Workforce Development for Teachers and Scientists

Funding Profile by Subprogram

(dollars in thousands)

	FY 2005 Current Appropriation	FY 2006 Original Appropriation	FY 2006 Adjustments	FY 2006 Current Appropriation	FY 2007 Request
Workforce Development for Teachers and Scientists					
Undergraduate Research Internships	3,338	2,963	—	2,963	3,170
Graduate/Faculty Fellowships	3,049	3,090	-72[a]	3,018	6,722
Pre-College Activities	1,212	1,139	—	1,139	1,060
Total, Workforce Development for Teachers and Scientists	7,599[b]	7,192	-72	7,120	10,952

Public Law Authorizations:
Public Law 95-91, "Department of Energy Organization Act"
Public Law 103-62, "Government Performance and Results Act of 1993"
The Omnibus Energy Legislation: Sec. 995. Educational Programs in Science and Mathematics amends the Public Law 101-510, "DOE Science Education Enhancement Act"
Public Law 109-58, "Energy Policy Act 2005"

Mission

The mission of the Workforce Development for Teachers and Scientists (WDTS) program is to provide transforming science and technology experiences to the Nation's students and teachers of science, technology, engineering, and mathematics (STEM).

WDTS performs the following functions in support of its overall mission: (1) builds a link between the national laboratories and the science education community by providing funding, guidelines and evaluation of mentored research experiences at the national laboratories to K-12 teachers and college faculty to enhance their content knowledge and research capabilities; (2) provides mentor-intensive research experiences at the national laboratories for undergraduate and graduate students to inspire commitments to the technical disciplines and pursue careers in science, technology, engineering and mathematics thereby helping our national laboratories and the Nation meet the demand for a well-trained scientific/technical workforce; and (3) encourages and rewards middle and high school students across the nation to share, demonstrate, and excel in math and the sciences, and introduces these students to the national laboratories and the opportunities available to them when they go to college.

Benefits

In order to provide the nation with the leadership to help guide it to a renewed excellence in science and mathematics education, WDTS has a grade school through graduate school continuum of programs. This is designed to provide students with an uninterrupted pathway to STEM careers. Through this unified program, WDTS can attract, train, and retain the talent needed for the national laboratories to execute

[a] Reflects a rescission in accordance with P.L. 109-148, the Emergency Supplemental Appropriations Act to Address Hurricanes in the Gulf of Mexico and Pandemic Influenza, 2006.
[b] Total is reduced $61,000 for a rescission in accordance with P.L. 108-447, the Consolidated Appropriations Act, 2005.

the compelling science that the Department of Energy (DOE) conducts and support the Nation's ability to remain a world leader in science and technology.

WDTS supports three science, technology and workforce development subprograms that are designed to provide appropriate opportunities at various stages in STEM career paths: 1) Undergraduate Research Internships, provides research opportunities for a broad base of undergraduate students planning to enter STEM careers, including teaching; 2) Graduate/Faculty Fellowships for STEM students, teachers, and faculty; and 3) Pre-College Activities for middle and high school students, specifically the Middle and High School National Science Bowls. Each subprogram targets a different group of students and teachers to attract a broad range of participants to the programs and to expand the pipeline of students who will enter the STEM workforce. In this fashion, the subprograms use our national laboratories to meet the Department's needs, as well as a national need, for a well-trained scientific and technical workforce. The program also has a focus on professional development for teachers and faculty who often serve their students as the primary models and inspiration for entering the scientific and technical workforce.

Significant Program Shifts

The Laboratory Science Teacher Professional Development (LSTPD) activity is a 3-year commitment experience for K-14 teachers and faculty and was originally designed to add a cohort of about 50 teachers each year. FY 2007 represents the fourth year of this program. The first cohort of 62 teachers began in FY 2004, the second cohort of approximately 28 teachers began in FY 2005, and the third cohort of 18 teachers will begin in FY 2006.

After the first year of implementation in FY 2004, an external evaluation concluded that this program was a success. Two of the participating laboratories were shown to be premier models in achieving the LSTPD program's systemic goal to create a cadre of STEM teachers who have the proper content knowledge and scientific research experience coupled with the necessary educational leadership experience to become agents of positive change in their local, regional and national education communities.

The FY 2007 request includes a significant increase in funding for LSTPD which will expand the fourth cohort to about 300 teachers. The $5,645,000 requested in FY 2007 for LSTPD will be used to provide K-14 teachers, with an emphasis on middle school teachers, the content knowledge and leadership skills that will transform them into agents of change and lead to not only institutional reform in the STEM education system but also improved student achievement.

Supporting Information

As documented by a July 2001 DOE Inspector General Report, the Department faces a critical and immediate shortage of scientific and technical staff sufficient to meet its mission requirements. In the report on "Recruitment and Retention of Scientific and Technical Personnel," (DOE/IG-0512, July 2001, http://www.ig.doe.gov/pdf/ig-0512.pdf), GAO reported that, "the Department was unable to recruit and retain critical scientific and technical staff in a manner sufficient to meet identified missions. Based on their analysis of attrition and hiring since 1999, GAO determined that as of January 2001, the Department faced an immediate need for as many as 577 scientific and technical specialists. Furthermore, if this trend continues, the Department could face a shortage of nearly 40% in these classifications within five years." WDTS is addressing this shortfall by managing its current programs to ensure that they align with the mission of SC and the national laboratories.

