

Workforce Development for Teachers and Scientists

Funding Profile by Subprogram

(dollars in thousands)

	FY 2006 Current Appropriation	FY 2007 Request	FY 2008 Request
Workforce Development for Teachers and Scientists			
Undergraduate Research Internships	2,958	3,170	3,070
Graduate/Faculty Fellowships	2,793	6,722	6,576
Pre-College Activities	1,369	1,060	1,354
Total, Workforce Development for Teachers and Scientists	7,120 ^a	10,952	11,000

Public Law Authorizations:

Public Law 95-91, "Department of Energy Organization Act", 1977

Public Law 103-62, "Government Performance and Results Act of 1993"

The Omnibus Energy Legislation: Sec. 995. Educational Programs in Science and Mathematics amends Public Law 101-510, "DOE Science Education Enhancement Act", 1995

Public Law 109-58, "Energy Policy Act of 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 to 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 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.

^a Total is reduced by \$72,000 for a rescission in accordance with P.L. 109-148, the Emergency Supplemental Act to Address Hurricanes in the Gulf of Mexico and Pandemic Influenza, 2006.

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 provide 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 Department of Energy Academies Creating Teacher Scientists (DOE ACTS) program, formerly known as the Laboratory Science Teacher Professional Development (LSTPD) program, is a 3-year commitment experience for K–12 teachers and faculty. FY 2008 represents the fifth year of this program and there will be a total of 300 teachers (27 new and 273 continuing). The LSTPD program is renamed to DOE ACTS in response to recommendations from the Education and Workforce Subcommittee of the Secretary of Energy's Advisory Board (SEAB).

Each national laboratory can select to implement either or both of the two types of teacher professional development models in DOE ACTS: (1) Teachers as Investigators (TAI) is geared towards novice teachers typically in the elementary to intermediate grade levels; and (2) Teachers as Research Associates (TARA) for teachers with a stronger background in science, mathematics, and engineering. In FY 2007, 17 national laboratories will participate in this program. Each laboratory in 2006 submitted a proposal that was peer reviewed by a group of external evaluators that included teachers, university professors, and program evaluation experts. The program's overall outcomes are designed to be in line with the No Child Left Behind Act, specifically assisting teachers with becoming highly qualified in their content areas and assessing the direct impact on the quality of teaching and the instruction that students receive.

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 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. These two models were the foundation for the DOE ACTS.

In *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, National Academies, 2005, it states, "This Nation must prepare with great urgency to preserve its strategic and economic security...Recommendation A: Increase America's talent pool by vastly improving K–12 science and mathematics education." *Rising Above the Gathering Storm* also points to summer institutes as a solution to teacher training and for improving the content knowledge of teachers. In the Appendix, it referred to DOE's LSTPD program (now called DOE ACTS) as an example of a teacher training institute.

In the *Final Report of the Secretary of Energy Advisory Board's (SEAB) Science and Mathematics Education Task Force*, May 5, 2006, the committee found that "Teachers—especially middle-school

teachers—are crucial for maintaining students’ enthusiasm for science and encouraging students to consider science and engineering as careers, yet they are also the most underserved and least prepared by traditional training.” The report continues, “DOE’s national laboratories have the additional potential to transform science teachers into “scientist-teachers,” by allowing them to discover the fascination of participating in authentic scientific investigation, so they thus can excite students with both up-to-date knowledge and personal enthusiasm.”

A previous SEAB report stated, “...just as NASA inspires school children with the excitement and beauty of space sciences, just as NIH similarly reaches out to schools to explain the frontiers and the benefits of the life sciences, so should DOE use its vast frontier technological facilities and the collaboration of scientists from all over the world to inspire students and teachers with the rich frontiers of the molecular, atomic, nuclear and sub-nuclear worlds. The Department’s laboratories and university programs offer unique resources for mounting aggressive programs to support the Nation’s students and teachers in science, mathematics and engineering.” Charles M. Vest *et al.*, SEAB Task Force on the Future of Science Programs, *Critical Choices; Science, Energy, and Security*, October 13, 2003.

DOE participated in the Academic Competitiveness Council (ACC) interagency efforts during 2006 to help develop a comprehensive government-wide math and science education and outreach program inventory, review the quality of our program evaluations, collaborate in the development of common goals and performance metrics, and begin implementing changes to improve evaluation and program operations. In winter 2007, the Secretary of Education will transmit to Congress a final report describing the activities of the ACC and setting forth recommendations for improving the effectiveness of Federal science and math education investments.

