Report of the Science and Mathematics Education Task Force

Final Report of the Secretary of Energy Advisory Board's Science and Mathematics Education Task Force

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Secretary of Energy Advisory Board
U.S. Department of Energy

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Science and Mathematics Education Task Force

On July 8, 2004, U.S. Secretary of Energy Spencer Abraham announced that the U.S. Department of Energy (DOE) and its National Laboratories were launching an initiative to promote science literacy and help develop the next generation of scientists and engineers. Secretary Abraham outlined a seven-step program named STARS: Scientists Teaching And Reaching Students. The program is designed to enhance the training of America's mathematics and science teachers; grow students' interest in science and math, especially in the critical middle-school years; and draw attention to the women and men who have done DOE science so very well—and thereby encourage young people and prospective teachers to pursue careers in math and science. Secretary Abraham also announced that he would create a special task force—to be chaired by a prominent leader in the world of science, technology, and business—to assess what additional ways DOE can help improve science education in America. The Science and Mathematics Education Task Force (SMETF) was appointed in September 2004. This is the final report of its findings.

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Science and Mathematics Education Task Force
Terms of Reference

The objective of the Science and Mathematics Education Task Force is to advise the Department of Energy (DOE) on how it can effectively utilize its scientific and technical resources, especially the National Laboratories, to inspire, educate and encourage a new generation of career scientists and engineers to meet the challenges of the future and enhance the scientific literacy of the nation.

The Task Force builds upon the Secretary of Energy's Science Education Initiative to recommend short-term and long-term initiatives. The Task Force's recommendations complement the conclusions from studies by earlier DOE task forces as well as independent efforts by the National Science Foundation, National Aeronautics and Space Administration, Department of Education, and other Federal agencies.

Background:

The United States leads the world in basic scientific research and development of technology. In the early grades, the nation's children express keen interest in these areas and get a quick start given the advantages they enjoy growing up with Internet access in a nation that is a global scientific superpower. According to the 1999 Trends in International Mathematics and Science Study (TIMSS) funded by the National Science Foundation, our nation's school children perform well at the fourth grade level, but then fall behind during middle school, with achievement levels that lag behind nearly every other industrialized nation.

The United States cannot sustain its world leadership in science if these achievement patterns do not improve. The rapid pace of technological change and the globalization of the economy demand that the nation's workforce be literate in science and math. National security depends on access to a workforce that has highly advanced technical skills, particularly if the Department of Energy is to fulfill its vital roles in cyber-technology and other science and engineering necessary to countering nuclear proliferation, and assuring our nation's energy future.

The Department of Energy is the Federal government's single largest supporter of basic research in physical sciences, managing 17 National Laboratories and a dozen other facilities, and funding research in over 250 universities nationwide. Basic scientific research undergirds the Department's missions in national security, energy security, and environmental restoration. DOE

thus has a responsibility to assure that the next generation of American scientists, mathematicians, engineers, and technicians will be ready to support the Department's missions in the future, advance the frontiers of science, and ensure the security of our nation.

Description of the Task Force's Duties:

The Science and Mathematics Education Task Force shall build upon the Secretary of Energy's Science Education Initiative. The Task Force should prepare a report recommending short-term and long-term education roles and initiatives utilizing the resources of the Department of Energy and its National Laboratories to address its need for skilled scientists, engineers, and technicians and to enhance the scientific literacy of the nation. The Task Force's recommendations shall build upon existing DOE programs and complement the efforts of the National Science Foundation, National Aeronautics and Space Administration, and other Federal agencies. The Task Force shall provide the Secretary of Energy, through the Secretary of Energy Advisory Board, with an actionable plan to address this issue and leverage the considerable assets of the Department of Energy and its system of National Laboratories.

FINDINGS AND RECOMMENDATIONS

> "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: Energizing and Employing America for a Brighter Economic Future*, National Academies, 2005

> "…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."
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> – Charles M. Vest *et al.*, SEAB Task Force on the Future of Science Programs, *Critical Choices: Science, Energy, and Security*, October 13, 2003

The United States faces a national educational crisis that is threatening to erode its research preeminence. Although much attention has focused on the enormous educational and economic strides made by India, China, and other nations over the past 20 years, as well as their potential consequences to American balance of trade and prosperity, domestic trends pose a threat even more serious and relentless (*Sustaining the Nation's Innovation Ecosystem*, President's Council of Advisors on Science and Technology [PCAST], 2004; *Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, National Academies, 2005.) According to two recent reports by the U.S. General Accounting Office, 11 percent more students graduated in academic 2003–2004 with baccalaureate degrees in science, technology, engineering and mathematics (STEM) disciplines than did in 1994–1995 (578,000 vs. 519,000)—yet, the *proportion* of STEM degrees compared to degrees in other disciplines *fell* significantly from 32 percent to 27 percent (GAO, *Higher Education: Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends*, October 2005; GAO, *Higher Education: Science, Technology, Engineering, and Mathematics Trends and the Role of Federal Programs*, May 2006).

The Department of Energy, through its 17 National Laboratories and a dozen other facilities, operates a unique scientific and computational infrastructure essential to the competitiveness and security of the American economy [see table and maps at end]. In late 2004, the Secretary of Energy Advisory Board (SEAB) appointed an 11-member Science and Mathematics Education Task Force (SMETF) to "advise the Department of Energy on how it can effectively utilize its scientific and technical resources, including its National Laboratories, to inspire, educate and encourage a new generation of career scientists and engineers to meet the challenges of the future and enhance the scientific literacy of the nation."

The Science and Mathematics Education Task Force's most important findings are these:

- During the middle school years, many of the nation's children *lose interest* in science and math; moreover, relatively few high school graduates are *interested in* furthering their education in science, technology, engineering, or math;
- 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;
- Existing DOE programs (such as the Science Bowls, Science Appreciation Day, Career Day, and the like) are important in connecting local communities—citizens, families, and students—to the world of science and to DOE scientists;
- 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;
- DOE's Laboratory Science Teacher Professional Development (LSTPD) program being piloted at selected laboratories offers a solid foundation for the Task Force's proposed Scientist-Teacher Professional Development (STPD) program, an expanded program built upon best practices, for implementation by *all* DOE laboratories;
- DOE leadership in support of K-12 teachers would both increase the credibility of the classroom teachers and would make teachers better ambassadors to students for science, technology, engineering, and mathematics (STEM) careers (including fields of potential benefit to DOE).

Numerous studies have revealed that while U.S. students enjoy and do as well as their international counterparts in achievement tests in science and mathematics through elementary school (fifth grade), in middle school they lose interest, and by high school they lag well behind other nations (*Trends in International Mathematics and Science Study*, National Center for Education Statistics, 1995, 1999, 2003; *Science and Engineering Indicators*, National Science Board, 2004 and earlier). Yet, as early as middle school, students are seriously considering career choices. So the nation's prospects depend on the "pipeline" of future scientists and engineers now in grades K-12—a conclusion also of DOE's earlier Task Force on Education (*Final Letter Report*, Hanna H. Gray, DOE Task Force on Education, December 2, 1998).

"A student's experience from kindergarten through 12th grades played a large role in influencing whether the student pursued a STEM degree," according to university officials interviewed by the GAO. Those who did major in STEM disciplines "associated their interests with teachers who taught them good skills in mathematics or excited them about science" whereas teachers who "were unqualified and unable to impart the subject matter [caused] students to lose interest" in STEM subjects. Nor is the difficulty resolved in college. Although professors may be expert in STEM fields, the GAO reported that some "do not like to teach, do not value teaching as a professional activity, and therefore lack any incentive to learn to teach effectively." (GAO, *Higher Education,* October 2005, p. 33).