According to the National Center for Education Statistics, between 2000 and 2008, enrollment in public high schools is expected to increase by 4% while more than 25% of teachers are at least 50 years old and the median age is 44. This translates to 150,000 to 250,000 openings for teachers in the nation's elementary and secondary schools over the next ten years.

The WDTS program provides a grade school through graduate school set of opportunities that are unified under the common belief that DOE national laboratories can provide unique training and professional development research experiences that enhance the technical skills and content knowledge in science and mathematics of teachers and students, strengthen their investigative expertise, inspire commitments to science and engineering careers, and build a link between the resources of the national laboratories and the science education community. These opportunities are complimentary to the efforts of other federal agencies, such as the NSF and the Department of Education, and provide support that might otherwise be unavailable to these agencies' programs and students they serve.

Undergraduate Internships

Funding Schedule by Activity

(dollars in thousands)

	FY 2005	FY 2006	FY 2007
Undergraduate Research Internships			
Science Undergraduate Laboratory Internship	2,560	2,377	2,645
Community College Institute of Science and Technology	401	328	311
Pre-Service Teachers	377	258	214
Total, Undergraduate Research Internships	3,338	2,963	3,170

Description

The goal of the Undergraduate Research Internships subprogram is to continue the Department's long-standing role of providing mentor-intensive research experiences at the national laboratories for undergraduate students to enhance their content knowledge in science and mathematics and their investigative expertise; and to inspire commitments to careers in science, engineering, and K-12 STEM teaching. Through providing a wide variety of college undergraduates the opportunity to work directly with many of the world's best scientists and use the most advanced scientific facilities available, this program will expand the Nation's supply of highly skilled scientists and engineers, especially in the physical sciences where the greatest demand lies because of a steady decline in U.S. citizens entering these fields.

The SC Program Goals will be accomplished not only through the efforts of the direct (GPRA Unit) programs but with additional efforts from the subprograms which support the GPRA Units in carrying out their mission. Undergraduate Research Internships performs three functions, as indicated in the Supporting Information, in support of the overall SC mission.

Benefits

The Undergraduate Research Internships subprogram provides a wide diversity of research opportunities for undergraduate students to experience genuine scientific discovery and become a member of the unique scientific culture of the national laboratory community. It also provides the laboratory mentors with a more enriching environment in which to conduct their research.

Supporting Information

The Undergraduate Research Internships subprogram contains three activities. To ensure all participants enjoy the greatest benefit from their participation, clear expectations and benchmarks are designed into all programs. Programs are regularly evaluated and adjustments are made to evolve the programs to the changing needs of the nation.

The Science Undergraduate Laboratory Internship (SULI) strengthens the students' academic training and introduces them to the unique intellectual and research facility resources present at the national laboratories. Research internships are available during the spring, summer, and fall terms.

The Community College Institute (CCI) of Science and Technology provides a ten-week summer workforce development program through research experiences at several DOE national laboratories for

highly motivated community college students. The CCI is targeted at underserved community college students who have not had an opportunity to work in an advanced science-research environment. It incorporates both an individually mentored research component and a set of enrichment activities that include lectures, classroom activities, career guidance/planning, and field trips.

Pre-Service Teachers (PST) is for undergraduate students who plan on pursuing a teaching career in science, technology, engineering, or mathematics. Students work with scientists or engineers on projects related to the laboratories' research programs. They also have the mentorship of a master teacher who is currently working in K-12 education as a teacher and is familiar with the research environment of a specific national laboratory.

FY 2005 Accomplishments

- To document and evaluate the quality of the research experience and the collaboration of the intern with their mentor researcher, WDTS publishes the "Journal of Undergraduate Research" containing full-length peer-reviewed research papers and abstracts of students' research in the activity. All scientific research abstracts are graded to measure the quality of the students' ability to prepare scientific manuscripts. A fifth edition was published in 2005, with 15 full-length papers and 653 abstracts.
- In 2005, more than 96% of all students in undergraduate research internships submitted abstracts and research papers.
- The students who published full-length papers presented their work at a poster session at the American Association for the Advancement of Science (AAAS) national meeting in Washington, DC in February 2005. Of the 15 students who presented their work, 5 received awards from the AAAS judges.
- The "Undergraduate Research Internships Program Guidebook" was revised in 2005 to specify outcomes for the Faculty and Student Teams (FaST) undergraduate faculty and updated laboratory contact information. It is an invaluable tool for both students and laboratory research mentors as it describes the responsibilities, requirements, and outcomes that are associated with a successful internship. The guidebook contains formats and instructions for the written requirements, including scientific abstract, research paper, oral presentation, poster, and instructions for an education module for the PST activity.
- There was an increase in National Science Foundation (NSF) funded participants at national laboratories in the undergraduate internship programs and the FaST. For summer 2005, there were a total of 68 NSF funded students that participated on FaST teams selected by 11 laboratories. These participants were eligible for supplemental funding from the NSF to pay for their stipends and travel.
- WDTS staff designed and published "Building Toward a Better Future," a college planning guide for students and families in both English and Spanish versions. This guide provides useful information and tips on preparing for college and becoming a successful applicant for college admission and financial aid. Tips for parents and students begin at the elementary school level.
- WDTS has upgraded its innovative, interactive Internet system for all SC national workforce development programs, to receive and process hundreds of student and teacher/faculty applications for summer, fall, and spring semester research appointments at participating DOE laboratories. The on-line application system is linked with an SC laboratory central processing center, called Education Link, and allows the students and researchers at the laboratories to select and match in