Undergraduate Research Internships

Funding Schedule by Activity

(dollars in thousands)

	FY 2006	FY 2007	FY 2008
Undergraduate Research Internships			
Science Undergraduate Laboratory Internship	2,447	2,645	2,545
Community College Institute of Science and Technology	283	311	311
Pre-Service Teachers	228	214	214
Total, Undergraduate Research Internships	2,958	3,170	3,070

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 perform 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 2006 Accomplishments

- In 2006, more than 97% of all students in undergraduate research internships submitted abstracts (about 620) and research papers, which were published in the sixth edition of the “Journal of Undergraduate Research.” The 15 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 St. Louis, Missouri in February 2006.
- 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 questionnaires. In 2006, the national laboratories' education staffs are completing their self-assessment on-line. The self-assessment provides WDTS with information on how each laboratory implemented the programs that WDTS funds.
- CCI is open to students from all community colleges. In the summer of 2006, 56 community college students, including National Science Foundation funded participants, attended a 10-week mentor-intensive scientific research experience at several DOE national laboratories. About 37% of the participating students came from under-represented 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.
- In 2006, 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.
- A 3-year NSF “Dear Colleague” letter was signed that continues NSF support of their students in WDTS undergraduate programs, including the Faculty and Student Teams (FaST) program. This letter provides information to the NSF principal investigators on the WDTS programs and the partnership the two agencies have with respect to the undergraduate research internships and FaST programs at the national laboratories. This is the avenue that NSF utilizes to provide funding to the students and faculty that are selected to participate in WDTS programs.

Detailed Justification

(dollars in thousands)

FY 2006	FY 2007	FY 2008
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Science Undergraduate Laboratory Internship	2,447	2,645	2,545
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Science Undergraduate Laboratory Internship (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 student’s 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 careers 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 an annual evaluation by a group of peers, both within and outside of the DOE. An undergraduate student journal is produced annually that publishes peer-reviewed research papers and all abstracts of students in this 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 2006, with DOE, NSF and other leveraged support, 26 students participated in the spring semester program, 377 students participated in the summer, and 21 students participated in the fall semester program. The DOE contribution will support an estimated 355 students in FY 2007 and 340 in FY 2008.

Community College Institute of Science and Technology	283	311	311
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Community College Institute of Science and Technology (CCI) 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 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 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 student’s 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

(dollars in thousands)

FY 2006	FY 2007	FY 2008
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collaborative effort with DOE, its national laboratories, the American Association of Community Colleges (AACC), 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 2006, 56 students directly participated in this internship, with an estimated 50 students participating in FY 2007 and the same number of students in FY 2008.

Pre-Service Teachers	228	214	214
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The Pre-Service Teachers (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 DOE 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 an optional research paper, 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, PST was hosted at 6 national laboratories with 42 participating students. In FY 2008, the program is flat funded and continues at 4 national laboratories with about 29 students participating, the same as in FY 2007.

Total, Undergraduate Research Internships	2,958	3,170	3,070
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Explanation of Funding Changes

FY 2008 vs. FY 2007 (\$000)

Science Undergraduate Laboratory Internship

The number of students participating in this program will decrease by 15 in FY 2008, from 355 in FY 2007. Funding is reallocated to support National Science Bowl requirements.

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Graduate/Faculty Fellowships

Funding Schedule by Activity

(dollars in thousands)

	FY 2006	FY 2007	FY 2008
Graduate/Faculty Fellowships			
DOE Academies Creating Teacher Scientists ^a	1,618	5,645	5,593
Faculty and Student Teams	335	243	243
Albert Einstein Distinguished Educator Fellowship	750	650	650
Energy Related Laboratory Equipment	90	90	90
Faculty Sabbatical Fellowship	—	94	—
Total, Graduate/Faculty Fellowships	2,793	6,722	6,576

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 need 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 four functions, as indicated in the Supporting Information, in support of the overall SC mission.