One consequence of poorly qualified and unenthusiastic teachers from K-16 is that students lose interest in STEM careers, a matter of direct importance for the Department of Energy as well as to the nation at large. As a result of negative experiences, students come to perceive science to be dull, full of bewildering technical terms and abstract equations for which they think they will have no earthly use—because science is all-too-often presented as pedestrian memorization, devoid of excitement and real-life examples. Young people don't enter fields they perceive to be boring or irrelevant. They are attracted to fields they find so fascinating they can't keep their hands off them. Thus, fascination, excitement, and relevance to real-world problems are central to achieving educational goals.

Moreover, in discussions at the National Laboratories and with educational experts, the Task Force found that middle school teachers are especially critical for sustaining students' interest and enthusiasm about science, and for encouraging students to consider science or engineering as a career. Yet, standard educational training leaves middle-school teachers uniquely underserved and unprepared. In general, K-12 teachers are prepared either to be high-school subject-matter specialists, or to be elementary generalists. Middle-school teachers may be drawn from either pool. But neither background prepares a teacher to deal with the particulars of middle school: the transition from elementary to high school, the emergence of adolescence, and the shift from dependence to independence. Teachers trained to be high-school specialists find the middle-school curriculum is generally organized around subjects and 40- to 50-minute periods, similar to high school. Yet middle-school students, fresh from elementary school, lack the level of maturity and concentration required by this regimen, and with the onset of puberty can be distracted by peer relations. Teachers trained to be elementary generalists may be more comfortable with children than with budding adolescents, and lack subject-matter depth adequate for science and math at middle-school level. Moreover, even if science teachers are dedicated, enthusiastic, and knowledgeable, their effectiveness in imparting their expertise or in getting students to experience scientific inquiry -- especially at the middle-school level -- may be attenuated by an unsupportive environment or lack of resources such as up-to-date textbooks or laboratory equipment.

In the Task Force's view, the Department of Energy with its major resources has a significant opportunity to address both qualifications and enthusiasm of K-12 teachers. The Task Force feels this could be done best by offering multiyear summertime laboratory research experiences for K-12 teachers. Most elementary, middle, and high school teachers have *never been scientists themselves or experienced science as it really is*—sleuthing, detective work, investigation at the edge of the unknown—nor have they spent much time with live working scientists to be kindled by the endless curiosity that drives their research and questions about the world. Absent such experience, teachers can only teach from textbooks, which may be several years out of date, sometimes inaccurate, and often written in flat, colorless prose.

A summertime laboratory experience, by contrast, would differ significantly from the courses K-12 teachers usually take as part of their mandatory professional development. The environment of the National Laboratories also is decidedly different from that typical of current teacher preparation programs in colleges of education. Instead of sitting in classrooms, teachers would be working in laboratory settings; instead of treating teachers as adult students, the National Laboratories *accept teachers into their scientific communities as partners*. By collaborating on actual research, teachers establish long-term relationships with the scientific community, perhaps even co-authoring research papers. In turn, *teachers become genuine ambassadors of science*, extending the powers and reach of the National Laboratories into K-12 classrooms, capable of inspiring their students towards STEM careers and improved academic achievement.

During visits to the National Laboratories and discussions about DOE's current pilot Laboratory Science Teacher Professional Development (LSTPD) program, the Task Force learned that the primary value of bringing teachers into the laboratories is the far-reaching influence on them of spending several weeks in an environment of authentic, up-to-the-moment scientific research focused on critical "in the news" problems. Especially for middle-school science teachers, such genuine laboratory experiences equip them with adequate background in the science they need to teach, so they become more effective advocates for fields that their young students may feel are difficult or "nerdy." When teachers become fascinated by the enterprise, they not only bring their own understanding of science up to date, but transfer their enthusiasm to their students, who in turn begin to think seriously about STEM careers. In short, teachers' excitement and fascination become *essential* points of entry to achieving educational goals that are critical to the U.S. STEM pipeline and to DOE's own long-term manpower needs.

The Task Force's review of DOE's LSTPD and other educational programs, as well as its review of the educational efforts in other federal agencies, leads us to our conclusion that DOE has a significant opportunity to enhance STEM education in the nation. Moreover, it is clear from our review (as well as from the GAO reports) that the educational activities of DOE and other Federal agencies could benefit from increased cooperative activities with one another, with industry, with colleges and universities, and with science teachers' professional organizations. In both nationwide influence and in cooperative partnerships, DOE is already positioned to take a leadership role. DOE's National Laboratories are geographically distributed over the country [see maps at end], allowing access to teachers across the nation. Moreover, the network of

National Laboratories is also tightly linked with industrial and academic resources, giving DOE the ability to forge educational partnerships that can extend its reach, and therefore also its capacity to enhance STEM education nationwide.

Therefore, the Task Force makes the following recommendations:

Recommendation 1.

> **The Task Force recommends that DOE establish a multiyear Scientist-Teacher Professional Development (STPD) Program for K-12 teachers in each of the National Laboratories. The STPD should be based on the Laboratory Science Teachers Professional Development (LSTPD) program now being tried on a pilot scale in selected laboratories. It also should incorporate "best practices" from educational programs elsewhere in DOE. The STPD should be ramped up at all 17 National Laboratories, until it is annually serving as many school districts as feasible. The program should be designed also to assist STPD graduates to serve as mentors to other teachers within their districts who have not yet had an opportunity to participate in the STPD program themselves. The program's design also should provide for ongoing formative and summative evaluation of the program's effectiveness for both teachers and their students.**

The Scientist-Teacher Professional Development (STPD) program, which would run from four to eight weeks each summer, would place K-12 teachers into laboratory settings in which they work alongside scientists on significant research problems. The objective would be for them to experience first-hand the process of leading-edge research—pursuing questions, learning about the unknown, testing hypotheses—immersed in the reality of genuine scientific enterprises. Such an opportunity would transform them from science teachers into "scientist-teachers," giving them an insider's perspectives and providing realizations and anecdotes they can share with their students, with the aim of bringing science alive in the classroom instead of relying solely on textbook lessons.

The proposed multiyear program would build on the solid base of DOE's already-existing Laboratory Science Teachers Professional Development (LSTPD) program for K-12 teachers. Developed by DOE's Office of Workforce Development for Teachers and Scientists (WDTS) in the Office of Science, the LSTPD program is now in its third year as a small pilot program for some 100 teachers in several laboratories. Half are from high schools, a third from middle schools, and the rest from elementary schools. LSTPD teachers commit to a three-year program where each summer they spend at least four weeks at one or more National Laboratories for a mentored research experience. At the outset, the LSTPD program evaluates participants' gaps in content knowledge, and then designs a custom three-year plan for each teacher. In their first year, most teachers have chosen to be involved in an "institute" model, in which they are provided a

series of structured guided laboratory experiences (such as spending a week working in teams with scientists using a nuclear accelerator to identify an unknown material). By their second and third year of participation, however, the teachers have usually gained enough confidence to be embedded in a research lab with scientists performing actual research. Even before completing the program, many teachers are already voluntarily giving presentations at regional and national conferences and co-authoring research papers for publication.

The Task Force recommends that the LSTPD program be expanded into a full-fledged multiyear Scientist-Teacher Professional Development program. The STPD program would introduce a LSTPD-type program to the rest of DOE's National Laboratories in a consistent manner so that it can ultimately serve some 1,000 new teachers each year. Moreover, would also incorporate successful elements from other DOE educational programs for K-12 teachers now run independently at individual laboratories without central coordination.

Last, the Task Force recommends that the National Laboratories' current mentoring programs—which currently focus on high school teachers—also develop extensions appropriate for middle-school teachers that are designed around the particular challenges of those formative years.

Recommendation 2.