research areas of common interest and includes online submission of research papers, grant requests, and surveys.

- CCI is open to students from all community colleges. In the summer of 2005, 80 community college students, including NSF funded participants, attended a 10-week mentor-intensive scientific research experience at several DOE national laboratories. About 30% of the participating students came from underrepresented groups in STEM disciplines; many were "non-traditional" students. Grades of abstracts for these students were statistically equal to those from the four-year program. Fourteen community college students also participated with faculty members as part of a Faculty and Student Team.
- WDTS established a relationship with the National Institutes of Health (NIH) to bring NIH funded students from minority serving institutions into the WDTS undergraduate programs.

Detailed Justification

(dollars in thousands)

	FY 2005	FY 2006	FY 2007
Science Undergraduate Laboratory Internship (SULI)	**2,560**	**2,377**	**2,645**

SULI supports a diverse group of students at our national laboratories in individually mentored research experiences. Through these unique and highly focused experiences these students are transformed into long-term members of the National Laboratory community and become a repository of talent to help the DOE meet its science mission goals. Students in the program: 1) apply on a competitive basis and are matched with mentors working in the students' fields of interest; 2) spend an intensive 10-16 weeks working under the individual mentorship of resident scientists; 3) produce an abstract and research paper; and 4) attend seminars that broaden their view of science career and help them understand how to become members of the scientific community. Activity goals and outcomes are measured based on students' research papers, students' abstracts, surveys, and outside evaluation. An undergraduate student journal is produced annually that publishes peer-reviewed research papers and all abstracts of students in the activity. Full research papers published in the journal are presented by the student authors at the annual symposium of the American Association for the Advancement of Science (AAAS). The abstracts of these students' and their mentors' works are posted on the AAAS web site. The NSF collaborates with DOE to offer students in its undergraduate student programs access to individually mentored research internships that they would otherwise not have. This activity will ensure a steady flow of students with growing interest in science careers into the Nation's pipeline of workers in both academia and industry. A system is being refined to track students in their academic career paths.

In FY 2005, with DOE, NSF and other leveraged support, 32 students participated in the spring semester program, 395 students participated in the summer, and 22 students in the fall semester program. The DOE contribution will support an estimated 300 students in FY 2006 and 355 students in FY 2007.

Community College Institute of Science and Technology (CCI)	**401**	**328**	**311**

This activity is designed to address shortages, particularly at the technician and paraprofessional levels, and will help develop the workforce needed to continue building the DOE's capacity in critical areas for the next century. Since community colleges account for over 40% of the entire Nation's undergraduate

(dollars in thousands)

enrollment and a majority of under-represented minorities in STEM, this is a clear avenue to increase the numbers of U.S. scientists and engineers. The CCI particularly targets students from under-represented populations in the science and technology fields to increase the diversity of the workforce. The CCI provides a ten-week mentored research internship at a DOE national laboratory for highly motivated community college students. Students in the program: 1) apply online and are matched with mentors working in the students' field of interest; 2) spend an intensive ten weeks working under the individual mentorship of resident scientists; 3) produce an abstract and formal research paper; and 4) attend professional enrichment activities, workshops, and seminars that broaden their view of career options, help them understand how to become members of the scientific community, and enhance their communication and other professional skills. Activity goals and outcomes are measured based on students' research papers, students' abstracts, surveys, and outside evaluation. An ongoing undergraduate student journal was created to publish selected full research papers and all abstracts of students in this activity. CCI was originally a collaborative effort with DOE, its national laboratories, the American Association of Community Colleges, and specified member institutions. Through a Memorandum of Understanding with the NSF in FY 2001, undergraduate students in NSF programs (e.g., the Louis Stokes Alliance for Minority Participation and Advanced Technology Education program) are also participating in this activity. This allows NSF's undergraduate programs to include a community college internship in the opportunities they provide to students. The CCI program is now available to students from all community colleges.

In FY 2005, 68 students directly participated in this internship, with an estimated 54 students participating in FY 2006 and an estimated 50 students participating in FY 2007.

