed, for example, the Army's regulation #70-5 for *Grants to Nonprofit Organizations for Support of Scientific Research*, and found no mention of diversity or broadening participation requirements.[41]

- Department-wide, DOD does not have policies that specifically address women and persons with disabilities within STEM areas.

Broadening Participation Programs

- DOD sponsors a number of outreach initiatives to attract underrepresented minorities to careers in its civilian and military workforce. The *Minority-Serving Institutions Research Partnerships Conferences,* the *Annual Hispanic Engineer National Awards Conferences*, and symposia at Hispanic-Serving Institutions and Tribal Colleges, as well as speaking engagements featuring minority military officers at minority-serving institutions, are some examples of these initiatives.

- Despite some efforts on the part of DOD to reach out to minority institutions, some HBCUs appear to be unaware of department's grant and contract opportunities.

- DOD also sponsors four major department-wide programs that focus on attracting and assisting students in the STEM pipeline, but only one of these programs has a specific focus on an underrepresented group in STEM. The first program is *SMART (Science, Mathematics and Research for Transformation Defense)*, which provides scholarships and fellowships to students from kindergarten through graduate school. The second is *Materials World Modules*, which provides a curriculum and hands-on research experiences for middle and high school teachers and students in materials science and technology. The third is the *ASSURE (Awards to Stimulate and Support Undergraduate Research Ex*periences) program, which is administered through NSF's *Research*

[40] Memorandum from Deputy Secretary of Defense regarding "Action Agenda for Civilian Equal Employment Opportunity Progress in the Department of Defense," May 10, 1995.
[41] Public Law 85-934, September 6, 1958 and as amended by Public Law 93-608, January 2, 1975.

Experiences for Undergraduates (REU) program. Finally, the fourth is DOD's *Infrastructure Support Program for Historically Black Colleges and Universities and Minority Institutions* (ISP HBCU/MI). This latter program was established by the Defense Authorization Act of 1991.[42] It provides for principal investigator awards, research and technology capacity enhancements, science and engineering student scholarships and fellowships, and establishes partnerships between defense laboratories and HBCU/MI.

- The individual armed services also provide their own education and employment training programs in STEM fields. For example, the Department of the Army provides financial support to Historically Black Colleges and Universities and other minority-serving institutions to create *Army Centers of Excellence* on campuses designed to enhance long-term critical research as well as basic research.[43] The Department of the Navy provides scholarship funds for engineering students at minority-serving institutions.[44]

- The Department of Air Force, however, was the only armed services branch that agreed to participate in discussions about its broadening participation/diversity outreach and research experience programs, which included the following:

  STARBASE—program for at-risk K-12 students, designed to improve science knowledge of minority and other youth.

  K-12 Outreach—program of extensive outreach events for minority and other youth.

  Science and Humanities Symposium—for minority undergraduates.

  HBCU-MI—program for undergraduate and graduate students.

  Directorate of Safe Energy Vehicles—program for undergraduate and graduate students.

Best Practices

- Assigning senior researchers as mentors to students who are fully engaged in reviewing student work products and participation.

- Conducting interactive open house presentations and tours of the Air Force Research Laboratory (AFRL).

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[42] Public Law 101-510, Section 832, 1991.
[43] Connie Reeves, *Department of the Army Historical Summary: Fiscal Year 1996,* Center of Military History, U.S. Army. Washington, DC, 1997, page 138.
[44] Naval Sea Systems Command Office, March 28, 2007.

- Providing incentive credits to researchers to work with students.

Lessons Learned

- Senior management level commitment to broadening participation is a must.
- Recruitment of minorities without relationship-building is not effective.

Financial Investments in Broadening Participation

- Funding information was not available for all of DOD's department-wide broadening participation programs. Only the following program budgets were obtained.

  FY 2005: $70 million (Air Force programs only)
  FY 2006: $70 million (Air Force programs only)
  FY 2007: $99.6 million (*SMART* and *ISP-BCUMI* department-wide plus Air Force programs)

Assessment of DOD's Broadening Participation Programs

- DOD's department-wide science outreach and education programs are evaluated internally on an annual basis by a review panel. The Air Force's program is also evaluated by internal staff.
- The agency representatives noted that tracking students after their involvement in the programs is particularly problematic

Evaluation Approaches and Metrics

- The research methods that are typically employed in evaluating the department-wide and Air Force programs are program exit surveys, pre- and post-program student tests, and descriptive profiles of participants.
- The metrics used for assessing K-12 programs include the number of requests received for assistance from schools and other organizations, number of students and their demographics, and number of volunteers participating in the K-12 program activities. For the undergraduate programs, the metrics are the number of students involved in the programs, the number of student and institutional awards and funding, and number of student research publications and presentations. For graduate students and post-docs, the metrics include amount of financial support provided, number of grant awards and funding, number of new hires, and number of research publications and presentations. Finally, the metrics used for assessing outreach activities are number of requests received for student and teacher events, and number of participants in outreach events and demographics.

Management of Broadening Participation Efforts

- DOD has a department-wide overview board that monitors and reviews the goals and activities of program initiatives, but there is no overview function specific to diversity and broadening participation initiatives.

- Broadening participation programs within the individual armed services are managed by the leadership of the services.

Inter-Agency Collaborations

- DOD and NSF jointly administer the *ASSURE* program.

Recommendations from Mrs. Kent

- DOD is very interested in further collaborating with NSF and the other federal agencies involved in science and engineering to help broaden participation of underrepresented groups in STEM.

- DOD and NSF should jointly fund outreach initiatives aimed at women, underrepresented minorities, and persons with disabilities.

- DOD, in collaboration with other agencies, should fund a *SMART* program targeted to underrepresented minorities or minority-serving institutions.

National Oceanic and Atmospheric Administration

Department of Commerce

Agency Participant in the Conversation

Ms. Jacqueline Rousseau, Director of the Educational Partnership Program

Agency Background in Broadening Participation

- The National Oceanic and Atmospheric Administration's (NOAA) involvement in broadening participation dates back to 1972 with programs such as the *Student Career Experience Program* (SCEP), which focused on recruiting women and minority undergraduate and graduate students into the sciences and providing them with advanced training in NOAA sciences and employment opportunities related to their academic or career goals. Successful participants who completed the program were then accepted into the agency's STEM workforce. A number of initiatives to broaden participation were subsequently undertaken by the individual units within NOAA, such as the National Weather Service, National Ocean Service, or Office of Marine and Aviation Operations.

- The agency has not functioned under any Congressional mandates. As with most federal agencies, however, NOAA is required to comply with the Executive Orders that mandate program opportunities be made available to Historically Black Colleges and Universities, Tribal Colleges and Universities, and Hispanic-Serving Institutions.[45]

Priority Status of Broadening Participation within NOAA

- NOAA's top leadership is committed to increasing educational and career opportunities in STEM for underrepresented groups, as articulated in the agency's strategic plan: "*We must continue our commitment to valuing NOAA's diverse workforce, including effective workforce planning strategies designed to attract, retain and develop competencies at all levels of our workforce.*"[46]

- NOAA has a diversity plan, which focuses on providing recruitment and employee development opportunities for all employees. All NOAA line offices are required to have a diversity plan.

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[45] For example, Executive Order #13256 for HBCUs, February 12, 1992; Executive Order #12900 for HSIs, February 2, 1994; and Executive Order #13021 for TCUs, October 19, 1998.

[46] "New Priorities for the 21st Century –NOAA's Strategic Plan Updated for FY 2006-FY2011," April 2005, page 12.

Policies and Procedures

- Ms. Rousseau said that NOAA does not have an agency-wide policy specifically for broadening participation for individuals underrepresented in NOAA mission sciences and STEM in general, but does have a Workforce Management Program (WMP) that facilitates the recruitment, development, and retention of a diverse workforce. WMP "... *develops, recommends and implements NOAA-wide policy for managing diversity to ensure inclusion and supportive and flexible systems, policies, practices and workplace behaviors.*"[47] Furthermore, according to Ms. Rousseau, NOAA emphasizes the importance of having a diverse STEM workforce in a majority of its grant announcements.

Broadening Participation Programs

- Established in 2001, NOAA's *Educational Partnership Program with Minority-Serving Institutions* (EPP-MSI) is the agency's major broadening participation program. The EPP-MSI provides financial assistance to minority-serving academic institutions to support collaborative research and training of students in NOAA-related sciences through competitive processes. The program's goal is to increase the number of students who successfully complete their education and graduate in these sciences. Financial grants are provided for: (1) *Cooperative Science Centers*, which advance collaborative research with MSIs in NOAA-mission related sciences; (2) *Environmental Entrepreneurship Program*, which provides funding to MSIs on a competitive basis to engage students in pursuing advance academic study and entrepreneurial opportunities; (3) *Graduate Sciences Program*, which provides support for graduate students pursuing degrees in STEM areas, entry-level employment and hands-on research experience at NOAA; and (4) *Undergraduate Scholarship Program*, which offers support to increase the number of college juniors and seniors to study and matriculate in NOAA-related disciplines.

- NOAA does not have broadening participation education programs that specifically focused on women or persons with disabilities. The agency's Equal Employment Opportunity Office does provide information for educational assistance and assistive technologies for employees with disabilities.

- NOAA's outreach programs include, but are not limited to, speaking engagements on the campuses of minority-serving institutions, participation in national association meetings such as SACNAS and AISES, and a bi-annual conference held in partnership with a minority-serving institution. An example is the 4th NOAA Educational Partnership Program's Education and Science Forum, "Science Stewardship." The forum features speakers on various NOAA-related topics that are designed to stimulate the interest of students in oceanic,

[47] Program Charter for Workforce Management, November 29, 2005, page 1.

atmospheric and environmental sciences and remote sensing technologies. It also exhibits technological innovations and provides students opportunities to discuss research and career opportunities, and provides opportunities for students to interact with practitioners from the earth and space science fields.