> **The Task Force applauds DOE's well-known Science Bowls and other successful community outreach programs. The Task Force further recommends that DOE employ its research expertise and resources, including advanced computational resources, to develop instructional simulations of scientific concepts for K-12 teachers and students, and also explore interactive remote access to its scientific facilities for classroom involvement in authentic research.**
>
> **Moreover, the Task Force recommends that DOE consider an expanded public information campaign for parents, students and teachers, to communicate vividly the essence of DOE's mission and its current research, and to convey energy as exciting, relevant, and important as a career.**

The Task Force applauds DOE's existing programs for captivating the minds and hearts of K-12 students, particularly in the critical middle-school and high-school years, and heartily encourages the continuation of the annual DOE National Science Bowl and DOE National Middle School Science Bowl, as well as the local activities (e.g., Science on Saturday). The National Laboratories also should continue to offer open houses, summer camps, visitations and other similar outreach efforts, as well as continuing to administer the Albert Einstein Distinguished Educator Fellowship program for outstanding elementary and secondary teachers.

The Task Force further recommends that DOE's National Laboratories should make extensive use of its advanced computational resources to create captivating science simulations for K-12 education, bringing scientific concepts to life with the same effectiveness that Dreamworks and Pixar have captured in creating entire fictional worlds. Just as the Council on Competitiveness' High Performance Computing Initiative has demonstrated how some of these facilities (such as those at the Sandia National Laboratory) have assisted industry in performing complex simulations to support improved manufacturing competitiveness, advanced simulations for K-12 schools might improve learning and understanding of scientific concepts. Moreover, through the Internet, such exciting educational simulations can provide interactive tools to teachers and students without requiring travel to the labs.

Moreover, the Task Force recommends that DOE should also explore providing classroom remote access to selected laboratory instruments to pursue actual scientific experiments, similar to NASA programs that allow students to work alongside scientists investigating Mars (http://mars.jpl.nasa.gov/classroom/students.html and http://msip.asu.edu/whatismsip.html), and how the National Oceanic and Atmospheric Administration's Jason program, which allows students to participate in research with pilot remote-controlled vehicles miles under the ocean (http://www.nurp.noaa.gov/Spotlight/Jason.htm]).

To complement the Science Bowl—a fast-paced and primarily verbal contest where students compete to answer questions or solve technical problems—the Task Force also recommends that DOE consider an annual Energy Olympics where K-12 students are challenged to solve some kind of energy-related problem using common materials. The goal is to lead students to experiment with materials, invent techniques, use scientific trial-and-error, and gain physics intuition through **tinkering with the real world**. Such an Energy Olympics, especially if run through school science clubs, could give DOE a high profile in K-12 schools nationwide; prizes might be college scholarships ($500 to $5,000).

Last, because the influence on students of parents and peers are as great as that of teachers, the Task Force also recommends that DOE create a coordinated public information campaign, guided by headquarters and laboratory education entities, focusing on parents, students, industry, academia, and the general public as well as on teachers. With material presented at a level accessible to parents and elementary-school teachers as well as to students and teachers in middle and high school, its purpose would be to translate current research into fascinating prose readable by the general public. Not only would that inform schools and the general public about DOE's work and research, but it would update and supplement lessons from textbooks, it would encourage parents to discuss interesting breaking science news with their offspring—and it would reinforce the science-education standard of science being a process. As just a few starter ideas for inspiration (not requirements), the campaign might include:

- an effective news web site that might be titled Science@DOE, modeled on the popular Science@NASA site (which now draws some 100,000 hits per day), written to be accessible at the middle-school level;

- a series of inexpensive or even free kits devised by DOE for students and teachers to learn energy concepts using everyday materials—solar power, wind power, water power, gravity power, etc., and to encourage hands-on experimentation and tinkering.
- an agency-wide quarterly color glossy STEM magazine for teachers—perhaps titled *The Energy Teacher* (a deliberate echo of *The Science Teacher* published by the National Science Teachers Association)—whose articles could feature profiles of the National Laboratories, news of DOE's educational programs, practical hands-on classroom science experiments and activities, and teachers' feedback evaluations and suggestions.

Recommendation 3.

The Task Force recommends that the Department of Energy reestablish an Office of Education reporting directly to the Secretary of Energy, to oversee all educational activities. It should call for the U.S. Congress to commit to increasing funding for education within the DOE appropriate to the magnitude of the task and commensurate to the size of the agency, funds that should be earmarked solely for K-12 STEM education.

DOE should also recommend to the President that he call on all Executive Branch departments and independent agencies to renew, invigorate and coordinate K-12 STEM educational outreach programs. DOE should take a leadership role in developing educational efforts and materials together with other Federal agencies and organizations, and according to "best practices" in metrics for assessing the effectiveness of both teacher professional development and student education.

The Task Force's findings are independently confirmed by the GAO reports of 2005 and 2006, which revealed that although there are more than 200 K-12 education programs in various Federal agencies, the programs are not coordinated in any way, and few of them have been evaluated for their actual effectiveness for teachers or students.

The Task Force therefore recommends that the Secretary of Energy should recommend to the President that all Executive Branch departments and independent agencies renew and invigorate STEM educational outreach programs, and that a high-level interagency working group be tasked to gather and share "best practices" in both teacher professional development and student education programs and assessment metrics. The Task Force further recommends that agencies partner with each other, with industry and academia, and with such organizations as the National Science Teachers Association and the National Science Education Resources Center.

The Task Force further recommends that DOE take a leadership role in such coordination. The Secretary of Energy should recommend that an Executive Order be issued charging DOE to establish an MOA/MOU with all Federal agencies to develop an integrated plan for STEM

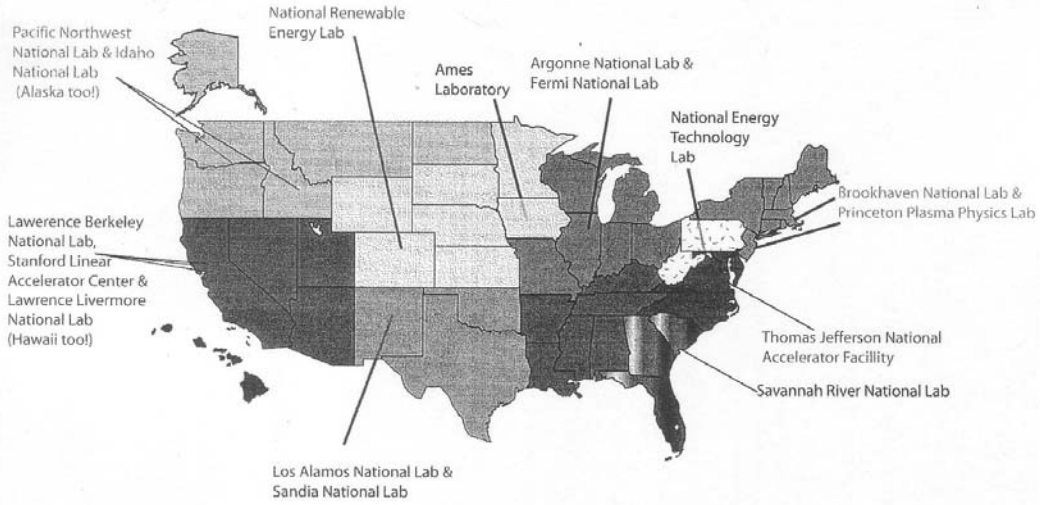
education congruent with the mission of each agency or department. Furthermore, the Secretary of Energy should recommend that the DOE's Office of the Undersecretary for Science be charged with establishing an external steering committee to guide the implementation of these recommendations and, in particular, guide the scaling of existing best practice programs for maximum impact as well as the bringing of pilot programs to full scale.