Pre-Service Teachers (PST)	**377**	**258**	**214**

The PST activity is for students who are preparing for a teaching career in a STEM discipline. This effort is aimed at addressing the national need to improve content knowledge of STEM teachers prior to entering the teaching workforce. The NSF entered into a collaboration with SC on this activity in FY 2001. This allows NSF's undergraduate pre-service programs to include a PST internship in the opportunities they provide to students. Students in this program: 1) apply on a competitive basis and are matched with mentors working in the student's field of interest; 2) spend an intensive ten weeks working under the mentorship of a master teacher and laboratory scientist to help maximize the building of content knowledge, and skills through the research experience; 3) produce an abstract and an educational module related to their research and also may produce a research paper or poster or oral presentation; and 4) attend professional enrichment activities, workshops, and seminars that help students apply what they learn to their academic program and the classroom, help them understand how to become members of the scientific community, and improve their communication and other professional skills. Activity goals and outcomes are measured based on students' abstracts, education modules, surveys, and outside evaluation. In FY 2006, the Pre-Service Teachers (PST) activity was reduced to 9 National Laboratories with 33 participating students, compared to 10 National Laboratories with 52 students in FY 2005. In FY 2007, the program is further reduced to 7 National Laboratories and about 29 students participating in order to direct funds to higher priority activities.

Total, Undergraduate Research Internships	**3,338**	**2,963**	**3,170**

Explanation of Funding Changes

	FY 2007 vs. FY 2006 ($000)
Science Undergraduate Laboratory Internship	
The number of students participating in SULI increases by 55 students from 300 students in FY 2006 to 355 students in FY 2007.	+268
Community College Institute of Science and Technology	
The number of students participating in CCI decreases by 4 students, from 54 students in FY 2006 to 50 students in FY 2007.	-17
Pre-Service Teachers	
The number of students participating in PST decreases by 4 students, from 33 students in FY 2006 to 29 students in FY 2007.	-44
Total Funding Change, Undergraduate Research Internships	**+207**

Graduate/Faculty Fellowships

Funding Schedule by Activity

(dollars in thousands)

	FY 2005	FY 2006	FY 2007
Graduate/Faculty Fellowships			
Laboratory Science Teacher Professional Development	1,494	1,840	5,645
Faculty and Student Teams	365	260	243
Albert Einstein Distinguished Educator Fellowship	700	700	650
Energy Related Laboratory Equipment	90	90	90
Faculty Sabbatical Fellowship	400	128	94
Total, Graduate/Faculty Fellowships	3,049	3,018	6,722

Description

The goal of the Graduate/Faculty Fellowships subprogram is to build a link between the resources of the national laboratories and the science education community by providing mentor-intensive research experiences at the national laboratories to students, teachers and faculty to enhance their content knowledge in science and mathematics and their investigative expertise, to enhance the research capabilities at academic institutions and to train Instrumentation Specialists in areas of critical needs at the national laboratories.

The SC Program Goals will be accomplished not only through the efforts of the direct (GRPA Unit) programs but with additional efforts from the subprograms which support the GPRA Units in carrying out their mission. Graduate/Faculty Fellowships performs five functions, as indicated in the Supporting Information, in support of the overall SC mission.

Benefits

Three activities at the graduate level each provide different benefits. The Laboratory Science Teacher Professional Development (LSTPD) will establish long-term relationships between K-14 teachers and the national laboratories. These teachers will not only improve their content knowledge but also become authentic partners in the scientific community. As highly trained leaders in STEM education they will be empowered to reform our nation's science education and help to meet the President's goal of a qualified teacher in every classroom. The Faculty and Student Teams (FaST) and Faculty Sabbatical programs will benefit the individual faculty, their students and their respective institutions by giving them the training needed to successfully compete for federal science grants.

Supporting Information

In a survey of STEM graduate students, conducted by the NSF, 84% of those surveyed stated that they made their choice to choose a STEM field career by the time they left high school. This suggests that teachers hold the key to increasing the number and quality of the science, technology, and engineering workforce. The President's "No Child Left Behind" initiative has put great emphasis in providing a "qualified teacher in every classroom." In 1999, only 41 percent of U.S. eighth graders received instruction from a math teacher who specialized in math. "About 56% of high school students taking physical science are taught by out-of-field teachers as are 27% of those taking mathematics. Among schools with high poverty rates, students have a less than 50% chance of getting a science or math

teacher who holds both a license and degree in the subject area being taught" (The National Commission on Mathematics and Science Teaching for the 21st Century 1999 citing and Linda Darling-Hammond). Furthermore, the business community is also sounding the alarm at the future of the workforce and the American ability to maintain technological superiority by calling for education reform targeted at teachers. The Business Roundtable, in a report published in July 2005 entitled, "Tapping America's Potential: The Education for Innovation Initiative," calls for the federal government and agencies to, "Support cost-effective professional development [for teachers] and prepare them to teach the content effectively." The DOE's unique role in teacher training arises from the existence of its national laboratories. The Laboratory Science Teacher Professional Development (LSTPD) program is targeted at the nation's teachers. The primary goal of the LSTPD program is to create a cadre of STEM teachers who have the proper content knowledge and scientific research experience to perform as leaders and agents of positive change in their local and regional education communities. The program has been specifically designed around the best practices in professional development as outlined from educational research and program improvements based upon evaluation data. In developing the program, several models have been considered, including: the National Board Professional Teaching Standards, "Five Core Principles" and Loucks-Horsley and colleagues' "Fifteen Strategies of Professional Development."