Benefits

There are three activities at the graduate level supported in FY 2008 and each provides different benefits, plus the Energy Related Laboratory Equipment activity that grants available excess equipment to institutions of higher education for energy-related research. The Department of Energy Academies Creating Teacher Scientists (DOE ACTS) program will establish long-term relationships between K–12 teachers and the national laboratories. This program was formerly known as Laboratory Science Teacher Professional Development (LSTPD). 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) program will benefit the individual faculty, their students, and their respective institutions by giving them the training needed to successfully compete for federal science research grants. The Albert Einstein Distinguished Educator Fellowship benefits federal agencies and Congressional offices by these outstanding teachers providing their “real world” classroom expertise and advice. After their fellowship, the teachers go back to their school districts better prepared to be leaders at the local, regional, and

^a Formerly the Laboratory Science Teacher Professional Development program.

national levels, to be master teachers, and to bring knowledge of federal programs that provide resources to school districts.

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 DOE ACTS program is targeted at the Nation's teachers. The primary goal of DOE ACTS 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."

DOE ACTS provides K-12 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, and teacher leadership roles in school, district, region, state, and national levels. 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 under-represented 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 the Science Undergraduate Laboratory

Internship (SULI) or Community College Institute of Science and Technology (CCI) activities. Over a ten-week summer visit to the laboratory, faculty is 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. The Albert Einstein Distinguished Educator Act of 1994 gives the DOE responsibility for administering this 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.

FY 2006 Accomplishments

- 17 national laboratories submitted proposals in 2006 to conduct the DOE ACTS in FY 2007. Each proposal was peer reviewed by a panel consisting of teachers, professors, and education program evaluators.
- In FY 2006, WDTS developed, as part of its innovative, interactive Internet system and its central processing center called Education Link, a system to allow teachers to create an on-line electronic portfolio that will include a professional development plan, a survey of content knowledge, and an educational module based on the teacher's research experience at the laboratory. This portfolio will store these materials in snapshots in time during the three years that teachers are involved in DOE ACTS and will be peer-reviewed by external and internal evaluators over time in order to have an independent assessment of the program's impact.
- In 2006, six national laboratories—Argonne, Brookhaven, Lawrence Berkeley, Lawrence Livermore, Oak Ridge, and Pacific Northwest—placed 53 Faculty and Student Teams, with 43 of those being partially supported by the NSF. For summer 2006, there were a total of 172 NSF funded students and faculty that participated on FaST teams. These participants were eligible for supplemental funding from the NSF to pay for their stipends and travel. Since the program began, more than 25 FaST faculty have submitted 62 grant proposals to federal institutions/agencies. A new proposal funded in FY 2006 at the University of Texas El Paso, Super-High Temperature Alloys and Composites from Nb-W-Cr Systems, is a direct product of the FaST experience.
- By leveraging resources and collaborating with other service agencies, the Albert Einstein Distinguished Educator Fellowship activity for FY 2006–2007 placed 17 outstanding K–12 science, math, and technology teachers: 4 in Congressional offices, 2 at the DOE, 2 at the National Aeronautics and Space Administration (NASA), 4 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). In addition, one Fellow was continued at NIH and 2 have continued on in Congressional offices, thus expanding the impact of the Einstein Fellowship.

Detailed Justification

(dollars in thousands)

FY 2006	FY 2007	FY 2008
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DOE Academies Creating Teacher Scientists	1,618	5,645	5,593
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DOE ACTS (formerly known as LSTPD) requires a three-year commitment by teachers to participate in this program which is based on research in teacher professional development that indicates that change takes place over an extended period of time and that multi-year professional development is required to make the necessary differences. Each teacher 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–12 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 plus travel and housing expenses.

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.

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 the long-term impact of the program on student achievement. External evaluators submitted a report on the first program year which found that success of this research experience relies on proper placement of each participant to match their professional developmental needs and the follow-on interaction between the teachers and the national laboratories.

The DOE ACTS, which began in FY 2004, funded 103 teachers in FY 2006 (88 continuing from FY 2004 and FY 2005) and will fund 300 teachers in FY 2007 (42 continuing from FY 2005 and FY 2006 and 258 in the new cohort). The FY 2008 request would fund 300 teachers, the same number as

(dollars in thousands)

FY 2006	FY 2007	FY 2008
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FY 2007, with support for 27 new teachers in addition to supporting the 15 teachers that began in FY 2006 and the 258 teachers that began in FY 2007.