DOE Multi-Program and Single Program Laboratories

Major Multi-program Laboratories	Single-program Laboratories
Argonne National Laboratory[1]	Ames National Laboratory[1]
Brookhaven National Laboratory[1]	Fermi National Accelerator Laboratory[1]
Lawrence Berkeley National Laboratory[1]	National Energy Technology Laboratory[5]
Lawrence Livermore National Laboratory[2]	National Renewable Energy Laboratory[4]
Los Alamos National Laboratory[2]	Princeton Plasma Physics Laboratory[1]
Oak Ridge National Laboratory[1]	Savannah River National Laboratory[3]
Pacific Northwest National Laboratory[1]	Stanford Linear Accelerator Center[1]
Sandia National Laboratories[2]	Thomas Jefferson National Accelerator Facility[1]
Idaho National Laboratory[6]	

1 Laboratories Managed by the Office of Science
2 Laboratories Managed by the National Nuclear Security Administration
3 Laboratory Managed Office of Waste Management
4 Laboratory Managed Office of Energy Efficiency and Renewable Energy,
5 Laboratory Managed Office of Fossil Energy
6 Laboratory Managed Office of Nuclear Energy

Locations of DOE National Laboratories and Other Facilities



LAB	Region	States
ANL/Fermi	Great Lakes	IL, WI, IN, OH, MO, MI
Ames	Mid West	IA, MN, SD,
NETL	Amish	PA, WV, (OH?)
BNL/PPPL	North East/ New England	ME, NY, VT, NH, MA, CT, RI, NJ,
LBNL/SLAC/ LLNL	West Coast	CA (full representation!), HI, NV, AZ, UT
SRNL	Deep South	SC, GA, FL
ORNL	Deep South	TN, MS, AL, LA, AR, KY
LANL/SNL	South West	NM, TX, OK
TJNAF	Chesapeake Bay	VA, DC, NC, MD, DE
PNNL/INL	Pacific Northwest	WA, OR, AK, ,ID, MT, ND, WY
NREL	West	CO, WY, NE, KS

Attachment A

Science and Mathematics Education Task Force

BACKGROUND AND FINDINGS

A National Educational Crisis in Science Technology Engineering and Mathematics (STEM)

Until the launch of Sputnik in October 1957, the United States was regarded as the undisputed world leader in space exploration and technological advance. Overnight, Soviet national focus and technological advance changed that perception. Immediately, the U.S. sought to regain its footing as the world leader in science and technology. One of the most prominent U.S. responses to Sputnik was the National Defense Education Act of 1958. The NDEA provided substantial financial aid to education at all levels, stimulating the advancement of programs in science, technology, engineering, and mathematics (STEM) as well as in foreign languages. It inspired a generation of high school and college students to become scientists, mathematicians, and engineers and to innovate and expand American technological sophistication.

Today, half a century later, the U.S. again faces a threat to its research preeminence. As our investment and national interest in science and technology has at best leveled off, other nations are making major investments in science and technology and viewing these investments as building a foundation for a successful future of economic competitiveness. The most commonly cited examples are the enormous strides of the last 20 years in India, China, and nations of the "Pacific Rim" whose potential consequences to American balance of trade and prosperity has been illustrated in widely read books such as *The World is Flat: A Brief History of the Twenty-First Century* by Thomas L. Friedman (Farrar, Straus, and Giroux, 2005). Many developing nations are investing in higher education and long-term R&D. In 2004 while the U.S. awarded 70,000 engineering degrees, India graduated 350,000 engineers and China 600,000. Even Japan, which has roughly half the population of the U.S., graduated nearly twice as many engineers. For science degrees, the U.S. now ranks 17th in the world in the *number* of 18-24 year olds who receive degrees in science—and the *percentage* of the 18-24 year old population with science degrees is even lower. A consortium of U.S. high-tech business organizations recently released a report calling for the U.S. to "double the number of science, technology, engineering and mathematics graduates with bachelor's degrees by 2015." (*Tapping America's Potential: The Education for Innovation Initiative,* U.S. Chamber of Commerce, Business Roundtable, 2005, p. 1)

Even worse for future prospects, the pipeline of potential future scientists and engineers now in grades K-12 looks bleak. In the early grades, the nation's children have a keen interest in mathematics and science, and get a quick start in computer literacy growing up with Internet access in a nation that is a global scientific superpower. During the middle-school years, however, the nation's children lose interest in science and math. According to the National Center for Education Statistics, U.S. fourth and eighth graders finish in the middle of the international pack in math. According to the Third International Mathematics and Science Study (TIMMS) in 1999, U.S. school children perform well at the fourth grade level, but their scores fall during middle school, and by high school their achievement levels lag behind nearly every other industrialized nation, and high school seniors (12^{th} graders) perform below the international average in math and science.

The United States cannot sustain world leadership in science if the achievement records of the nation's young students do not improve, and if more STEM degrees at all levels are not awarded to U.S. citizens. Moreover, the rapid pace of technological change and the globalization of the economy demand that the nation's general workforce be literate in science and math. According to the National Science Board (NSB), the U.S. has considerable work to do:

> *If the trends identified in [NSB's] Indicators 2004 continue undeterred, three things will happen. The number of jobs in the U.S. economy that require science and engineering training will grow; the number of U.S. citizens prepared for those jobs will, at best, be level; and the availability of people from other countries who have science and engineering training will decline, either because of limits to entry imposed by U.S. national security restrictions or because of intense global competition for people with these skills.*

This growing national educational crisis and the concomitant urgent need to reinvigorate and inspire a new generation of mathematicians, scientists, and engineers have been studied and documented in half a dozen independent major reports over the past decade. Just a few of their conclusions (emphasis added) are:

- "Americans are living off the economic and security benefits of the last three generations' investment in science and education, but we are now consuming capital. Our systems of basic scientific research and education are in serious crisis, while other countries are redoubling their efforts…. In this Commission's view, the inadequacies of our systems of research and education pose a greater threat to U.S. national security over the next quarter century than any potential conventional war that we might imagine. …" (*Roadmap for national security,* the Hart – Rudman report, 2001)
- "Our Nation's bright future rests today, as in the past, on the combination of exceptional creative brain power and our unique free enterprise system…. The human talent spawning industrial growth has largely been drawn from those having advanced science and engineering capabilities…. [Today] U. S. students are weak in math and science skills and lag behind most of the world in these capabilities. … [PCAST] identified a

number of top-level recommendations: (1) improving the K-12 educational system; (2) improving K-12 teacher preparation; and (3) improving undergraduate and graduate STEM training and retention." (*Sustaining the Nation's Innovation Ecosystem*, President's Council of Advisors on Science and Technology [PCAST], 2004, pp. 1, 9*).*

- "The legacy America bequeaths to its children will depend on the creativity and commitment of our nation to lead a new era of prosperity at home and abroad…. catalyze the next generation of American innovators: (1) Stimulate creative thinking and innovation skills through problem-based learning in K-12, community colleges, and universities, and (2) create innovation learning opportunities for students to bridge the gap between research and application." (*Innovate America*, report of the National Innovation Initiative, Council on Competitiveness, 2004, p. 9)
- "The United States takes great pride in the vitality of its economy, which forms the foundation of our high quality of life, our national security, and our hope that our children and grandchildren will inherit ever-greater opportunities. … Past economic studies have estimated at least 85% of growth in U.S. income per capita is due to technological change. … [T]he committee is deeply concerned that the scientific and technical building blocks of our economic leadership are eroding at a time when many other nations are gathering strength. … To address these challenges, the committee structured its ideas according to four basic recommendations that focus on the human, financial, and knowledge capital necessary for U. S. prosperity. … **Recommendation A: Increase America's talent pool by vastly improving K-12 science and mathematics education** . . ." (*Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, National Academies, 2005. Executive Summary, pp. 1–4)
- "The bedrock of America's competitiveness is a well-educated and skilled workforce. Education has always been a fundamental part of achieving the American Dream… The *American Competitiveness Initiative* (ACI) funds increased professional development for teachers, attracts new teachers to the classroom, develops research-based curricula, and provides access to flexible resources for worker training." (*American Competitiveness Initiative: Leading the World in Innovation,* Domestic Policy Council & Office of Science and Technology Policy, 2006, p. 1).