The LSTPD program provides K-14 classroom teachers long-term, mentor-intensive professional development through scientific research or research-like opportunities at the national laboratories. The goal of the program is to improve teachers' content knowledge, student achievement in STEM, and numbers of students pursuing STEM careers. The outcome is that students will show increased involvement in STEM courses, extracurricular activities and pursuit of higher level STEM courses and ultimately show rising average scores on standardized tests. Teachers completing the initial laboratory summer experience will be provided monetary support to: help them extend what they have learned to their classes; connect students via classroom activities to ongoing national laboratory research; continue communication and collaboration with other participant teachers and laboratory scientists; take subject enhancement trips to the laboratory; and, present their experiences at professional conferences and in publications.

The FaST program provides research opportunities at national laboratories for faculty and undergraduate students from colleges and universities, including community colleges, with limited prior research capabilities as well as institutions serving populations underrepresented in the fields of science, technology, engineering, and mathematics, particularly women and minorities. The FaST program supports teams comprised of one faculty member and two to three undergraduate students. The undergraduate students on the FaST teams are funded either by SULI or CCI funds. Over a ten-week summer visit to the laboratory, the faculty are introduced to new and advanced scientific techniques that contribute to their professional development and help them prepare their students for careers in science, engineering, computer sciences, and technology. These opportunities are also extended to faculty from NSF funded institutions.

The Albert Einstein Distinguished Educator Fellowship activity supports outstanding K-12 science and mathematics teachers, who provide insight, extensive knowledge, and practical experience to the legislative and executive branches. This activity is in compliance with the Albert Einstein Distinguished Educator Act of 1994, which gives the DOE responsibility for administering the activity of distinguished educator fellowships for elementary and secondary school mathematics and science teachers.

The Energy Related Laboratory Equipment (ERLE) activity grants available excess equipment to institutions of higher education for energy-related research.

The Faculty Sabbatical program is an extension of the successful FaST program and provides research sabbaticals for faculty members from Minority Serving Institutions (MSI) to collaborate with resident scientists at national laboratories for up to one year on research projects specific to the visiting professors' areas of investigation and the courses they teach. It is the extended stay at the laboratory, along with the concentrated support of the mentor scientist that develops the faculty members' scientific expertise as a teacher, the research capacity of their home institution, and supports their efforts to apply for and receive grants from SC and other granting institutions.

FY 2005 Accomplishments

- The LSTPD program continued at seven national laboratories for 90 teachers. An external evaluation team provided an evaluation report on the first cohort, and found that the LSTPD Program in its pilot year was successful in improving teacher content knowledge and leadership skills. The report indicated that each laboratory had shown significant merit in helping teachers gain new knowledge in a broad range of science. In particular, two national laboratories (Pacific Northwest National Laboratory and Lawrence Berkeley National Laboratory) showed outstanding achievement in meeting the LSTPD program's systemic goals to create a cadre of STEM teachers who have the proper content knowledge and scientific research experience, coupled with the necessary educational leadership experience, to become agents of positive change in their local and regional teaching communities. These two national laboratories will be used as models for other laboratories in their LSTPD programs.
- FaST is aimed at helping faculty from colleges who are in the lower 50th percentile of federal research funding and those institutions serving populations, including women and minorities, underrepresented in STEM fields. In 2005, five SC laboratories–Argonne, Brookhaven, Lawrence Berkeley, Oak Ridge, and Pacific Northwest National Laboratories–placed 42 hosted Faculty and Student Teams, with 35 of those being partially supported by the NSF. Since the program began about 28 FaST faculty have submitted grant proposals to federal institutions/agencies. Some of the funded proposals include: (1) Jackson State University (MS)—Use of both two-dimensional gel electrophoresis; (2) Laney Community College (CA) & LBNL—Environmental Control Technology Education for Advanced Building Operation and Management; and (3) Southern University (LA)—X-ray Detector Lab Development. In FY 2004–05 alone, six faculty participating at the Brookhaven National Laboratory submitted 17 grant proposals, with 6 being funded, and 5 still pending notification. These grants have been a direct product of the FaST experiences. Three Faculty and Student Teams have received peer-reviewed publications in the Journal of Undergraduate Research.
- By leveraging resources and collaborating with other service agencies, the Albert Einstein Distinguished Educator Fellowship activity for FY 2005–2006 placed 17 outstanding K-12 science, math, and technology teachers: 4 in Congressional offices, 1 at the DOE, 2 at the National Aeronautics and Space Administration (NASA), 5 at the NSF, 2 at the NIH, 1 at the National Institute of Standards and Technology (NIST), and 2 at the National Oceanic and Atmospheric Administration (NOAA). This is the largest representation of agencies and highest number of Fellows placed in any year since the inception of the program. By continuing to collaborate with other federal agencies, we hope to be able to place five more fellows in FY 2006 than previous years.
- Two faculty members impacted by Hurricane Katrina were placed at DOE national laboratories in Faculty Sabbatical appointments.

professional developmental needs and the follow-on interaction between the teachers and the national laboratories.