Best Practices

- Collaborations between NOAA and academic institutions have proven to be highly effective in recruiting and educating students in the STEM fields.

- Involvement of NOAA staff in research collaborations with colleges and universities has also been an effective strategy in broadening participation.

Lessons Learned

- Agency leadership commitment to broadening participation is tantamount to program funding and success.

Financial investments in Broadening Participation

- Over the last three fiscal periods, NOAA invested the following amounts in its broadening participation programs:

  FY 2005: $17,000,000
  FY 2006: $14,200,000
  FY 2007: $14,200,000

Assessment of NOAA's Broadening Participation Programs

- The Educational Partnership programs are evaluated by both internal and eternal sources.

- NOAA has been able to successfully track students who participate in and graduate from its educational and training programs. Ms. Rousseau said that someone to manage the student data tracker system helps in having current data that NOAA uses to validate the success of the program.

- Ms. Rousseau also noted several challenges that have emerged from implementing and evaluating the Educational Partnership Program. These include the following: making NOAA scientists more receptive to mentoring; hiring students from minority-serving institutions; addressing the perception that MSI students are not interested in or academically prepared for pursuing research in the earth sciences; and attracting high school students to the earth sciences.

Evaluation Approaches and Metrics

- The agency uses non-experimental methods to evaluate its programs, such as exit surveys and post-program follow-up studies to ascertain whether students earn a STEM degree or enter the STEM workforce.

- The metrics used in the program assessments include the number and demographics of the student participants, and the number of students who earn STEM degrees.

Management of Broadening Participation Efforts

- As the Director of the Educational Partnership Program, Ms. Rousseau manages the diversity initiatives and programs within EPP. She reports directly to the Director of NOAA Education, who is located within the Office of the Undersecretary for Oceans and Atmosphere at the Department of Commerce.

- In addition, the broadening participation efforts of the agency are monitored by an Education Council.

Inter-Agency Collaborations

- NOAA participates in the recently formed Minority-Serving Institutions Community of Partners Council(MSI-COPC), which, as previously mentioned, is an inter-federal body dedicated to broadening participation opportunities for traditionally underrepresented groups. The Council is composed of representatives from many federal agencies, including NSF, NOAA, DOD, DOE, SBA, EPA, DHS, HUD, NASA, Treasury, ED, USDA, STATE, USAID, NRC, DOL, VA, SSA, and DOJ. Enhancing the capacity and quality of minority-serving institutions is the Council's primary goal.

- NOAA also collaborates with NSF, USGS, DOD, and other agencies in support of STEM related projects involving diversity.

Recommendations from Ms. Rousseau

- NOAA is very interested in collaborating with NSF and the other agencies, if the collaboration will benefit NOAA's mission. Ms. Rousseau felt that this would be true for all of the agencies.

- The different agencies need to understand that we do have common goals, despite our individual missions in STEM.

- Each agency has to make a long term financial commitment to broadening STEM participation.

- The agencies should consider forming an inter-agency internship program, which would allow for inter-disciplinary experiences. Such a collaboration would also provide greater resources for the internship program than can be provided by a single agency.

- An inter-agency mechanism should exist for sharing résumés from talented individuals in STEM who are seeking internship opportunities and employment.

- NSF should take the lead in partnering with the other agencies in areas of common interest to all parties involved.

National Institute of Standards and Technology

Department of Commerce

Agency Participants in the Conversation

Ms. Mirta-Marie M. Keys, Director of the NIST Civil Rights and Diversity Office Mr. Essex Brown, Chief of Client Services, Human Resources Management Division Ms. Any Cubert, Human Resource Specialist, Dr. Claire Saundry, Director of Office of International and Academic Affairs, Ms. Cynthia Snipes, Equal Employment Opportunity Program Manager, and Mr. David Glines, Human Resource Specialist
NIST Laboratory staff: Dr. Willie E. May, Director, Chemical Science and Technology Laboratory; Linda D. Decker, Product Specialist, Measurement Services Division; Dr. Albert Wavering, Deputy Director, Manufacturing Engineering Laboratory; Dr. James St. Pierre, Deputy Director, Information Technology Laboratory; Dr. James K. Olthoff, Deputy Director, Electronics and Electrical Engineering Laboratory; Dr. Theodore Vorburger, Acting Deputy Director, Center for Nanoscale Science and Technology; Jeremy E. Lawson, EEO Specialist, Physics Laboratory; and Dr. Daniel Neumann, Director, NIST Center for Neutron Research

Agency Background in Broadening Participation

- The Institute's history with broadening participation began in 1978 with an initiative to recruit minority-serving institutions to participate in NIST-supported STEM education programs. In response to Executive Orders to increase the participation of minority-serving institutions, NIST also launched efforts to engage Historically Black Colleges and Universities and other minority-serving institutions in NIST mission areas during 1980s.[48] With subsequent cuts in agency funds and changes in staffing levels, however, agency-wide emphasis on broadening participation declined. According to Ms. Keys, individual employee efforts were able to sustain some isolated diversity outreach and recruitment activities. Only recently has the agency been able to fund more activities in broadening participation.

- When the civil rights and diversity functions of NIST were combined into a single office in 2005, a renewed focus emerged on broadening educational and career opportunities for underrepresented groups.

[48] For example, Executive Order #13256 for HBCUs, February 12, 1992; Executive Order #12900 for HSIs, February 2, 1994; and Executive Order #13021 for TCUs, October 19, 1998.

- NIST defines diversity in a broad sense that refers to many variables including race, religion, color, gender, national origin, disability, sexual orientation, age, education, geographic origin, and skill characteristics as well as disciplines and perspectives.[49]

Priority Status of Broadening Participation within NIST

- NIST's Director is committed to achieving diversity within the Institute's STEM workforce, as reflected in the following statement: *"NIST senior management is committed to taking substantial action to achieve pre-eminent performance through diversity."*[50]

- Diversity in STEM is not a major highlight in the Department of Commerce's strategic plan,[51] but it is within the Institute's strategic plan.[52] The latter addresses partnerships with minority-serving institutions as one way of creating a pipeline for developing a diverse STEM workforce at NIST; the need for outreach to K—12 schools; and internships to provide underrepresented groups with hands-on experience in the sciences and technologies.

Policies and Procedures

- The Institute has an explicit policy regarding diversity, as stated by the Director:"*NIST will strive continually to establish and maintain a workforce that reflects America's diverse populace and promotes an environment that respects and values individual difference. NIST recognizes that the ability to attract, develop, and retain a skilled workforce is key to the Institute's continued success and must be viewed and treated as a top priority."*[53]

- Ms. Keys indicated that NIST is currently updating its human capital plan, which includes an action plan for recruiting minorities into the NIST workforce. She further said that the perspective and mindset of individuals responsible for carrying out recruitment and hiring activities are at times a challenge, and that the recruiters must become more aware of the potential talent among the underrepresented groups and the issues that confront them in accessing educational and employment opportunities.

- The Institute does not have criteria related to broadening participation within its grant-giving guidance.

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[49] NIST Diversity Strategic Plan, page 1.
[50] Ibid.
[51] Department of Commerce Strategic Plan for FY 2004-2009.
[52] See Footnote 49.
[53] Memorandum to staff from the Director, Dr. William Jeffrey, regarding NIST EEO and Diversity Policy Statement, August 11, 2006.

Broadening Participation Programs

- NIST's endeavors are focused on (1) improving students' science, engineering, mathematics, and technology skills; (2) strengthening the links between the agency and colleges/universities; (3) expanding science, engineering, and technology programs at undergraduate and graduate institutions; (4) promoting continuing education; and (5) increasing the pipeline of future STEM employees.[54]

- The Institute's portfolio of agency-wide educational and outreach programs include the following:

  Student Temporary Employment Program (STEP) and the *Student Career Experience Program* (SCEP)—for high school, undergraduate and graduate students at NIST.

  Professional Research Experience Program (PREP)—laboratory experience for undergraduate, graduate and post-graduate students.

  Summer Undergraduate Research Fellowship Program (SURF)—a collaborative effort involving NIST and NSF.

- For the summer of 2007, NIST designed and implemented a program that will bring middle school teachers to the agency to participate in an agency sponsored educational training academy that will focus on training students in the sciences. Additionally, steps are being taken to revitalize the NIST *High School Volunteer Program* which will expose local high school students to the agency's science and business environments while receiving academic credit and/or work experience.

- Ms. Keys noted that major challenges exist in trying to make minority-serving institutions more aware of educational and employment opportunities at NIST and to attract students into the STEM pipeline. Another major challenge is limited agency funds to support broadening participation programs.

- Ms. Keys also said that there is a challenge in trying to convince the Institute's laboratories to adopt broadening participation programs. She noted that this requires a re-education of mind-sets of the scientists who do not always see the value in cultivating the untapped talent from underrepresented groups.

[54] National Institute of Standards and Technology FY 2006 MD-715 EEO Program Status Report, December 2006, page 13.