Teacher Quality a Central Factor in Addressing the STEM Education Crisis

The pipeline of students interested in entering careers in science and engineering critically depends on the quality of STEM teachers. Teacher quality primarily depends on two things: a deep knowledge of subject matter and effective teaching skills.

President Bush's "No Child Left Behind" Act 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 less than a 50% chance of being taught by a science or math teacher who holds both a license and degree in the subject area (The National Commission on Mathematics and Science Teaching for the 21st Century 1999). The National Academies' 2005 report *Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future* focuses directly on teachers. It calls for annually attracting 10,000 new STEM teachers as well as strengthening the skills of 250,000 current teachers through "training and education programs at summer institutes…"

These reports conclude that it is with *teachers* that the first efforts to STEM education must begin. Moreover, those reports suggest that the biggest impact for improvements in STEM in the U.S. can occur by funding programs for K-12 teachers.

Overview of DOE National Laboratories

The Department of Energy is the single biggest civilian research and development agency in the United States. DOE is responsible for fully 40 percent of the Federal investment in physical science, as well as 14 percent of Federal basic research investments in mathematics and computing, environmental sciences, and engineering. Approximately 37 percent of DOE's entire budget is allocated to R&D. It has an excellent record of scientific accomplishment. The DOE is most noted for its 17 National Labs that are considered the world's premier centers of excellence in scientific research. The National Laboratories are managed by different program offices within the Department of Energy. The offices of Waste Management, Energy Efficiency and Renewable Energy, Fossil Energy and Nuclear Energy each manage one National Lab. The National Nuclear Security Administration manages three National Labs and the Office of Science manages 10 National Labs.

The Department of Energy's 17 National Laboratories are a critical national resource. They are geographically distributed in 19 states of the nation (some labs have sites in more than one state) and house exceptional scientific and engineering facilities of unparalleled strength and importance. Although most noted for there physical sciences and engineering, the National Labs execute substantial amounts of basic and applied research in all the natural sciences. In aggregate, the National Labs employ some 55,000 scientists, mathematicians, engineers and technical personnel. Moreover, each year, the Office of Science facilities alone are used by more than 18,000 additional researchers from universities, other government agencies, and private industry.

From its inception in 1977, one of DOE's primary missions was to "support continued United States leadership in science and technology." Because of its unique scientific facilities and profile as the nation's premier centers of science, the Department has historically played a significant role in supporting the career development and professional achievement of many of the nation's leading scientists and engineers.

In the last decade, before the Science and Mathematics Education Task Force (SMETF), DOE has twice looked to appointed task forces to examine DOE's potential role in education and issues in communicating its core missions. In 1997, Secretary of Energy Federico Peña asked SEAB to form a Task Force on Education to investigate ways "how the Department of Energy can most effectively use its unique resources in science and technology to bolster science, technology, engineering and mathematics education, and the scientific literacy of the American public."

Chaired by Hanna H. Gray (president emerita of the University of Chicago), the Task Force on Education issued its *Final Letter Report* to Secretary of Energy Bill Richardson on December 2, 1998. While noting that "it is not the Department's mission to fix the problem of science education in this country," the report suggested that DOE "should view education as a very important role within its appropriate sphere of activities," focusing on programs "closely linked to its programmatic activity and mission, to the organization of the laboratories and facilities, to the special strengths of those institutions, and to the particular strengths of the scientists and other technical experts working there." The Gray report found DOE's "undergraduate, graduate, and post graduate programs to be excellent," but identified two further areas of greatest potential contribution for the nation: science, math and technology education at the K-12 level—with particular emphasis on the preparation of teachers—and improving the scientific and technological literacy of all Americans. It also observed that the DOE's strategic missions (national security, energy security, environmental clean-up, and basic science research) were not well known or understood by the general public.

On May 8, 2002, SEAB chartered another Task Force, this one on the Future of Science Programs at the DOE, to evaluate the content and structure of science programs at the DOE "to [identify] current and future opportunities to advance DOE's mission through coordinated and focused scientific research" and to "address questions regarding strategies for positioning the Department's science program" to meet critical 21st-century needs. Chaired by Charles M. Vest, president emeritus of the Massachusetts Institute of Technology, the Task Force on the Future of Science Programs published its final report *Critical Choices: Science, Energy, and Security* on October 13, 2003.

In reviewing the mission of DOE, the 2003 Vest report states:

> The U. S. Department of Energy serves our nation through three essential missions – Energy, Security, and Science.
>
> The Department of Energy (DOE) is responsible for:
>
> - Developing and promoting policies, programs and technologies to assure that the Nation will have secure, sustainable, clean and affordable sources and distribution of energy;
> - Contributing to our national defense and homeland security by maintaining our nuclear capability and by developing and operating unique research programs and infrastructure to support this mission;
> - Developing and operating programs and infrastructure to maintain U.S. leadership in two domains: science and advanced technology that directly support the Department's energy and security missions, and areas of fundamental scientific research for which it has stewardship; and
> - Protecting the environment by providing a responsible resolution to the environmental legacy of the Cold War and providing for the permanent disposal of the Nation's high-level radioactive waste.
>
> The Department of Energy has the primary federal role in providing policy, scientific and technological leadership, vision, and accomplishment… no other federal agency has a mission of more fundamental importance to the future of our nation and planet. It is imperative that the DOE's priorities and budgets reflect a sense of urgency… (Vest, 2003)

Although the Vest report's focus was not on education, it nonetheless urged that the "Department of Energy must lead our nation effectively by… Inspiring, attracting, educating and training the best and brightest as scientists and engineers for careers in DOE-related fields." Specifically, the Vest report declared that "**America can be free, secure and economically strong in the 21st century only if we continue to excel in science and advanced technology.** … It is, therefore, imperative that we improve education at all levels, paying particular attention to the quality, attractiveness, and effectiveness of science, mathematics, and engineering education." That includes "…**strengthening its outreach at the K-12 level.**" In the Task Force's view, "just as NASA inspires school children with the excitement and beauty of space 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 world." (Vest, 2003, pp. vi, 4, 24, 25; the report's own emphasis)

On July 8, 2004, Secretary of Energy Spencer Abraham announced that DOE and its National Laboratories were launching the Science Education Initiative to promote science literacy and help develop the next generation of scientists and engineers. The Science Education Initiative includes a seven-step program named STARS: Scientists Teaching and Reaching Students, to enhance the training of math and science teachers, grow students' interest in math and science, especially in the critical middle-school years, and to draw attention to male and female DOE scientists who have done well—all to encourage young people and prospective teachers to pursue careers in math and science. STARS initiatives are:

- Bringing K-12 teachers and community college faculty to DOE's national energy laboratories where they will work with scientists and engineers to improve their knowledge of science and ability to teach through the DOE Laboratory Science Teacher Professional Development program;
- Upgrading Argonne National Laboratory's successful "Ask a Scientist" web site;
- Organizing and hosting annual "What's Next?" conferences joining scientists and corporate innovators to demonstrate breakthrough technologies, to focus national and student attention on how exciting science may change our daily lives;
- Sponsoring Career Day programs by sending scientists out to local schools, especially middle schools, to conduct hands-on experiments in science classes, discuss careers with students, help with science fair projects, and hold open houses at the labs;
- Hosting Science Appreciation Days at the national energy laboratories for 1,000 fifth-graders and 1,000 eighth-graders;
- Enlisting Nobel laureates and other scientific leaders to draw attention to science as a career;
- Creating an Office of DOE Science Education to coordinate and implement the Secretary's initiative.

Secretary Abraham created the SEAB Science and Mathematics Education Task Force (SMETF) to assess what additional ways DOE can help improve science education in America.

The Science and Mathematics Education Task Force's Findings

The Task Force was asked to build upon the Secretary of Energy's seven-step Science Education Initiative, and to propose both short-term and long-term initiatives that show how DOE could use its National Laboratories to encourage children and young adults (K-12) to pursue education and perhaps careers in mathematics, science, and engineering.