The request for FY 2007 would expand the Laboratory Science Teacher Professional Development program to a major national program supporting 300 teachers, and especially targeting middle school teachers, to participate in mentored research opportunities at the national laboratories. This provides the opportunity to make a real impact in attracting students to study and ultimately work in STEM careers. By incorporating STEM teachers into the scientific community of the national laboratories, they are provided with the tools they need to improve their classroom and overall professional performance, their leadership abilities in the STEM educational community, and most importantly, their student's achievement.

Faculty and Student Teams (FaST)..... **365** **260** **243**

Faculty from minority serving institutions have overwhelmingly identified the FaST program as providing a high quality developmental scientific experience. FaST activities at SC laboratories are being conducted in collaboration with the NSF. Faculty from colleges and universities with limited prior research capabilities and those institutions serving women, minorities, and other populations under represented in the fields of science, engineering, and technology are encouraged to take advantage of the FaST opportunity to prepare students for careers in science, engineering, computer sciences, and technology and for their own professional development. In the first year (FY 2001) of this program, there was one FaST team. In part because of increasing support from the NSF, there were 6 teams in FY 2002, 23 teams in FY 2003, 31 teams in FY 2004, and 42 in FY 2005. In FY 2006, with similar support from NSF, it is projected that there will be about 34 FaST teams, with 10 fully funded by DOE. With funding reduced overall for WDTS in FY 2006, the FY 2006 DOE contribution for FaST is also reduced. The FY 2007 request will reduce the number of teams participating in order to focus funding on higher priority activities. FaST is a very productive and over-subscribed activity among the laboratory scientists and faculty members and has enjoyed wide support from the national laboratories. It provides an opportunity for faculty to advance their scientific expertise through a close relationship with a national laboratory.

Albert Einstein Distinguished Educator Fellowship.... **700** **700** **650**

The Albert Einstein Distinguished Educator Fellowship Awards for outstanding K-12 science, mathematics, and technology teachers continues to be a strong pillar of the program for bringing real classroom and education expertise to Congress and to DOE and other agencies' education and outreach activities. These outstanding teachers provide practical insights and "real world" perspectives to policy makers and program managers. The Einstein Fellowship has been a valuable professional growth opportunity for the teachers, as they return to their education field with knowledge of federal resources and an understanding of national education issues. In FY 2005, with the organizational support of DOE, other federal agencies, including the NSF, NASA, NOAA, NIH, and NIST, were able to place 17 teachers as Einstein Fellows. The FY 2007 request will directly support 4 fellows in Congress and 1 at DOE. It will also allow for the continued organizational support for the placement of additional fellows in other federal agencies.

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Energy Related Laboratory Equipment (ERLE)	**90**	**90**	**90**

The ERLE grant activity provides excess equipment to institutions of higher education for energy-related research. Through the Energy Asset Disposal System, DOE sites identify laboratory equipment that is then listed on the ERLE website, which is maintained at the Office of Scientific and Technical Information and updated several times a week. Colleges and universities can search for equipment of interest to them and apply via the website. DOE property managers approve or disapprove the applications. The equipment is free, and the receiving institution pays for shipping costs.

Faculty Sabbatical Fellowship.....	**400**	**128**	**94**

The Faculty Sabbatical provides support for up to a year of direct research with resident national laboratory scientists on research projects specific to their areas of investigation and courses they teach. The Faculty Sabbatical activity was originally designed for MSI faculty to work with a national laboratory scientist on a well funded, focused research project of the faculty member's choice to develop the faculty members' scientific expertise. Many of the MSI's have indicated that it is difficult to release a faculty member for a year sabbatical, but are encouraging their faculty to participate in the FaST program and bring their students to the national laboratories, ultimately increasing workforce numbers and diversity. Initial planned funding in FY 2005 was for 12 faculty members, but due to a lack of response, only 10 were placed, and of this number, 2 were placed at the last minute because of the Hurricane Katrina disaster. Because of this experience and the overwhelming success of the FaST program, support is reduced in FY 2006 to 4 and further reduced to 2 Faculty Sabbatical appointments in FY 2007.