Faculty and Student Teams **335** **243** **243**

The Faculty and Student Teams (FaST) summer internship/fellowship provides the opportunity for faculty from colleges and universities with limited prior research capabilities and those institutions serving women or minorities to participate with up to three of their undergraduate students in a mentor-intensive science research project at one of six national laboratories. Faculty members may come back to the laboratory in subsequent summer terms. These faculty members 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 minority serving institutions 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 part because of increasing support from the NSF, the number of teams has increased from 6 in FY 2002 to 53 teams in FY 2006. In FY 2007 and FY 2008, with similar support from NSF, it is projected that there will be about the same number of FaST teams, with 9 fully funded by DOE. 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 **750** **650** **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 2006, with the organizational support of DOE, other federal agencies (including the National Science Foundation, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, National Institutes of Health, and National Institute of Standards and Technology) were able to place 17 teachers as Einstein Fellows. Of these, 5 were directly supported by WDTS (4 fellows in Congress and 1 at DOE). The FY 2008 request will directly support 4 fellows in Congress and 1 at DOE, the same as FY 2007. It will also allow for the continued organizational support for the placement of additional fellows in other federal agencies.

Energy Related Laboratory Equipment **90** **90** **90**

The Energy Related Laboratory Equipment (ERLE) grant activity provides excess equipment to faculty at 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 by 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; the receiving institution pays for shipping costs.

Pre-College Activities

Funding Schedule by Activity

(dollars in thousands)

	FY 2006	FY 2007	FY 2008
Pre-College Activities			
National Science Bowl®	1,009	718	918
Middle School Science Bowl	360	342	436
Total, Pre-College Activities	1,369	1,060	1,354

Description

Beyond providing students an opportunity to interact with the scientific community, an additional goal of the Middle and High School Science Bowls 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.

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 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 2006 Accomplishments

- 2006 marked the 16th anniversary of the DOE’s National Science Bowl[®]. More than 12,000 high school students were hosted in the 65 regional science bowl events.
- Interactive hands-on activities at the National Science Bowl[®] were included for the first time. The interactive discovery activities are designed to test the team’s ability to actually “do” science in the way that scientists and engineers do. For example; in “Hitting the Target” teams had to roll the marble and hit the center of the target in one try by placing the “target” where the ball will land. They did this by creating a simulation where the hill is the inclined plane, the table is the flat portion, a steel ball the boulder, the table is the “drop”, and a paper target represents the car. Teams were required to provide qualitative and quantitative documentation as to their problem solving process and rationale.
- The Middle School Science Bowl, initiated in FY 2002 with 8 teams, expanded to 27 regional events with 28 teams traveling to the nationals in FY 2006. The national event was hosted by the National Renewable Energy Laboratory at the University of Denver in Denver, Colorado.
- During FY 2006, nineteen teacher workshops at regional MSSB sites were held to explain and demonstrate the design and construction of fuel cell model cars, and a Teacher Workshop summit was held on best practices for teaching and disseminating information on fuel cells.
- Saturday science seminars at the National Science Bowl[®] weekend continued, introducing students to many contemporary issues and findings in contemporary scientific research. In FY 2006, two of the speakers were former science bowl participants who have graduated and are launched into their science careers.
- In FY 2006, 16 of the 65 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. Eight of these teams raced in the stock category and the other eight in the hill climb. Awards were presented to the top teams in this event.

Detailed Justification

(dollars in thousands)

FY 2006	FY 2007	FY 2008
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National Science Bowl[®]

1,009

718

918

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. Since 1991, the National Science Bowl[®] has encouraged high school students from across the Nation to excel in mathematics and science and to pursue careers in those fields. The National 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

(dollars in thousands)

FY 2006	FY 2007	FY 2008
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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. WDTS funding provides all of the travel and lodging expenses for each winning team and seminar speaker to attend the National event, trophies and other awards, and items for the teams to participate in the various hands-on activities and events (e.g. fuel cell car kits, equipment for the interactive science activities, etc.).

The number of regional events remains relatively constant from one year to the next with 64 to 67 teams participating each year. In FY 2008 support for the National Science Bowl is increased by \$200,000 to reflect cost increases in areas such as travel, lodging, activities, and speakers.

Middle School Science Bowl	360	342	436
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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 is 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.

The number of regional events remains relatively constant from one year to the next with 28 to 31 teams participating each year.

Total, Pre-College Activities	1,369	1,060	1,354
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Explanation of Funding Changes

FY 2008 vs. FY 2007 (\$000)

National Science Bowl

Funding reflects cost increases in areas such as travel, lodging, activities, and speakers.

+200

Middle School Science Bowl

The increase provides for slight increases in organizational costs.

+94

Total Funding Change, Pre-College Activities

+294