From the outset the Task Force also was aware of the importance of connecting its recommendations for DOE educational activities to the ongoing efforts of the National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), the Department of Education (ED), other Federal agencies, and other national organizations (such as the National Science Teachers Association (NSTA).

The Task Force also reviewed DOE's manpower needs, in particular the unique requirements for skilled professionals in science, engineering, and technology to fulfill DOE's responsibilities in promoting scientific and technical advances essential to the wellbeing and security of our nation. The agency expects a large number of retirements of critical personnel over the next ten years and, given the low rate of U.S. citizens who are pursuing STEM careers, it is questionable whether the DOE can effectively staff its future technical requirements.

DOE's Transforming Influence: Teachers 'Becoming' Scientists

The environment of the DOE National Laboratories is decidedly different from that of colleges and universities. Academic institutions, by design and conditioning, connote an environment of two populations: teachers and students. Thus, a high school teacher who participates in a professional development program at a college or university typically feels like a student. In contrast, the National Laboratories *accept teachers into their scientific communities as partners*. By collaborating on actual scientific research, teachers establish long-term relationships with the scientific community. In turn, *teachers become genuine ambassadors of science*, extending the powers and reach of the National Laboratories into K-12 classrooms, capable of inspiring their students towards STEM careers and improved academic achievement.

During the Task Force's visits to the National Laboratories, one of the most important discoveries was the Laboratory Science Teachers Professional Development (LSTPD) program, now in its third year. Developed by the staff of the Office of Workforce Development for Teachers and Scientists (WDTS) in the Office of Science, the LSTPD program is intended to create a cadre of outstanding elementary, middle, and high school science and math teachers who will serve as leaders in their local and regional teaching communities. The goal of the LSTPD program is to address a major shortcoming of primary and secondary science and mathematics education in this country: that STEM teachers all too often do not have a sufficient level of content knowledge or deep appreciation of STEM and therefore can neither effectively teach nor inspire their students.

LSTPD teachers commit to a three-year program where each year they spend at least four weeks at one or more National Laboratories for a mentor-intensive research experience. At the outset, the LSTPD program evaluates participants' gaps in content knowledge, and then designs a custom three-year plan for each teacher to transform them into effective leaders in STEM education. LSTPD program assessments include:

- Evaluation of participant's subject-matter knowledge and skills prior to and progressing through the program;
- Long-term tracking and evaluation of the programs impact on participants' pedagogy, professional development and leadership;
- Long-term tracking of impact on student achievement;
- Evaluation of evidence that participants were agents of change in the schools and district through their instituting enhanced teacher collaboration, teacher professional development, enhanced inquiry-based instruction, data driven decision making, extracurricular science activities, etc.

In the current LSTPD program, middle school teachers in their first year of participation have most often chosen to be involved in an "institute" model: rather than be embedded in a research lab with scientists performing actual research, they are provided a series of scientific experiences structured on authentic discovery-based investigations. For example, at one laboratory, middle school teachers spent a week working in teams with scientists using a nuclear accelerator to identify an unknown material. At another National Laboratory, fifth- and eighth-grade physical science teachers participated in a four-week institute where scientists prepared rigorous coursework, lectures, and laboratory experiments to beef-up the teachers' scientific expertise in magnetism, optics, and electricity. By their second and third year of participation middle school teachers have often gained enough confidence to move to the embedded "Teacher as Researcher" model. A critical component of this program, which is unusual for professional development programs, is that each teacher is given up to $4,000 per year to buy materials for their classrooms and travel to professional conferences. This allows teachers to effectively execute their new knowledge and technical skills in their classrooms and also have an impact on the wider educational community.

Current LSTPD program outcomes include:

- Entrance evaluations were made of 99% of participants to establish base-line values;
- Attrition rate for 101 participating teachers over the program's three years is under 5%;
- Many teachers are already voluntarily giving presentations at regional and national conferences and submitting papers for publication;
- External Evaluator's summary: "The LSTPD program in its pilot year was an overall success." (Worldviews, LLC**)**

The pilot LSTPD program is currently funded at $1.8 million, which provides for 115 participants. A third are teachers from middle schools, a handful are from elementary schools, and the rest from high schools. Since the funding has been relatively low, there has been little need for advertising or trying to get an even balance of high and middle school teachers. A draft assessment of the program was published in April 2005 and additional assessments are to be conducted each year of the program, with a comprehensive assessment preformed when the program is fully instituted for more than 3 years at more than 300 participants.

In addition to the LSTPD program, there are other DOE education programs for both teachers and students, not just at the Office of Science labs, but at other DOE National Labs such as the National Renewable Energy Laboratory, Los Alamos National laboratory and the Lawrence Livermore National laboratory. These programs are typically regional in scope. The director of the WDTS office in the Office of Science has initiated annual meetings with all of the 17 National Laboratories science education directors and program staff to discuss their various programs and share best practices. This has allowed the National Labs to prepare a coherent plan and common metrics for a national teacher professional development that could run at all DOE National labs.

DOE's Advanced Scientific Computing Centers

The National Laboratories hold the most powerful civilian computers in the world (as just one example, in 2006, the Oak Ridge National Laboratory's advanced computing center will be operating at 100 teraflops). Such computing prowess is needed for the advanced simulation of complex phenomena, as well as maximizing the value of DOE's synchrotron light sources for fundamental research in the physical and life sciences. Moreover, the Office of Science's Office of Scientific and Technical Information, which manages the distribution and virtual collection of scientific and technical information for the entire DOE, has pioneered web-based technology that gathers and distributes scientific and technical information across all Federal science agencies.

DOE could harness these mammoth computing resources to develop and deliver unparalleled K-12 science education. First, animated simulations could make concepts in science and mathematics more compelling and more accessible for a wide range of students and perhaps quicken their learning time, as well as help teachers themselves gain more scientific understanding and competence. Second, just as NASA and NOAA have captivated students' and teachers' through their "Challenger" and "Jason" projects, which respectively engage students in space and deep ocean exploration by allowing classrooms actually to manipulate real spacecraft and undersea vehicles, DOE could provide exciting opportunities of a similar authentic interactive nature by allowing remote access of its unique advanced facilities and computing centers in its National Labs.

Attachment B

FUNDING HISTORY OF DOE EDUCATION PROGRAMS SINCE 1990

In thousands

	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998
Totals	27,282	44,945	54,200	55,700	54,074	60,731	18,921	*	*

* No funding provided specifically for education activities in FY 1997 and FY 1998; however, Congress allowed DOE to fund activities within available program funding.

	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
Totals	4,500	4,472	4,460	4,460	5,392	6,432	7,599	7,192

Attachment C

SEC. 1102. EDUCATIONAL PROGRAMS IN SCIENCE AND MATHEMATICS.

(a) SCIENCE EDUCATION ENHANCEMENT FUND.—*Section 3164 of the Department of Energy Science Education* Enhancement Act (42U.*S.C. 7381a) is amended by adding at the end:*

"(c) SCIENCE EDUCATION ENHANCEMENT FUND.—The Secretary shall use not less than 0.3 percent of the amount made available to the Department for research, development, demonstration, and commercial application for fiscal year 2006 and each fiscal year thereafter to carry out activities authorized by this part..".

(b) *AUTHORIZED EDUCATION ACTIVITIES.—Section 3165 of the Department of Energy Science Education Enhancement Act (42U.S.C. 7381b) is amended by adding at the end the following:*

"(14) Support competitive events for students under the supervision of teachers, designed to encourage student interest and knowledge in science and mathematics.

"(15) Support competitively-awarded, peer-reviewed programs to promote professional development for mathematics teachers and science teachers who teach in grades from kindergarten through grade 12 at Department research and development facilities.

"(16) Support summer internships at Department research and development facilities, for mathematics teachers who teach in grades from kindergarten through grad 12.