Broadening participation and diversity programs located at NIST's laboratories and centers include the following:

Chemical Science and Technology Laboratory
*Minority-serving Institution Conferences (*minorities*)*

Materials Science Development Technology
*Exhibits at NOBCChE Annual Conferences (*African Americans*)*

Manufacturing Engineering Laboratory
*Summer Undergraduate Research Fellowship (*women and minorities*)*

Information Technology Laboratory
*Summer Undergraduate Research Fellowships (*women and minorities*)*

Electronic and Electrical Engineering Laboratory
*Summer Undergraduate Research Fellowship (*women and minorities*)*

Center for Nanoscale Science and Technology
*University of Maryland Coop Program (*all groups*)*

Physics Laboratory
*Summer Undergraduate Research Fellowship (*women and minorities*)*
Post-doc Joint Program NRC

NIST Center for Neutron Research
*Summer Undergraduate Research Fellowship (*women and minorities*)*

Best Practices

- Providing educational opportunity information to all ages and education levels increases the span of outreach.
- The web site for the SURF program is very effective in attracting students.
- Bench-level staff support of and interest in the students helps a lot.
- Providing post-doc and student employment opportunities helps to prepare them for the workforce.
- Close relations with participating educational institutions works well.
- Having an active and engaging Laboratory Diversity Committee facilitates overall diversity efforts.
- Extensive funding for SURF program provides adequate support for summer student housing and employment.
- The University of Maryland Coop program adds significant flexibility to bring on-board people with diverse backgrounds.

- We maintain an up-to-date website describing CNST activities which serves as a portal by which young researchers can become interested in our activities and seek employment at the center.
- The efforts of lab staff to increase the diversity of our user community has helped to increase our ability to reach a broader group of students and professors outside of the neutron scattering user group.
- Presentations made by our staff at universities helps to enhance our outreach efforts.
- Staff commitment to improving science instruction at middle and high schools is an asset.

Lessons Learned

- People of all ages are interested in what NIST does and how NIST can help them in their studies and career advancement.
- It can be hard to connect with the right people to get the word out about our programs.
- It is important to keep communications on a personal level; mass mailing and e-mails can only pique interests.
- It can be difficult to attract the highest performing students due to competitors who offer higher salaries.
- It is important to have the involvement and awareness of all staff regarding diversity programs.
- The inclusion of many students in our research programs benefits our researchers and provides incentives for the students to pursue technical careers.
- Support and commitment from management is essential for our diversity programs.

Financial Investments in Broadening Participation

- The funding levels for NIST's broadening participation programs for the last three fiscal periods are as follows:

FY 2005:	$ 563,931
FY 2006:	$2,042,234
FY 2007:	$2,129,051

Assessment of NIST Broadening Participation Programs

- NIST's diversity programs are evaluated internally, using specific outcome metrics. The agency also uses the Office of Personnel Management survey and an agency generated survey for employees. Moreover, grantees are required to evaluate the progress and outcome of their projects.

Evaluation Approaches and Metrics

- NIST typically employs program exit interviews, follow-up studies, and participant profiles to assess their diversity programs.
- The metrics used in the evaluations are number and description of program participants, relationships between NIST laboratories and local colleges, requests of on-line NIST information, requests for SURF brochures, and number of hires from SURF program.

Management of Broadening Participation Efforts

- The NIST Director charged the Civil Rights and Diversity Office with broadened responsibility for defining, clarifying, identifying, and taking an active role in the promotion of diversity activities and opportunities at NIST.[55] Ms. Keys reports directly to the Director.

- The Institute has established a linkage between employee performance and achieving the agency's diversity goals. Ms. Keys indicated, however, that the goals and metrics need to be refined. At the time this report was being prepared a process was underway to establish clearer measurable standards and enhance existing measurement to more clearly assess progress.

- The Civil Rights and Diversity Office in conjunction with the NIST Office of Human Resources Management, provides diversity training for managers in outreach and recruitment approaches for minority-serving institutions and minority-serving programs within majority institutions.

Inter-Agency Collaborations

- As noted earlier, NIST and NSF are presently collaborating on the *Summer Undergraduate Research Fellowship Program* (SURF).

- NIST and the Montgomery County Public School System in Maryland have agreed to work in partnership to motivate and better prepare students in science and mathematics so they can pursue careers in the STEM professions.[56]

Recommendations from Ms. Keys and Staff

- NIST is willing to collaborate with NSF and other federal agencies to increase diversity within the STEM pipeline and workforce. Collaborations can work and provide increased energy for broadening participation of underrepresented groups in STEM.

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[55] Ibid, page 11.
[56] www.nist.gov, News Release, April 19, 2007.

- STEM agencies should consider sharing program resources to expand opportunities for underrepresented groups in STEM.
- Research experiences for students at various agencies should be coordinated.
- STEM agencies should exchange information on best practices.
- Agency commitment to broadening participation can be measured by how much money each agency brings to the collaboration table.
- NIST would welcome opportunities to gather information from CEOSE and to attend its meetings to learn more about its experiences.
- Résumés of STEM talent submitted to the individual agencies, which may not have job vacancies at a given time, should be shared with other STEM agencies, as a means of broadening employment opportunities for graduating or graduated STEM students.
- The nature of collaborations should be kept as informal as possible, since formal arrangements can sometimes lead to logistical complexities and barriers.
- There is a level of competitiveness among the STEM agencies for funding, and this issue needs to be recognized.
- NSF should set the tone for the collaborations, with ground rules and explicit expectations.

U.S. Department of Agriculture

Agency Participants in the Conversation

Dr. George E. Cooper, Deputy Administrator of Science and Education Resources Development, Cooperative State Research, Education and Extension Service (CSREES)
Dr. Jeffrey L. Gilmore, Director of Higher Education Programs.

Agency Background in Broadening Participation

- USDA's history with broadening participation in STEM began with the passage of the Morrill Act of 1890, which provided African Americans access to higher education at land-grant institutions.[57] This led to the creation of 18 Historically Black Colleges and Universities land-grant institutions. The Morrill Act was first enacted in 1862 to provide lower socioeconomic Americans with access to higher education in schools of agricultural science and the mechanical arts. Because of segregationist policies of the southern states where most of the land-grant institutions were located, African Americans were denied the educational opportunities offered by the Morrill Act. In addition to providing more funds for the land-grant schools, the second Morrill Act (1890) redressed the issue of racial discrimination by prohibiting racially discriminatory land-grant institutions from receiving added funding. The USDA was given responsibility to administer funding for the land-grant institutions. Although increased funds were appropriated for the land-grant schools, development of the land-grant HBCUs was slowed due to insufficient funding until the late 1960s.

- According to Dr. Cooper, the USDA in 1968 provided a $287,000 grant to the land-grant HBCUs to enhance their research and facility capacity in agriculture and food science. Following this in 1988, USDA launched the *USDA/1890 Initiative* in the Office of Agricultural Research Service. Designed to encourage partnerships between USDA and the 1890 schools, this initiative aimed to improve outreach to students, and the capacity of these institutions to teach and conduct research.[58] Since then, USDA has continued to provide other program opportunities to HBCUs. Furthermore, under Executive Orders, USDA has also provided support for research and capacity-building to Tribal Colleges and Universities, Alaskan Native and Native Hawaiian institutions, and Hispanic-Serving Institutions.[59]

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[57] Act of August 3, 1890, ch. 841, 26 Stat. 417, 7 U.S.C. 322, et seq.
[58] Sandy Miller Hays ARS Helps Science Flourish at 1890 Schools. *Agricultural Research*, February 1993.
[59] For example, Executive Order #13256 for HBCUs, February 12, 1992; Executive Order #12900 for HSIs, February 2, 1994; and Executive Order #13021 for TCUs, October 19, 1998.

Priority Status of Broadening Participation within USDA

- Dr. Cooper noted that USDA's top leadership is committed to broadening participation. For instance, the FY 2008 CSREES budget proposal states that, among other things, "[*the agency will*] e*xpand diversity and opportunity through support to minority-serving and insular area institutions, and improve outreach to underserved communities.*" [60]

- Diversity is highlighted in the agency's Human Capital Strategic Plan, which states: *"The Plan commits USDA to...support a workplace that values diversity and promotes increased diversity through targeted outreach and hiring programs"* [61]

Policies and Procedures

- USDA's merit review criteria for grant proposals address diversity, but not specifically with regard to the agency's research programs. Dr. Gilmore noted that efforts are made to ensure that the peer review panels are composed of diverse individuals recruited from the faculty of minority-serving institutions.

- The 1977 National Agricultural Research Extension and Teaching Policy Act established the Cooperative State Research, Education, and Extension Service, which administers broadening participation programs.[62]

Broadening Participation Programs

- Several CSREES programs offer opportunities for minority-serving and insular area institutions to reach and encourage participation in the food and agricultural sciences by African Americans, Hispanics, American Indians, Alaska-Natives, Native Hawaiians, and Asians. Within CSREES, the Science and Education Resources Development (SERD) unit offers an array of education enhancement, institution capacity-building, and research partnership programs, examples of which include the following:

  1890 Evans-Allen Program—supports agricultural research at 1890 land-grant institutions.

  1890 Teaching and Research Capacity-building Grants—intended to strengthen teaching and research programs in the food and agricultural sciences by enhancing institutional capacity at 1890 land-grant institutions.

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[60] FY 2008 President's Budget Proposal. Advancing Knowledge for the Food and Agricultural System. Overview, February 2007.
[61] United States Department of Agriculture Strategic Human Capital Plan, December 2006, page 7.
[62] Public Law 95-113, September 29, 1977.

Tribal Colleges Research Grants—designed to promote and strengthen higher education institutions in food and agricultural sciences at Tribal Colleges designated as 1994 land-grant institutions.

Hispanic-Serving Institutions Education Grants—offers competitive grants to promote and enhance the food and agricultural research capacity of HSIs.

Higher Education Multicultural Scholars Program—offers competitive undergraduate scholarship grants to increase the multicultural diversity of the food and agricultural scientific and professional workforce.

- Dr. Copper and Dr. Gilmore said that attracting minorities into the agricultural and foods sciences remains a challenge. Increased and creative efforts in outreach are required and are currently being addressed by CSREES.

Best Practices

- Working closely with minority-serving institutions and relating to them as research partners has proven to be an effective in enhancing institutional capacity.