Total, Graduate/Faculty Fellowships.....	**3,049**	**3,018**	**6,722**

Explanation of Funding Changes

	FY 2007 vs. FY 2006 ($000)
Laboratory Science Teacher Professional Development	
The number of teachers participating in LSTPD increases by 192 in FY 2007, from 108 in FY 2006 to 300 in FY 2007, reflecting an increased effort to train middle school teachers at national laboratories.	+3,805
Faculty and Student Teams	
The number of SC funded FaST teams is reduced by 1 (from 10 in FY 2006 to 9 in FY 2007) but continued coordination with NSF is likely to result in a comparable number of teams as supported in FY 2006.	-17

	FY 2007 vs. FY 2006 ($000)
Albert Einstein Distinguished Educator Fellowship	
The number of Albert Einstein participants receiving direct DOE support in FY 2007 remains at 5, the same as FY 2005 and FY 2006. Continued collaboration with other federal agencies should result in an equal or greater number of Einstein Fellows (12) supported in FY 2006 and FY 2007.	-50
Faculty Sabbatical Fellowship	
The number of Faculty Sabbaticals for faculty members from MSIs is reduced by 2 (from 4 in FY 2006 to 2 in FY 2007).	-34
Total Funding Change, Graduate/Faculty Fellowships	**+3,704**

Pre-College Activities

Funding Schedule by Activity

(dollars in thousands)

	FY 2005	FY 2006	FY 2007
Pre-College Activities			
National Science Bowl®	937	799	718
Middle School Science Bowl	275	340	342
Total, Pre-College Activities	1,212	1,139	1,060

Description

Beyond providing students an opportunity to interact with the scientific community, an additional goal of the middle and high school Science Bowl is to provide opportunities for students interested in science and math to share and demonstrate their talents outside the classroom in an interactive manner that validates their accomplishments and encourages future science and math studies.

The SC Program Goals will be accomplished not only through the efforts of the direct (GPRA Unit) programs but with additional efforts from the subprograms which support the GPRA Units in carrying out their mission. Pre-College Activities performs two functions, as indicated in the Supporting Information, in support of the overall SC mission.

Benefits

These Pre-College Activities introduce middle and high school students to the national laboratory system and the available opportunities they may wish to participate in when they go to college. It also provides a critical component of "modeling" to inspire students' interest in science.

Supporting Information

The Pre-College Activities subprogram contains two activities which provide an avenue of enrichment, enlightenment, inspiration, and reward through academic science achievement:

The National Science Bowl® is a prestigious educational event that continues to grow in reputation among students, educators, science coaches, and volunteers as a very important educational event and academic tournament. It is a "grass roots" tournament where over 1,800 high schools from all across the nation participate in regional events and where each regional event sends a team to the national event. The regional and national events are primarily volunteer programs where several thousand people dedicate weeks of their time to run and judge educational events and be involved with bright, enthusiastic students who attend science and technology seminars and compete in a verbal forum to solve technical problems and answer questions in all branches of science and math. High school teams also design, build, and race hydrogen fuel cell model cars. Since its inception, more than 100,000 high school students have participated in regional tournaments leading up to the national event. At the national event, students meet numerous DOE and non-DOE scientists and are given a rare chance to learn about the wide variety of careers that scientists in all fields pursue.

The Middle School Science Bowl attracts students at one of the most critical stages of their academic development. The emphasis at this grade level is on discovery and hands-on activities such as designing,

building, and racing model hydrogen fuel cell cars. Students also solve problems in life and physical sciences and mathematics.

FY 2005 Accomplishments

- 2005 marked the 15th anniversary of the DOE's National Science Bowl® More than 12,000 high school students were hosted in the 63 regional science bowl events.
- The Middle School Science Bowl, initiated in FY 2002 with 8 teams, expanded to 24 regional teams in FY 2005. The national event was hosted by the National Renewable Energy Laboratory at the Colorado School of Mines in Golden, Colorado. The event has two main activities: 1) a science and mathematics academic question and answer forum; and 2) a hands-on activity sponsored by General Motors, where each team designs, builds, and races a scale-model hydrogen fuel cell car. Teachers attended a half day workshop in Physics and participated in many hands-on physics activities that they could in turn take back to their schools to enhance science lessons in their classrooms. Texas Instruments sponsored some of the awards for the winning teams.
- Students, coaches and coordinators evaluated the Middle School Science Bowl, an evaluation report was compiled and program improvements are being made based on the recommendations.
- Saturday morning science seminars were expanded in FY 2004 and continued in FY 2005 to include an entire day, at the National Science Bowl® weekend, introducing students to many contemporary issues and findings in contemporary scientific research. These seminars have featured world class scientists and Nobel laureates.
- National Science Bowl® awards expanded in FY 2005 to include a variety of academic awards to the top 16 teams and a Civility Award sponsored by IBM.
- In FY 2005, 18 of the 63 teams took part in designing, building, and racing cars under the Hydrogen Fuel Cell Model Car Challenge that was added to National Science Bowl® in FY 2003. Nine of these teams raced in the stock category and the other 9 in the hill climb. Awards were presented to the top teams in this event.
- General Motors (GM) has been a major sponsor of both the middle and high school Science Bowls, particularly regarding the fuel cell activities, and has been pleased with the quality and quantity of student and teacher involvement.