"(17) Sponsor and assist in educational and training activities identified as critical skills needs for future workforce development at Department research and development facilities.".

Attachment D

Science Education Programs
Department of Energy
National Laboratories

Prepared by: The Office of Workforce Development for Teachers and Scientists

Argonne National Laboratory Science Education Programs

Pre- College

Argonne Community of Teachers (ACT)

ACT is a network of science, math, computer science, and technology teachers whose purpose is to interact with other teachers, to exchange ideas and teaching materials, to link interested teachers to Argonne National Lab resources, and to assist in the development and implementation of new programs.

The Argonne Educational Outreach Vehicle and Summer Teacher Enhancement Institute

This is an enhancement program for precollege teachers intended to promote the use of sophisticated scientific research tools in precollege science courses. This program involves two main components: (a) training teachers in the operation and application of cutting edge research equipment, and (b) establishing a mechanism by which teachers can borrow the research equipment for use in their classroom. *Forensics* is utilized as a unifying multidisciplinary theme for the teacher institute and as a springboard for classroom activities.

Undergraduate

Nuclear Fuel Cycle Summer Program Cross-Cutting Technologies for a Sustainable Energy Future

Over the course of the summer, participants will work on projects relevant to the nuclear fuel cycle and participate as a team in several activities designed to explore cross-cutting topics in this area. The summer will begin with a kick-off conference providing an overview of government-sponsored research on the nuclear fuel cycle. Throughout the summer, participants will have opportunities to discuss technologies and tour facilities with researchers actively engaged in the nuclear research and development mission. At the end of the summer, participants will share the results of their projects at a conference featuring their posters or presentations.

Cooperative Education

Appointments made primarily during the academic year are typically available to students after completion of four semesters. Salaries are competitive and are based upon the field of study and academic year status of the student.

To be eligible for an appointment, a student must:

- have a grade point average of at least 2.5 on a 4.0 scale,
- be a full-time student, and
- be eligible for their college/university Cooperative Education Program.

Argonne has two types of CO-OP Programs:

- Alternating (semester at Argonne, followed by semester at college/university) and
- Parallel (part-time work to a maximum of 24 hours per week concurrent with full-time college/university enrollment).

A student who is employed in the CO-OP Program is expected to work a minimum of one year as a parallel CO-OP or three semesters as an alternating CO-OP. Students who are interested in shorter lengths of employment should apply for the Research Aide appointment described in the preceding section. Graduate CO-OP opportunities are available to students while they are attending graduate schools in the Chicago area activities.

Graduate

Nanoscience Research Summer School

Purpose: The main purpose of the School is to educate graduate students attending U.S. universities on the scientific opportunities associated with the emerging fields of nanoscience and nanotechnology. The School will offer tutorial lectures on the principles of nanofabrication including chemical and bio-self-assembly and electron beam lithography. The School will also be devoted to the characterization of novel nanocomposite materials via seminars as well as hands-on experiments.

Target Audience: Graduate students attending US universities majoring in physics, chemistry, biology, materials science, or related engineering fields. A limited number of postdoctoral appointees and junior scientists from universities, national and industrial laboratories may be selected to attend as allowed by the class size.

Brookhaven National Laboratory

Pre-College

MAGLEV Contest

Long Island, like so many areas, has traffic congestion problems. Many experts believe the best way to solve them is to design new transportation systems. One approach is to develop "MAGLEV" vehicles which float over a fixed track, supported (levitated) and driven by magnetic fields. This is like flying with lift provided by magnets instead of wings. In this contest, you will learn about MAGLEV technology and use math, science, and technology principles to optimize the design of a MAGLEV vehicle.

Community Summer Science Program (CSSP)
The summer high school research program at BNL consists of four separate programs based on grade level and previous experience at BNL. Preference is given to Suffolk County students.

- If you have completed 10th grade, please apply to this program.
- If you have completed 11th grade and have NOT participated in a BNL high-school research program, please apply to this program.

If you have completed 11th or 12th grade and HAVE participated in a BNL high-school research program, please apply to the High School Research Program.

Minority High School Apprenticeship Program (MHSAP)
This program offers research apprenticeships to students who have **completed 9th grade** during the 04-05 academic year and are an under-represented minority (African Ancestry, Hispanic/Latino, Native American or Pacific Islander).
Students should have demonstrated ability and/or potential in science-oriented studies and activities. Each high school in Suffolk County and Inner City Outreach schools are invited to submit nominees for participation.
Approximately 15 students are selected to participate in a four-week program. The program consists of four one-week modules of instruction: physics, biology, chemistry, and environmental science

Undergraduate

College Mini-Semester
Offers exposure to modern day science through environmental science and technology exploration to students selected from schools affiliated through BNL partnerships. Students spend one week during college breaks to introduce them to the Lab's science. All students in good standing who attend our affiliated schools are invited to apply; strong emphasis is placed on ethnic and gender diversity. Some of these students return to BNL as part of the Community College Institute (CCI) or the Science Undergraduate Laboratory Internship (SULI). Both of these programs offer students the opportunity to become part of a scientific research team for a summer. The SULI program also offers internships during the fall and spring semesters. Non-affiliates are encouraged to join.

Fermi National Accelerator Facility

Pre College

Phriendly Physics
Phriendly Physics takes a slightly different approach. Teachers enhance their understanding of physics concepts relevant to the classroom curriculum during a week-long summer institute. A team of Fermilab physicists and master teacher offer the instruction.

Particles and Prairies

Midlevel students have a unique opportunity to be scientists by doing research that will provide meaningful data for researchers and by collaborating with students from other schools in ongoing research. Teachers may purchase a kit of curriculum-related materials. The instructional materials include an optional award-winning videodisc with thirty-seven segments and ten slide collections covering four aspects of the prairie: its history, restoration, ecology and its use as a research site. A barcode guide and software with activities and databases of plants and birds comes with the videodisc.

Undergraduate

Summer Internships for Physics Majors

Fermilab offers internships for undergraduate physics majors to introduce them to the current methods and problems of high energy physics research. Occasionally, students in closely related fields of study such as computer science or engineering are accepted into the program when suitable projects arise.

Summer Internships in Science Technology for Minority Students

Fermilab offers summer internships that introduce minority students majoring in physics, electrical engineering, mechanical engineering and computer science to the current methods and problems of high-energy physics, particle beam physics and their related engineering endeavors.

Approximately 20 students of high academic achievement whose career interests coincide with Laboratory activities are selected each summer to work at Fermilab. These students are given a work assignment, tied closely to the research being done at Fermilab, which culminates in a scholarly paper. The papers are published by the Equal opportunity Office at the end of the term and available to the home university. In addition to the technical work, interns participate in a lecture series on accelerators and particle physics. Local transportation and housing is provided. A senior scientific or engineering staff person serves a supervisor during the summer. Appointments are for 11 weeks.

Graduate

Prairie Science Experience

Fermilab offers two graduate level programs for teachers who want to enhance their regular curriculum with prairie science experiences. Groups of teachers have developed Instructional materials that make the Fermilab prairie accessible to intermediate and midlevel classes. Teachers study the Fermilab field study sites, pertinent background information, and student and teacher materials. After incorporating the activities into their curriculum, teachers may schedule a prairie experience for their classes at Fermilab.

Accelerator Physics Graduate Research Appointments

University students who have passed all their graduate physics qualifying exams and are ready to choose a thesis topic are eligible to join this program. They arrange for a sponsor in their Physics Department, often a member of the high energy physics group, who is Fermilab's contact with

the university while the student is carrying out thesis research at Fermilab. A Fermilab committee interviews candidates, approves thesis topics, and assures the university of the student's progress. A Fermilab staff member, approved by both the committee and the university, is the student's supervisor during the thesis work here. Thesis problems can be in either theoretical or experimental accelerator work.