- Encouraging multiple HBCUs to work together benefits all involved and expands research capacity of the participant institutions

Lessons Learned

- Despite the agency's historical focus on minority-serving institutions, a high level of current outreach efforts is still necessary.

Financial Investments in Broadening Participation

- Since 1994, CSREES has provided approximately $1 billion in funds to 1890 land-grant institutions.[63] Among the targeted activities included in the CSREES FY 2007 budget are expanding agriculture and science literacy and capacity at minority-serving institutions; focusing on current and future workforce needs; and increasing diversity among agricultural professionals.[64]

[63] Partners-1890 Land Grants. CSREES DVD, Partners No. 13.
[64] Administrator's Report to the Partnership, November 2006, page 4.

- Total funds budgeted for CSREES programs targeted to minority-serving institutions for the last three fiscal years are as follows:[65]

  FY 2005: $134.5 million
  FY 2006: $136.6 million
  FY 2007: $146.9 million (projected)

Assessment of USDA Broadening Participation Programs

- According to Drs. Cooper and Gilmore, all of USDA's broadening participation programs are reviewed through the agency's PART process. Programs within the higher education portfolio are evaluated internally and by external evaluators.

- Grantees are required to provide impact statements for their project activities, using specific metrics. CSREES funding to 1890 Land-Grant institutions, for instance, has produced significant breakthroughs and research for applied use in forestry (Alabama A&M University), production of bait-fish (University of Arkansas at Pine Bluffs), aqua-culture (North Carolina A&T State University), food science and disease prevention (North Carolina State University), and farming innovations, involving use of advanced technologies (Tuskegee), and collaborations with NASA and other federal agencies.

Evaluation Approaches and Metrics

- The agency utilizes program exit surveys and follow-up studies to assess their broadening participation programs. Number and description of program participants are the primary metrics employed. Additionally, projects are required to report on their impacts.

Management of Broadening Participation Efforts

- Activities of SERD are monitored and managed by Dr. Cooper, who reports to the Administrator of CSREES who, in turn, reports to the USDA Under-Secretary of Research, Education and Economics.

- There is a mandated link, as articulated in the agency's human capital plan, between achieving agency goals (including broadening participation) and job performance. This link serves as an incentive to boost staff performance in increasing opportunities in STEM for underrepresented and underserved groups.

[65] CSREES Research and Education Activities Appropriation History (for FYs 2005 and 2006); CSREES Research and Education Activities (for FY 2007). Specific programs included in the sums above were highlighted by Dr. Cooper.

- Accountability for the agency's broadening participation programs is achieved through external review bodies, including for example, the 1890 Task Force for HBCUs, USDA HACU Leadership Group, and the Tribal College Council.

Inter-Agency Collaborations

- USDA partners with other federal agencies on research projects based at 1890 land-grant institutions. One example is the collaboration between CSREES and NASA at the Alabama A&M University project on using remote sensing to monitor and measure water quality.

Recommendations from Drs. Cooper and Gilmore

- USDA's CSREES is interested in collaborating with NSF to further broadening participation efforts across federal agencies. The benefits that will be mutually derived from such collaborations need to be made clear.

- Some types of inter-agency programs can be problematic, due to differing agency authorities, priorities, needs and bureaucratic routines. An inter-agency funding initiative is one example. Inter-agency exchange of information and dialogue about broadening participation are more easily implemented and sustained.

- Grantees should be consulted about the kinds of inter-agency collaborations they believe would be most useful.

- STEM-related agencies should collaborate in developing evaluation metrics to assess STEM education programs, as recommended by the Academic Competitiveness Council.

- Agencies need to establish an agreement on common ground rules and expectations from collaborating with one another, e.g. in a memorandum of understanding or a memorandum of agreement.

- For inter-agency collaborations to work and produce worthwhile products, they will require a commitment of time and resources on the part of the individual agencies.

National Institutes of Health

Department of Health and Human Services

Agency Participants in the Conversation

Mrs. Joyce Rudick, Director of Programs and Management in NIH's Office of Research on Women's Health (ORWH).
Dr. Jennifer Reineke Pohlhaus, AAAS Science and Technology Policy Fellow, ORWH
Dr. Vivian Pinn, Director of the Office of Research on Women's Health,
Ms. Hilda B. Dixon, Deputy Director, Office of Equal Opportunity and Diversity Management (OEODM)
Dr. Ruth L. Kirschstein, Senior Advisor to Director of NIH
Dr. John Ruffin, National Center on Minority Health and Health Disparities (NCMHHD)
Dr. Walter T. Schaffer, Senior Scientific Advisor for Extramural Research, who coordinated and compiled the requested data from NIH's 27 institutes and centers.

Agency Background in Broadening Participation

- NIH's history with broadening participation began in the 1960s with Dr. Geraldine Woods, the first African American woman to earn a Ph.D. in biomedical science. She was invited to join NIH's National Advisory for General Medical Sciences, and then worked as a consultant to the National Institute of General Medical Sciences. Following this, she worked diligently to establish the exemplary *Minority Schools Biomedical Support* (MSBS) and the *Minority Access to Research Careers* (MARC) programs in the late 1960s.[66]

- The Office Research on Women's Health was established in 1990. The ORWH serves as a focal point for women's health research funded by the NIH, advises the NIH Director and staff on matters related to women's health research, ensures that women are represented in biomedical and biobehavioral research studies supported by the NIH, and develops opportunities for women to enter into careers in the biomedical and biobehavioral sciences and research.

- In 1990, NIH established the Office of Research on Minority Health (ORMH), which provided training for minority faculty and students at the pre-college, undergraduate, graduate, and post-doctoral levels.

- The Minority Health and Health Disparities Research Act of 2000 established the NIH National Center on Minority Health and Health Disparities. The Center's purpose is to support research on minority health and training of minority students and faculty in the biomedical sciences.[67]

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[66] Important Events in MARC and MSBS History.
http://publications.nigms.nih.gov/mpu/ summer02/history.html
[67] Public Law 106-2, November 22, 2000.

- Since the 1990s, NIH has expanded and supported educational and workforce programs to increase access of women, men, minorities, and persons with disabilities to the biomedical and behavioral science professions.

- NIH's Revitalization Act of 1993 codified that women and minorities must be included as subjects in all NIH-funded research and clinical trials. The agency's grant guideline policy regarding the inclusion of women and minorities in NIH-funded projects was updated in August 2001 (revising forms and applications), and amended in October 2001 (incorporating the definition of clinical research as reported in the 1997 Report of the NIH Director's Panel on Clinical Research).

Priority Status of Broadening Participation within NIH

- According to Mrs. Rudick, NIH's Director, Dr. Zerhouni, and Deputy Director, Dr. Kington, are very supportive of diversity. For instance, the NIH Director asked each Institute/Center to develop a strategic plan that includes how minorities are to be included in the Institute's or Center's research, training and outreach activities directed at reducing health disparities; and that addresses initiatives to strengthen and diversify the pool of qualified health and behavioral scientists.

- The NIH Director has, moreover, expressed his commitment to women in science: *"It is critical to address the barriers that women face in hiring and promotion at research universities in many fields of science,"* said Dr. Zerhouni in response to the National Academies report on women in science, *Beyond Bias and Barriers, Fulfilling the Potential of Women in Academic Science and Engineering.* He also created a workgroup to review and recommend needed changes for women scientists employed in or supported by NIH.[68]

- There is no explicit mention of broadening participation of women, underrepresented minorities and persons with disabilities in biomedicine within the current DHHS strategic plan. Broadening participation is addressed in the strategic plans of the individual institutes of NIH, for example, in regard to health disparities and the need to support training and education of minority students and researchers in biomedicine.

- Mrs. Rudick presented information on the Coordinating Committee on Research on Women's Health Roster, which includes a broad participation of women in health-related issues from each NIH institute and center.

Policies and Procedures

- NIH's research funding guidelines require that women and minorities must be included as subjects in all proposed research projects. NIH proposal guidelines

[68] NIH News, January 29, 2007.

also provide guidance on outreach strategies for recruiting underrepresented groups into biomedical and behavioral science research.

- A policy statement on equal employment recently re-issued by the Director of NIH states, "*...the MD-715 process is designed to identify and eliminate barriers to the full participation of minorities, women, and individuals with disabilities within the [NIH] workplace.*"[69]

- In some NIH program announcements, the 1993 NIH Revitalization Act is cited as the basis for programs that focus on broadening participation, e.g., the *Initiative for Maximizing Student Diversity* program.

Broadening Participation Programs

- NIH has an extensive portfolio of agency-wide broadening participation programs. In addition, the individual institutes and centers of NIH offer other diversity-related programs. To follow are examples of major agency-wide or trans-Institute programs.

  ORWH/NIH Supplements to Promote Re-entry into Biomedical and Behavioral Careers program—provides support to women and men who are trained scientists to re-enter active research careers, after leaving for domestic or other reasons.

  Research Supplement Program for Underrepresented Minorities—designed to increase the number of underrepresented minority scientists participating in biomedical research and related health sciences. NIH also offers this program for persons with disabilities and socially disadvantaged persons.

  Minority Access to Research Career Program—provides training grants at the pre-doctoral and post-doctoral levels to underrepresented minority students, and is designed to increase the number and capability of minority scientists in biomedicine.

  Initiative for Maximizing Student Development—enhances academic and research competitiveness of underrepresented minority students and their progress in becoming biomedical researchers.

[69] Memorandum from the Director of NIH, March 21, 2006.

The Ruth L. Kirschstein National Research Service Awards—program that seeks to improve the diversity of the health-related research workforce by supporting training of pre-doctoral underrepresented students.

MARC Faculty Fellowships—program to support faculty members from minority-serving institutions to advance their training in health and health-related areas.