Detailed Justification

(dollars in thousands)

	FY 2005	FY 2006	FY 2007
National Science Bowl®	**937**	**799**	**718**

The National Science Bowl® is a nationally recognized prestigious academic event for high school students. It has attained its level of recognition and participation through a grass-roots design which engenders volunteer participation of professional scientists, engineers and educators from across the nation. The students answer questions on topics in astronomy, biology, chemistry, mathematics, and physics. In 1991, DOE began the National Science Bowl® to encourage high school students from across the nation to excel in mathematics and science and to pursue careers in those fields. The National

(dollars in thousands)

FY 2005	FY 2006	FY 2007

Science Bowl® provides the students and teachers a forum to receive recognition for their talent and hard work by solving both traditional academic problems in all fields of science and math in addition to their activity in various hands-on science challenges. The National Science Bowl® includes a day of scientific seminars, a set of model car competitions based upon the hydrogen economy of the future and an academic competition. Students participating in the National Science Bowl® are tracked to determine the impact on their academic and career choices, including participation in DOE Undergraduate Research Internships.

The regional and national events are primarily volunteer programs where thousands of people dedicate weeks of their time to organize and execute educational events and be involved with bright, enthusiastic high school students.

The number of regional events remains relatively constant from one year to the next. In FY 2007, support for the National Science Bowl is reduced by $81,000 below FY 2006 and $219,000 below FY 2005, which will result in the curtailment of the full day science seminars and workshops at the National Science Bowl weekend.

Middle School Science Bowl	**275**	**340**	**342**

It is well recognized that the middle school years are one of the most productive times to exert an effort to attract and retain student interest in science and math. There are two events at the Middle School Science Bowl: an academic event in mathematics and science, and an activity to design, build and race hydrogen fuel cell model cars. The academic competition is a fast-paced question and answer format where students solve problems about earth, life, physical, and general sciences and mathematics. The model hydrogen fuel cell car competition challenges students to design, build, and race model hydrogen fuel cell cars in order to help them understand the future energy challenges that our nation is facing. Students who win in regional events enjoy a trip to a national laboratory and participate in a final three-day event that will be designed to capture their interest and reward them for their hard work. The inspiration students receive by interacting with scientists and engineers at this age can positively impact them and be a transforming experience at this critical juncture of their lives and inspire them into STEM careers.

In FY 2007, 28 teams, the same as the FY 2006, will attend and participate in the National event.

Total, Pre-College Activities	**1,212**	**1,139**	**1,060**

Detailed Justification

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Laboratory Science Teacher Professional Development (LSTPD)	**1,494**	**1,840**	**5,645**

The National Commission on Mathematics and Science Teaching indicates that professional staff development is one of the most effective ways of improving the achievement of K-12 students. The National Academy of Sciences (NAS) and Teachers Advancement Program (TAP) reports point to teachers as the central players in improving U.S. student STEM achievement. The national laboratories clearly are not positioned to affect the hundreds of thousands of STEM teachers through direct retraining. However, the laboratories can play a pivotal role in reforming the nation's STEM education by creating sufficient numbers of highly trained teacher leaders as agents of change in STEM education. This is accomplished by providing carefully designed mentor-intensive training for science and math teachers that will allow them to more effectively teach; to attract their students' interests to science, mathematics, and technology careers; and to improve student achievement. Teachers apply on a competitive basis and are matched with mentors working in their subject fields of instruction.

Research in teacher professional development indicates that change takes place over an extended period of time and that multi-year professional development is required to make the necessary differences. Consequently, teachers make a 3-year commitment to the LSTPD, which began in FY 2004. Approximately 62 teachers in FY 2004, 90 teachers in FY 2005 (62 continuing from FY 2004 and 28 new), 108 teachers in FY 2006 (up to 90 continuing from FY 2004 and FY 2005) have or will spend an intensive four to eight weeks annually at the national laboratories working under the mentorship of master teachers and laboratory mentor scientists to help build content knowledge, research skills and a lasting connection with the scientific community through the research experience. Master teachers, who are expert K-14 teachers and adept in both scientific research and scientific writing, will act as liaisons between the mentor scientists and the teacher participants. This will help the teachers transfer the research experiences to their classrooms. Follow-on support is considered critical. Master teachers and other teacher participants receive an $800 per week stipend, travel, and housing expenses.

All teachers completing the initial summer experience will be provided monetary support each year for the three years they are in the program to purchase materials and scientific equipment, which is critical to transfer their research experiences to their classrooms. In addition, follow-on support will include returning to the laboratory in the first year for additional training sessions of approximately one week, long-term support in following years through communication with other teachers and laboratory scientists, more return trips to the national laboratory, and support to publish or present their work at professional conferences. Evaluation includes a self identification of science content gaps by the teacher participant, successful development of a professional development plan by each teacher, attainment of a leadership role, and impact on local STEM education and student achievement. External evaluation of program effectiveness will include visits to participant teachers' schools to assess long-term impact of the program on student achievement. External evaluators submitted a report on the first program year. Success of this research experience relies on proper placement of each participant to match their

Explanation of Funding Changes

	FY 2007 vs. FY 2006 ($000)
National Science Bowl®	
Support will be reduced for scientific seminars and workshops from a whole day to a half day for the students, but DOE will continue to provide funding for all teams to attend the National finals.	-81
Middle School Science Bowl	
A slight increase provides for minor increases in organizational costs	+2
Total Funding Change, Pre-College Activities	**-79**