Research Enhancement Awards—program to support individual investigator-initiated research projects aimed at developing researchers from minority-serving institutions.

Minority Biomedical Research Support—program to strengthen the biomedical research and research building capacity of ethnic minority institutions.

Research and Student Resources Health Disparities Endowment Grant—program to increase investment in student-centered programs to improve academic success of underrepresented minorities and socio-economically disadvantaged individuals in the biomedical and behavioral sciences.

HBCU Research Scientist Award—program to assist HBCUs in strengthening and augmenting their human resources by recruiting an established research scientist to enhance the careers of faculty.

Best Practices

- The *NCRR Research Centers in Minority Institutions* support infrastructure resources as determined by the needs of the institutions and the nature of the research to be undertaken. The program allows for collaborations with other institutions in the design and implementation of the research.

- The *NCRR Institutional Development Awards* program ensures effective communication between program and institutional staff and allows for the development of tailored programs with a high probability of success.

- The *NIGMS Minority Opportunities in Research* (MORE) program combines several agency diversity programs to support institutional transformation.

Lessons Learned

- The availability of professional as well as scientific mentors for young investigators is crucially important.

- While cooperative agreements are more labor-intense than regular grants, the former are useful because there is an understanding that the institutional partners have clear-cut goals and objectives for which they are held accountable.
- Investing in faculty development at institutions in regions that receive little or no NIH funding has proven effective in reaching underrepresented ethnic and racial minorities.
- Institution-wide support is critical for creating a diverse biomedical workforce.

Financial Investments in Broadening Participation

- The level of financial support provided by NIH for its diversity and broadening participation programs for the last three fiscal years is as follows:

FY 2005:	$235,754,371	
FY 2006:	$234,222,159	
FY 2007:	$142,050,809	*(Excludes unavailable amount for research supplements.)*

Assessment of NIH's Broadening Participation Programs

- Some of the agency's major programs have been evaluated by external sources. However, there is an inability to track program participants, since NIH's grant recipients are not required to disclose their gender, race/ethnicity, or disability status. This has limited the agency's ability to measure the impact of its broadening participation programs—a problem shared by NSF.
- Mrs. Rudick also noted some issues that present challenges to broadening participation efforts at NIH as well as other government agencies and organizations. These include: (1) ineffective mentoring for women and underrepresented minorities; (2) lack of adequate and sustained networking opportunities for women and minority students in biomedicine and behavioral sciences; and (3) unavailable or limited student loans for women, minorities and persons with disabilities.

Evaluation Approaches and Metrics

- NIH typically employs the following methodologies in evaluating its diversity and broadening participation programs: quasi-experimental studies, program exit interviews, and descriptive studies of program participants.
- The primary metrics used include: progress of research, investigator publications; faculty recruitment and retention; increased independent (non-NIH) support for research in minority-serving institutions; investigator participation on review panels and editorial boards; number of underrepresented students completing

Ph.D.s and going into biomedical careers; and patents acquired by investigators supported by NIH grants.

Management of Broadening Participation Efforts

- The NIH Director via senior staff meetings maintains oversight of programs focused on broadening participation. The newly established Office of Policy Analysis and Strategic Initiatives also oversees all trans-NIH programs, including those dealing with broadening participation. Additionally, the Extramural Policy and Management Committee exercises oversight of all NIH components, which includes reviewing broadening participation policies and programs.

Inter-Agency Collaborations

- NIH initially co-funded the *ADVANCE* program to promote women into leadership positions within research universities. *ADVANCE* is currently one of NFS's flagship programs.

- ORWH sponsors the development of educational curricula materials for women for the Health Resources and Services Administration of DHHS.

Recommendations from Mrs. Rudick

- Mrs. Rudick indicated that NIH could benefit from further collaborations with other agencies with a focus in the sciences and would be interested in working further with NSF in fostering diversity within the STEM pipeline and workforce.

- She also recommended that the federal agencies that participate in the CEOSE study should participate in more information-sharing and co-sponsoring of meetings and programs, and that they should collaborate more in broadening participation for women, underrepresented minorities, and persons with disabilities in federal programs and, hence, the workforce.

Department of Labor

Agency Participant in the Conversation

Mr. Greg Weltz, Director of Office of Youth Services, Office of Workforce Investment, of the Employment and Training Administration.

Agency Background in Broadening Participation

- DOL has a long history of providing employment opportunities for the socially and economically disadvantaged—most of whom are minorities. It began in the 1970s with the passage of the Comprehensive Employment and Training Act.[70]and the Work Investments Act.[71] According to Mr. Weltz, it has only been within recent years, however, that the DOL's Employment and Training Administration has begun to focus specifically on employment in STEM.

- Under the President's Freedom Initiative, DOL has provided a wide range of support to disabled persons, including assistive technologies and the expansion of educational opportunities to facilitate their entry into and retention in the general workforce.[72] But, these efforts have not been STEM-specific.

Priority Status of Broadening Participation within DOL

- While DOL's strategic plan and ETA's strategic plan focus on improving employee skills to meet labor market needs within a global and competitive economy,[73] neither plan focuses specifically on educational or career preparation of underrepresented groups for STEM. Increasing employment opportunities for women and persons with disabilities for high-growth industries (which would include STEM) is, however, noted as a priority in the DOL strategic plan.

Policies and Procedures

- According to Mr. Weltz, DOL does not have any policies or procedures that pertain specifically to increasing the representation of women, underrepresented minorities or persons with disabilities within STEM occupations.

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[70] Public Law 93-203, 1973.
[71] Public Law 105-220, 1998.
[72] New Freedom Initiative, February 1, 2001.
[73] U.S. Department of Labor Strategic Plan Fiscal Years 2006-2011; and Employment and Training Administration Strategic Plan FY 1998-FY 2002.

Broadening Participation Programs

- In November 2005, DOL launched *Workforce Innovation in Regional Economic Development (WIRED)*, a major funding program administered by ETA to support innovative approaches to workforce development within regional economic development areas. This program is designed to form partnerships among federal and state government agencies, industry, academic institutions, and the voluntary sector. It is part of an ongoing focus at the federal level on the United States' economic competitiveness in the areas of science and technology. The program stems in part from the National Innovation Initiative launched in 2003 by the Council on Competitiveness, and has been reinforced by warnings in reports such as the National Academies' 2005 report, *Rising Above the Gathering Storm.* Training and retraining of workers in the various STEM occupations is a prominent part of the grants supported by DOL. The program does not, however, target particular demographic groups.

- Since 2003, DOL has implemented the President's *High Growth Job Training Initiative*, which includes grants to community colleges to educate students in occupations that are in high demand. These occupational areas include biotechnology, aerospace, energy, geospatial technology, and information technology.[74] While the initiative does not specify demographic groups, a significant proportion of community college students are women and minorities.

- DOL does offer some STEM-specific education programs that are aimed at underrepresented groups. The *Girls' E-Mentoring in Science, Engineering, and Technology* (GEM-SET) is one example. Sponsored by DOL's Women's Bureau, this program is a multi-regional effort that provides group mentoring for girls aged 13-18 and connects women scientists and engineers with girls interested in pursuing an education in a STEM field.

- The Women's Bureau also offers the *Women in Science and Engineering Transitions* (WISE) program, which is designed to increase the number of young women in STEM education through innovative outreach initiatives.

- DOL does not currently offer STEM education or training programs targeted to underrepresented minorities. In 1995, the department did provide grants to HBCUs to develop employment training programs; but they were not specifically aimed at STEM areas.

- In the summer of 2007, through a Training and Employment Notice (TEN), the Employment and Training Administration issued a vision for the public workforce system's role in developing the talent needed for high growth industries that require science, technology, engineering, and math (STEM) skills.

[74] www.DOLeta.gov/brG/Job Training Initiative/#president

The TEN will encourage the public workforce system to focus on accessibility and broadening participation of STEM education and training opportunities for women, underrepresented minorities, individuals with disabilities, youth, and dislocated workers.

Best Practices and Lessons Learned

- Given fact that DOL does not have an extensive history of experience with broadening participation programs in the STEM areas, no best practices or lessons learned were reported that pertain to STEM education or employment programs.

Financial investments in Broadening Participation

- The amount of funds expended by DOL for the above women programs in FY 2005, 2006 and projected for 2007 were not available at the writing of this report. Funds for the *WIRED* and *High Growth Job Training* programs could not be disaggregated for specific underrepresented STEM groups; and using total funding amounts would overestimate the department's investments in broadening participation in these STEM-related programs.

Assessment of DOL Broadening Participation Programs

- According to Mr. Weltz, the *WIRED, High Growth Job Training* and the women-specific programs are all evaluated by grantees and by outside third-party evaluation consultants. On a department-wide basis, these programs are also reviewed within the context of DOL's major goals to (1) develop a prepared labor force and (2) meet the competitive labor demands of the worldwide economy.

Evaluation Approaches and Metrics

- The methods employed by DOL to assess their programs include program exit interviews and description studies of participants. The metrics employed include number and description of program participants.

Management of Broadening Participation Efforts

- The above programs are managed by the Directors of the Employment and Training Administration and the Women's Bureau who report to the Assistant Secretary on the activities and results of these programs.

Inter-Agency Collaborations

- Mr. Weltz indicated hat DOL's collaboration efforts are driven by employment demands of industry, and do not necessarily target individual underrepresented groups in STEM. For instance, DOL currently collaborates with other federal and

state government agencies, academic institutions and industry through the activities of the *WIRED* and *High Growth Job Training* initiatives, which cut across demographic groups. Also, DOL has collaborated in the past with NSF, ED, NASA, DOE and other STEM-related agencies, but not specifically related to broadening participation.

Recommendations from Mr. Weltz

- DOL/ETA is interested in working with NSF to broaden participation in STEM. However, Mr. Weltz noted that the partnership would have to be based on shared areas of interest that support talent-development strategies.

- Collaboration with NSF and the other STEM-related agencies could help add value to each agency's mission, and provide support for internships across agencies.

- There are some very logical opportunities in *WIRED* regions for supporting broadening participation in STEM education and employment.

- DOL/ETA would be open to joint funding of broadening participation programs.

Office of the White House Initiative on Historically Black Colleges and Universities

Department of Education

Agency Participants in the Conversation

Mr. Charles M. Greene, Executive Director of the White House Initiative on Historically Black Colleges and Universities (WHI-HBCU)
Dr. ReShone L. Moore, Management and Program Analyst

Agency Background in Broadening Participation

- Executive Order 13256 of February 12, 2002 authorized the continuation of the President's Board of Advisors on Historically Black Colleges and Universities (HBCU) "... *to strengthen the capacity of these institutions to provide the highest quality education, and to increase opportunities for these institutions to participate in and benefit from federal programs...* "[75] The Board was established within the Office of the Secretary of Education. The Board prepares and issues to the President an annual report on the results of participation of HBCUs in federal programs. Also, the Board advises the President and Secretary of Education on he needs of HBCUs concerning infrastructure, academic programs, faculty, and institutional development.

- The WHI-HBCU (1) provides staff, resources and assistance to the Board; (2) assists the Secretary in performing the liaison functions between the executive branch and HBCUs; and (3) assists the Secretary in carrying out responsibilities in regard to developing plans for HBCUs to participate in grant, cooperative agreement or contract programs with executive departments and agencies, as well as collecting annual performance reports from the departments and agencies.

Priority Status of Broadening Participation within WHIHBCU

- The WHI-HBCU is divided into clusters, based on disciplines. There is a cluster dedicated to science and technology.

Policies and Procedures

- The WHI-HBCU does not have agency status and therefore has no policies other than the Executive Orders under which it functions.

[75] Executive Order #13256 of February 12, 1992, page 1.

Broadening Participation Programs

- The WHI-HBCU does not provide direct funding to HBCUs, but rather advocates on behalf of HBCUs for program opportunities provided by federal agencies. Of particular interest to the present study were the science related programs, which vary in scope and focus on undergraduate and graduate education, faculty development, and enhancement of institutional research and technology infrastructure.

- Mr. Greene noted that not all of the federal agencies identified by the Education Secretary to participate with HBCUs provide his office with the mandated annual reports. He did, however, provide us with the *2002-2003 Annual Report to the President on the Results of Participation of Historically Black Colleges and Universities in Federal Programs*. Mr. Greene went on to say that *"Although this [underreporting] has been a historical problem, major improvements did begin in calendar year 2006 with regard to the FY 2005 annual performance reports. We are in the midst of collecting the FY 2006 reports and we are confident we will have a 100% response rate. As a result of the historical problem, information on the overall federal effort in assisting and enhancing HBCUs has not always been as complete as we would have liked."*

Best Practices

- Working closely with the administrations of the minority-serving institutions and providing them with grant announcement information are effective in helping these colleges and universities to compete for grant and contract opportunities offered by federal agencies.

Lessons Learned

- The WHI-HBCU has to constantly promote the value of HBCUs to the STEM and other professions, so that the federal agencies do not lose interest in outreaching to these institutions.

Financial Investments in Broadening Participation

- Federal agency funding for HBCUs increased by 60 percent during the period from 1993 to 2002, which was less than the 79 percent increase in federal funds for all institutions of higher education. In its 2002-2003 annual report to the President, the Advisory Board stated, "... *federal support for HBCUs is not keeping pace with overall federal support for all institutions of higher education.*"[76]

[76] *The Mission Continues. Annual Report to the President on the Results of Participation of Historically Black Colleges and Universities in Federal Programs 2002-03*, page 1.

- Funds expended for STEM areas were not available for FY 2005, 2006 and 2007.

Assessment of the WHI-HBCU Broadening Participation Advocacy

- The WHI-HBCU office reviews the annual data collected from the federal agency programs involving HBCU participants.

- Mr. Greene commented that because of the fluid nature of the advocacy work performed by his office, no formal evaluations of the impact of the WHI-HBCU have been undertaken. Actions have been taken to address this situation. Beginning with the FY 2006 Performance Reports and the FY 2007 Annual Plans, Mr. Greene's staff instituted an assessment process.

Evaluation Approaches and Metrics

- As indicated above, WHI-HBCU does not conduct formal evaluations of its outreach and advocacy program. The annual reports that it receives from the other federal agencies includes statistics on the number of institutions funded for research and other activities, as well as funding amounts.

- The primary metric used by the agency in its annual reporting to the Department of Education and the White House are the number of HBCUs that receive funding from the other federal agencies and the associated dollar amounts.

Management of Broadening Participation Initiative

- As Executive Director, Mr. Greene is responsible for directing and overseeing the activities of the WHI-HBCU. He reports to the WHI-HBCU Board of Advisors which, in turn, reports to the President and Secretary of Education.

Inter-Agency Collaborations

- The WHI-HBCU is mandate by Executive Order to encourage and work with all federal agencies designated by the Secretary of Education to engage HBCUs in agency programs that support student and faculty development and institutional capacity-building.

Recommendations from Mr. Greene

- NSF as well as other federal agencies needs to get a buy-in from all levels within the agencies to assist HBCUs.

- Biased perceptions of HBCUs within agencies need to be addressed in the context of institutional transformation. Specifically, agencies and their staffs must

perceive working with HBCUs as important partnerships that are mutually beneficial and support national needs.

- The WHI-HBCU should communicate and possibly collaborate with Tribal Colleges and Hispanic-serving Institutions in efforts that can collectively benefit the institutions.

National Science Foundation

Agency Participants in the Conversation

Dr. Victor A. Santiago, Acting Director, Human Resource Development
Dr. Jessie A. DeAro, Program Director, Human Resource Development
Ms. Marilyn J. Suiter, Program Director, Human Resource Development
Dr. James J. Powlik, Program Director, Human Resource Development
Dr. Celeste Rohlfing, Program Director of Chemistry

Agency Background in Broadening Participation

- In 1980, Congress passed the Equal Opportunities in Science and Engineering Act, which charged the National Science Foundation (NSF) with the responsibility for increasing the number of scientists and engineers and the number of women, underrepresented minorities, and persons with disabilities in the science and engineering workforce.[77] The Act also established within NSF the Committee on Equal Opportunities in Science and Engineering (CEOSE) to advise NSF on its policies and programs to support women, underrepresented minorities, and persons with disabilities who are pursuing careers in the fields of science, technology, engineering, and mathematics (STEM).

- Since 1980, NSF has created and supported numerous broadening participation programs, and has instituted policies in support of its efforts to increase the access of women, underrepresented minorities, and persons with disabilities to the STEM pipeline and workforce.

Priority Status of Broadening Participation within NSF

- The Foundation's high priority status given to broadening participation is evidenced in many of NSF's major documents. NSF's governing body, the National Science Board, most recently underscored the importance of broadening participation by devoting an entire publication to broadening participation in academia, and made several recommendations to improve opportunities for women, minorities, and persons with disabilities in STEM. For example, NSF programs should provide incentives and rewards to institutions that pursue or have implemented creative organizational strategies to advance underrepresented minorities into the professoriate.[78]

- As stated in its latest strategic plan, NSF "*...is seeking and accommodating contributions from all sources while reaching out especially to groups that have*

[77] Public Law 96-516.
[78] National Science Board *Broadening Participation in Science and Engineering Faculty.* October 4, 2004, page 3.

been underrepresented... and NSF will focus on broadening participation in the STEM disciplines."[79]

- The top leadership of NSF is committed to the broadening participation. In the 2008 Budget Hearings before Congress, the Director stated that, *"[Our plan] calls for expanding efforts to broaden participation in all of NSF's activities and programs."* [80]

- NSF's Deputy Director, Dr. Kathie Olsen, recently established an internal agency-wide Broadening Participation Working Group, which is charged with developing a plan to increase participation of underrepresented groups in NSF programs; increase their numbers among panel reviewers; and recruit, hire, and empower a highly qualified scientific staff that reflects the diversity of the STEM community. Members of the Working Group include representatives from all of the Foundation's science and engineering directorates. [81]

Policies and Procedures

- NSF has a merit review policy that directly impacts the grant opportunities for underrepresented groups in STEM. The policy consists of two criteria: (1) intellectual merit of the proposed grant; and (2) broader impacts of the proposal which must include a focus on broadening participation, or benefits to society, or how the project will enhance infrastructure for research, or advance discovery. All applicants must address both criteria for a proposal to be considered.[82] Although the broader impacts criterion does not specifically require that a grant applicant include a broadening participation component within the project, an increasing number of recent NSF solicitations do require grant applicants to include opportunities for underrepresented groups within the proposed research or training activities.

- NSF requires that its proposal review panels include members of the underrepresented groups.[83]

- All NSF directorates and offices are required to implement recruitment and selection plans for addressing human resource diversity within their operations.[84]

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[79] *Investing in America's Future.* National Science Foundation Strategic Plan FY 2006-2011, pages 2 and 4.
[80] Dr. Arden Bement, NSF Director's Testimony Before the Research and Science Education Subcommittee, House Science and Technology Committee, March 20, 2007.
[81] Presentation made before CEOSE, June 5-6, 2007.
[82] Merit-review criteria were adopted by the National Science Board in 1981 and amended in 2002 to enforce the policy.
[83] See, for example, pages 11 and 12 of *Broadening Participation in America's Science and Engineering Workforce. CEOSE 1994-2003 Decennial and 2004 Biennial Reports to Congress,*
[84] Ibid. page 13.

Broadening Participation Programs

- NSF has an extensive portfolio of programs designed to broaden participation in STEM education and employment. Examples of the Foundation's major programs include the following:

  ADVANCE–Increasing the Participation and Advancement of Women In Academic Science and Engineering Centers—facilitates advancement of women into faculty positions at Research I institutions.

  Alliances for Graduate Education and the Professoriate—intended to increase the number of American students receiving doctoral degrees in STEM and those who will become STEM faculty, with a special emphasis on underrepresented groups.

  Centers for Research Excellence in Science and Technology—invests in upgrading the research capabilities and infrastructure of research-productive minority-serving institutions.

  Graduate Research Fellowships—provides fellowship grants for all demographic groups, including women, underrepresented minorities, and persons with disabilities.

  Louis Stokes Alliances for Minority Participation—provides institutional funding to increase the number of minorities who receive bachelor's degrees in science and engineering fields, through alliances among 2-year, 4-year, and graduate schools.

  Research in Disabilities Education—supports projects that increase the participation and advancement of persons with disabilities in STEM.

  Research on Gender in Science—supports research, dissemination and application of research that results in increased numbers of girls and women entering the STEM fields.

  Historically Black Colleges and Universities Undergraduate program—provides awards to enhance the quality of undergraduate science education and research at HBCUs.

  Tribal Colleges and Universities Program—provides support to American Indian, Native Hawaiian, and Alaska Native-serving institutions to enhance the quality of their STEM instructional and outreach programs.

  Broadening Participation in Computing Program—aims to increase the number of Americans in the computing disciplines—with an emphasis on underrepresented groups—through alliances with academia and industry.

Research Experiences for Undergraduates—supports active research participation of women, minority and other undergraduate students on NSF projects, including partnership projects involving other federal agencies, e.g., DOD and DOE.

Best Practices

- NSF maintains good communication between program officers and principal investigators which contributes to successful project outcomes.
- Providing pre- and post-award technical assistance greatly facilitates effective and efficient implementation of the grant awards.
- Annual meetings (JAM) involving awardees offer opportunities for inter-project exchange of ideas and practices.
- Providing REU supplements enables students to afford summer housing and related expenses.
- Outreach and recruitment workshops and symposia are effective for attracting underrepresented groups.
- Workshops for department chairs of higher education institutions on gender and racial bias have proven effective in assisting with institutional transformation.

Lessons Learned

- Ongoing communication with the academic community about broadening participation is necessary, because one or few contacts with the institutions are not enough.
- Helping grantees prepare for post-award audits early in the project saves institutional and NSF staff time in closing out a project.

Financial Investments in Broadening Participation

- Funding for NSF programs dedicated to broadening participation for the last three fiscal years is as follows:[85]

  FY 2005: $222.70 million
  FY 2006: $231.16 million
  FY 2007: $254.47 million (planned)

[85] Data obtained from NSF's Division of Budget. Additional funding is included in other programs whose major focus is not broadening participation, but some of whose activities are directed at underrepresented groups.

Assessment of NSF Broadening Participation Programs

- NSF's broadening participation programs are evaluated internally, by outside subject matter expert reviewers (known as Committees of Reviewers), as well as by independent evaluators. Multiple output, outcome and impact measures are used in the evaluations. In addition, the project grantees within the various programs are also obligated to evaluate the implementation and outcome of their projects.

Evaluation Approaches and Metrics

- NSF employs a mixed-method approach in evaluating its broadening participation programs which includes quasi-experimental, program exit surveys, post-program follow-up interviews, focus groups, and participant profile analysis.

- The metrics used in NSF's evaluations include number and description of program participants; number of new programs at grantee sites; student enrollment and graduation from graduate school; number of new Ph.D.s; number of post-docs; number of publications; investigator success in acquiring other (NSF and non-NSF) funding support; and number of proposals submitted for funding and percent of awards to investigators from underrepresented groups.

Management of Broadening Participation Efforts

- NSF's management of broadening participation programs and related initiatives occurs on multiple levels. Program officers within the directorates are responsible for monitoring and assessing the broadening participation programs and subsidiary projects. The program officers are, in turn, responsible and report to their Assistant Directors of the directorates; and the Assistant Directors report to the NSF Director on a periodic basis. Finally, the Director reports to the National Science Board on the broadening participation activities and results of these activities.

- CEOSE also monitors and reviews the Foundation's broadening participation programs, and advises NSF leadership on related policies and plans. CEOSE prepares and submits to Congress biennial reports on the committee's actions and NSF's progress in broadening participation in STEM

Inter-Agency Collaborations

- NSF has collaborated with several other federal agencies in promoting and supporting broadening participation in STEM. At present, for example, NSF is collaborating with DOE, DOD, NASA and USGS in NSF's *CREST* program to

bolster research capacities of minority-serving institutions. NSF is also working with NIH and DOE in sponsoring workshops for women in chemistry.

Recommendations from NSF/CEOSE

- CEOSE has considered a number of ways in which NSF might further collaborate with other federal agencies to broaden participation, e.g., sharing of best practices, joint support of program initiatives, and integrating programs of different agencies where feasible. Through the present study, CEOSE/NSF is seeking recommendations from other federal agencies on ways to establish, improve, or expand cross-agency collaborations.

DISCUSSION and RECOMMENDATIONS

The purpose of this study was to gather information that would help CEOSE become more aware of the broadening participation efforts of other federal agencies, and to use this information to propose new or enhanced inter-agency collaborations that would increase the numbers of talented scientists and engineers from traditionally underrepresented groups in STEM. As a result of the conversations held with staff members of the eleven agencies, invaluable insights were gained about the operations, best practices, and challenges of federal broadening participation programs. The agencies also provided numerous recommendations about how they could join forces to achieve an even more diverse and globally-competitive STEM workforce.

Agency Commonalities and Differences

Many facets of broadening participation are shared among the eleven federal agencies. These commonalities could serve as a foundation for building new or expanding existing collaborations. For instance, all of the agencies have some history in providing education or employment opportunity programs aimed at the underrepresented groups in STEM. The executive leadership in all the agencies is already committed to increasing access to STEM education and employment for traditionally excluded groups. Inclusiveness in the workplace is commonly viewed as a priority by all the agencies, and they all include diversity as an important element in their strategic plans or other governing documents. All of the agencies are currently engaged in outreach and recruitment activities with minority-serving institutions. Funding of these institutions for student education, faculty development, and research capacity-building is also shared by all of the eleven agencies. With the exception of the two agencies that do not have a STEM-related mission (DOL and WHI-HBCU), the agencies are large and consist of multiple semi-autonomous units (laboratories or institutes) and have an internal management mechanism that oversees and holds accountable the broadening participation actions of their laboratories, institutes and research centers. Of particular import is that there is unanimous interest among the agencies to collaborate with one another in implementing an agenda that will increase diversity in STEM. Currently, all of the agencies collaborate with at least one other STEM-related agency in pursuit of broadening participation. The one exception is DOL, which very much wishes to join forces with NSF and the other agencies to expand employment opportunities in the science and engineering fields for women, underrepresented minorities, persons from socio-economically disadvantaged communities, and persons with disabilities. Some of these factors-in-common (i.e., leadership commitment, diversity as an organizational priority, emphasis on outreach and recruitment, management, and accountability of diversity efforts) are identical to factors found in the earlier mentioned GAO study which are associated with best practices in managing diversity within federal agencies.[86]

One final commonality among the agencies is that all eleven plus about 25 other federal agencies are members of a newly formed organization, called the *Minority-Serving Institutions Community of Partners Council*, whose mission is "...to maximize

[86] See Footnote No. 5, page 2.

relationships to foster government-wide collaborative efforts directed towards minority-serving institutions (MSIs). The Council is committed to utilizing its members (agency program directors) to provide programs, activities, and services that strengthen the capacity of MSIs to provide educational excellence, improve financial and physical infrastructure, and effectively participate in federal procurements." [87]

The present study also discerned some differences among the agencies. NSF and DOD focused on the three traditionally underrepresented groups in STEM (women, minorities, and persons with disabilities), while the other agencies target both genders, persons from other racial and ethnic groups, different cultures, geographical locations, socio-economic status, and those with diverse skill sets. While all of the agencies have mandated equal opportunity policies and view diversity in STEM as a priority, not all have specific policies related to increasing the presence of underrepresented persons in the STEM workforce. This group includes USGS, DOD, NOAA, and DOL. The broadening participation policies of DOD, NOAA, and NIST are specifically aimed at increasing diversity within their own workforces, compared to the other agencies whose focus is on broadening participation in the country's general STEM workforce---albeit all take pride in and count as successful outcomes post-docs and research trainees who subsequently become employed by the agencies. The eleven agencies also differ in that only four (NSF, NASA, NIH and NOAA) include in their grant-giving policies language that addresses broadening participation opportunities. Finally, all of the agencies collaborate with academia and the government sector (for example, through the WHI-HBCU) to support broadening participation initiatives; but only two agencies (NSF and DOE) collaborate directly with industry to increase the number of underrepresented groups in STEM. As noted in the introduction, more collaborations should be forged between the federal agencies and industry, given that private industry is the predominant employer of our scientists and engineers.

Evaluation of STEM Programs

With the exception of the WHI-HBCU, all of the agencies surveyed conduct evaluations of their broadening participation/diversity programs. There is, however, no uniformity of evaluation approaches across agencies, making it difficult to compare results for similar programs. Also, the agencies typically employ non-experimental methodologies that are not as robust as the experimental (or gold standard) designs, and therefore leave uncertainties as to the actual effectiveness of the programs. Examples of the methodologies commonly used by the agencies include program exit interviews, profile descriptions of participants, program participant satisfaction surveys, and post-program follow-up interviews. In the case of some programs, the NSF and NIH have utilized quasi-experimental approaches. But, the fact remains, and as pointed out in the Report of the Academic Competitiveness Council, more robust evaluation studies are needed to provide more definitive answers to what works and for whom in STEM education and training.

[87] Minority-Serving Institutions Community of Partners Council Charter.

The agencies noted several reasons for not being able to employ "the gold standard" of evaluation approaches. Lack of financial resources is a major one. Another has to do with an agency's reluctance on ethical grounds to set up experimental and control groups in which individuals assigned to the latter group would be denied access to a program opportunity, which may not be available at another time or place. Moreover, it is difficult in general to track students who participated in STEM internships, fellowships or other programs, and to attempt to follow-up with students in a control group would probably be even more of a challenge as they would have no real incentive to respond to a request for a post-program interview. Still further is the richness and diversity of the broadening participation/diversity programs themselves, which present a formidable challenge to robust evaluations of programs across agencies. Not all of the agency internship and fellowship programs are alike; some have participant facets that others do not have, e.g., "personal touch" or individualized assistance, or dedicated mentors, or close relationships with grantee institutions. The openness and fluidity of the outreach activities are not readily conducive to randomized experimental designs, nor are faculty development programs at women- or minority-serving institutions. Randomized experimental evaluation designs may be more applicable in K-12 settings where there are whole classes that can be randomly assigned to program and non-program conditions and where students are less mobile than undergraduate or graduate students.

Despite these issues, "What works and for whom?' remains a critical question for which answers are needed. Knowing what programs effectively produce scientists ad engineers could help in furthering executive commitment to and funding for broadening participation programs. It would further help program designers in selecting or modifying exemplary program models. Banning together to address the issue of improving the quality of evaluations of broadening participation/diversity programs is certainly one area for inter-agency collaboration.

Recommendations for Federal Inter-Agency Collaborations

The recommendations offered by the agencies can be grouped into three major themes: (1) ***information-sharing***, e.g., sharing of best practices and other information on broadening participation efforts; (2) ***joint funding of programs,*** e.g., jointly funding student education, pre-employment training, institutional infrastructure-enhancement, faculty development, and student outreach and recruitment programs; and (3) ***program coordination***, e.g., coordinating similar education and research experience programs to maximize the efficiency of agency resources and program impacts.

What follows is a synthesis of the specific recommendations offered by the individual agencies on what CEOSE/NSF should consider in developing a plan for inter-agency collaboration to broaden participation in STEM.

1. Collaborating agencies should set up a mechanism to share information and best practices.

2. The National Science Foundation should take the lead in forming ground rules for the collaborations.

3. The agencies should adopt a common language that parallels the NSF language of broadening participation in STEM fields.

4. How an agency would benefit from a given collaborative initiative must be made explicit, in order to ensure the involvement and support of agency leadership and staff.

5. To facilitate trans-agency collaborations to broaden participation in STEM, each partner agency should seek to establish its own "CEOSE."

6. The collaborating agencies need to address the issue of "competition" among them for funds in the executive budget, and agree on ways to better allocate dollars for similar broadening participation programs.

7. The Office of Science and Technology Policy should further support efforts to foster and sustain inter-agency collaborations.

8. NSF should develop guidance for increasing diversity on review panels, external advisory boards, and committees of visitors.

9. The collaborating agencies should jointly identify STEM talent in a strategic way to help meet the demands of the workforce. Résumés submitted to one agency that may not have job vacancies in a STEM area should be shared with the other agencies.

10. The collaborating agencies should jointly fund education and outreach programs for underrepresented groups in STEM. However, to avoid logistical problems with joint funding of certain types of programs, the joint agreements may have to be informal.

11. As the leader in broadening participation, NSF should develop a funding program to assist other agencies to establish and support broadening participation programs.

12. Each agency has to make a long-term financial commitment to broadening participation, in order for the inter-agency collaborations to work.

13. The collaborating agencies should form or capitalize more on existing relationships with professional societies or other organizations that have a focus on underrepresented groups in STEM.

14. The collaborating agencies should consider forming an inter-agency internship program, which would allow for interdisciplinary experiences for the students.

15. Grantee institutions of the collaborating agencies should be consulted as to what types of inter-agency efforts would be most beneficial to the grantees.

16. The collaborating agencies should develop common metrics for use in standardized program evaluations.

17. Institutional transformation initiatives should be undertaken by the collaborating agencies to address issues of biased perceptions of minority-serving institutions on the part of majority scientists and engineers.

The foregone recommendations further reflected willingness on the part of the federal agencies to join with one another in collaborations to help provide increased educational and employment opportunities for the underrepresented groups in STEM. The question arises, however, as to the best paths to take in forging and sustaining these collaborations. Related efforts are already underway, such as the Academic Competitiveness Council to better coordinate and evaluate STEM education programs, the Minority-Serving Institutions Community of Partners Council to strengthen the capacity of minority-serving institutions in fields that include science, and the broadening participation partnerships that currently exist between the individual STEM agencies. CEOSE is, therefore, confronted with the challenge of proposing strategies that will not duplicate but rather create new or complementary inter-agency initiatives.

Some Next Steps

- ☑ CEOSE should meet with the Science Committee of the White House Office of Science and Technology Policy to present the report's findings and to solicit the Committee's support in moving forward with an inter-agency collaboration agenda.

- ☑ CEOSE should then host a special meeting with the heads of the agencies that participated in the study to secure their buy-in for the collaborations.

- ☑ Next, CEOSE should meet with the agency representatives to discuss and decide on the following to:

  a) Establish an inter-agency alliance through a memorandum-of-understanding or memorandum-of-agreement.

  b) Set the purpose of the alliance, organizational ground rules, and decide how the alliance will interface with other groups involved in broadening participation.

  c) Prioritize the recommendations offered by the agencies in terms of order of implementation.

- ☑ A long range step would be for the alliance to develop a strategic plan to guide its long-term goals and objectives.

- ☑ Finally, an evaluation plan should also be developed and implemented to assess the process and outcomes of the alliance.

***

APPENDIX A

CONVERSATION GUIDE

CEOSE
National Science Foundation
Federal Agency Conversation Guide
About Broadening Participation

Agency: _____ Location: _____

Agency Representative: _____ Title: _____

Division/Unit: _____ Date: _____

Tele: _____ Email: _____

Agency Background on Broadening Participation

- Agency's legislation and history regarding Broadening Participation.

Priority Status of Broadening Participation within Agency

- Agency's top leadership commitment to and support of broadening participation efforts.
- Inclusion of broadening participation component in agency's strategic plan.

Policies and Procedures

- Broadening participation-related internal policies (e.g., grant-giving, contracting, and hiring).
- Diversity plans.

Broadening Participation Initiatives, Programs, and Projects

- Types of broadening participation programs and initiatives (agency-wide and localized).
- Outreach and recruitment of underrepresented STEM groups for agency and agency programs.
- Current collaborations with other federal, state or local governments, educational institutions, industry, and professional organizations.

Financial Investments in Broadening Participation

- Agency's financial investments in (or funding of) broadening participation efforts in 2005, 2006, and projected for 2007.

Assessment of Broadening Participation Efforts

- Methodological approaches used for program evaluations.
- Metrics used to measure effectiveness of agency's broadening participation programs.
- Evidence of long-term impact of agency's broadening participation efforts.
- Best practices in policies and programs; most successful initiatives; and lessons learned.

Management of Broadening Participation Efforts

- Oversight and accountability mechanisms employed for broadening participation efforts.
- Agency's challenges in establishing and implementing broadening participation efforts.
- Employee training in broadening participation.
- Broadening participation activities linked to employee performance.
- Succession planning for agency's future diverse workforce.

Lessons Learned

Inter-Agency Collaborations

- Agency's expected benefits from collaborating with NSF/CEOSE and other agencies.
- Agency's recommendations for future inter-agency broadening participation activities.

How many staff members returning from Iraq with disabilities?

Suggested Additional Agency Contacts

1. Name:

   Division/Unit:

   Telephone:

   Email:

2. Name:

   Division/Unit:

   Telephone:

   Email:

Procedures for Agency Conversations

1. Following an initial contact with the agency by Dr. Margaret E.M. Tolbert, C&A contacts the agency representative to arrange for a meeting date and time.

2. C&A then emails the topics of conversation to the agency representative in advance of the meeting, to facilitate the representative's preparation for the meeting.

3. C&A prepares a summary of the conversation and forwards it to the agency representative for review for accuracy, and then forwards a copy to Dr. Tolbert. Also, C&A informs the agency representative that he/she will receive a copy of the draft report for review and comments.

APPENDIX B

LIST OF PRINCIPAL AGENCY REPRESENTATIVES

Federal Agency Representatives to the Committee on Equal Opportunities in Science and Engineering 2006—2007

Ms. Evelyn Kent
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OSD Research and Engineering HBCU/MI Program
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Dr. Joseph V. Martinez
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Mr. Paul Lyons
Senior Executive Engineering Entrepreneurship Fellow
Business Relations Group
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Mr. Greg Weltz
Director
Office of Youth Services
Office of Workforce Investment
Employment and Training Administration
U.S. Department of Labor
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University Affairs Officer
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Dr. Carl S. Person
Director
Minority University Research and Education Programs
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Dr. Julie A. Pollitt
Program Analyst
Office of Program Analysis and Evaluation
NASA Headquarters
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Ms. Joyce Rudick
Director
Programs and Management
Office of Research on Women's Health
National Institutes of Health
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Ms. Mirta-Marie M. Keys
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National Institute of Standards & Technology
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Ms. Jacqueline Rousseau
Director of the Education Partnership Program
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Dr. George E. Cooper
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Science and Education Resources Development
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Dr. Robert Ridky
Education Coordinator
USGS
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