Idaho National Laboratory

Pre College

Student Action Teams

The INEEL offers a career development opportunity for high school students to team up with scientific and technical experts at the Lab. During an 8-week summer program, students are immersed in a research or applied project. Students are given opportunities to learn and apply science, mathematics, engineering, and technology concepts that reinforce as well as complement and go beyond a typical high school curriculum. Students are given confidence-building opportunities that deepen their knowledge and strengthen their career interests in science, mathematics, engineering, and technology.

INEEL Scholastic Tournament

The Scholastic Tournament is a quiz bowl competition matching math and science wits between Idaho high school students. The INEEL takes the tournament on the road, holding regional meets in the panhandle, the Treasure Valley and Eastern Idaho. The tournament is divided into three divisions reflecting school size, Class A, Class B, and Class C. Winners of the regional meets advance to the state championships in Boise to compete for their respective state titles. Each of the three championship matches are broadcast statewide on Idaho Public Television.

Undergraduate

Undergraduate Summer Fellowship

Full-time research support from 10 to 16 weeks during the summer, four awards per student maximum. Early termination may receive reduced stipend.

Undergraduate Academic Semester Fellowship

Minimum 15 weeks duration, 10-20 hours weekly, four academic awards per student maximum, no extensions, early termination may receive reduced stipend.

Graduate

Graduate Fellowship

This fellowship program is designed for students seeking either a masters or doctoral degree. The INEEL offers full- or part-time research experience to graduate students who would like to conduct research applicable to a thesis, dissertation, or project. Graduate appointments can be awarded up to 12 months and may be renewed for a cumulative maximum of 3 years. Depending on the research project, participants can be located at the INEEL, their university, or both. Before submitting an application for a graduate fellowship, it is imperative that the applicant or his/her

major advisor establish contact with the scientist or engineer who will serve as the INEEL mentor.

Lawrence Berkeley National Laboratory

Pre College

High School Student Participation Program (HSSPP)

Lawrence Berkeley National Laboratory provides talented high school students from the San Francisco Bay Area with summer work experiences in science, computing sciences, technology and related areas. Selection is based on the applicant's grades, especially in science and mathematics courses and demonstrated commitment to a future career in the sciences, computer sciences, engineering or related field. Teacher recommendations were an important factor in choosing candidates.

Genome Science Education Outreach 7th Grade School Tours at Berkeley Lab

Program goals:

- to bring ethnically diverse 7th Grade Life Science classes to the Lab to:
  - build a giant DNA model
  - learn about genetics and Sickle Cell Anemia
  - interact with the scientists who do the research
  - tour the lab to see state-of-the-art research tools
  - extract DNA from fruit in a hands-on activity
  - do a hands-on experiments
  - encourage interest in science careers

This program is approximately 2 hours and is available by appointment at Lawrence Berkeley National Laboratory Genome Science Center. Financial support for buses from schools with 30% or more of ethnically underrepresented students may be available.

Undergraduate

Computing Sciences

Computing Sciences at Berkeley Lab hosts a 12-week summer program for students majoring in Computer Science and related disciplines, which provides students with the opportunity to gain relevant, research experience while they are pursuing their degree. Participants will work on well-defined projects under the guidance of one or more members of Computing Sciences.

Graduate

Washington, DC Energy Efficiency Internships

Internship responsibilities include extensive research, interviewing, writing, and qualitative data analysis. Berkeley Lab Washington Interns are expected to be able to work with considerable independence, based on general guidance from a mentor drawn from our core staff. Each intern will prepare and present to LBNL staff a technical presentation at the end of the internship.

Lawrence Livermore National Laboratory

Pre College

Expanding Your Horizons

Expanding Your Horizons Conferences are one day conferences for young women, grades 6-12, that are designed to encourage them to consider careers in math and science related fields. In our region, the Consortium sponsors three conferences: Mills College EYH (Oakland), Tri-Valley EYH (San Ramon), and San Joaquin EYH (Stockton)

Fun with Science

Scientists from Lawrence Livermore National Laboratory travel to your school site to conduct interactive science presentations and demonstrations in chemistry, physical sciences, and environmental sciences. The presenter engages students in discussions about scientific and technological concepts, while asking questions and providing interactive, hands-on experiments to enhance learning and scientific thinking skills. Fun With Science presents to students and teachers at K-8 grade levels. The presentations are educational and enjoyable and students learn that Science is Fun!

Undergraduate

Lawrence Livermore Summer Internship Program

The Lawrence Livermore National Laboratory (LLNL) in Livermore, California holds an annual national competition for the prestigious Lawrence Livermore Summer Internship Program. Involvement in world-class research provides interns with a set of experiences that support their education and career goals. Typically, students gain hands-on experience and the opportunity to apply learned theory to real life problems.

In this capacity, students are making genuine contributions to program goals. Students publish and co-author papers as well as present their research at conferences and their schools. Yet another benefit is a pipeline to employment, strengthening collaborations with academia as well as other DOE laboratories and employers partnering in collaborative research.

Graduate

Computational Chemistry & Materials Science Institute

The goal of this summer institute is to provide an opportunity for graduate students to explore and learn some of the cutting-edge methods in computational materials sciences, computational chemistry, and other related areas of computational science during their first few years of graduate study. Each student will spend ten weeks at LLNL as the guest of an LLNL host scientist working on a computational project in the host's area of expertise. In addition, the students will take short courses presented by the leading professors and scientists, covering state-of-the-art and emerging computational methods, while focusing on the practical aspects of their numerical implementation.

Los Alamos National Laboratory

Pre College

High School Cooperative Program

The High School Cooperative (HS Coop) Program provides qualified high school seniors the opportunity to develop skills and gain work experience, while receiving exposure to a variety of technical and administrative career fields. This popular program provides employability skills and assists local area high school students with the school-to-work transition.

Undergraduate

LANL Undergraduate Student Program

The Undergraduate Student (UGS) Program offers summer, part-time, and full-time appointments for undergraduate students. The program is a year-round educational program that provides students with relevant research experience while they are pursuing an undergraduate degree. Eligibility is limited to those students who have completed high school and who are admitted and in active status in an undergraduate program.

This educational program is designed to complement the students' education with work experience related to their chosen field of study. There are appointments in both the technical and administrative fields. Appointments are available for 90-day summer internships with the option to continue working part-time during the academic year. Maximum years in the program are six (6) years for those pursuing a Bachelor's degree and three (3) years maximum for those pursuing an Associate's degree.

Graduate

LANL Graduate Student Program

The Graduate Research Assistant (GRA) Program is a year-round educational program that provides students with relevant research experience while they are pursuing a graduate degree. In some cases, students can arrange to conduct masters or doctoral thesis research at the Laboratory. The majority of the appointments are in the technical and scientific disciplines. Appointments are available for 90 days up to one year, with option for renewal based upon program requirements. Students are selected on the basis of field of study, grade point average, and research interests. Individuals may remain in the GRA program for up to three months after receiving a Ph.D.

National Renewable Energy Laboratory

Pre College

Junior Solar Sprint

The U.S. Department of Energy's Junior Solar Sprint (JSS) Program is a classroom-based, hands-on educational program for 6th, 7th, and 8th grade students. JSS student teams apply math, science, and creativity to construct model solar-powered cars and race them in interscholastic competitions hosted within their schools or within their states or regions. JSS began in 1990 as a single demonstration race and expanded to 10 regional competitions in 1991. The program now uses public and private sector support to improve education in middle/junior high schools across the nation. In recent years, the event grew to 83 host sites in 26 states involving 100,000 students and 15,000 teachers.

CLOUT - Coalition for Learning Opportunities and United Tutors Program

An After-School Reading and Hands-On Science Program for Fourth Grade Students
The Coalition for Learning Opportunities and United Tutors (CLOUT) Program, a science literacy enhancement tool, assists fourth grade students in Denver area schools in raising their science reading skills. CLOUT is supported through a leveraged partnership between the U.S. Department of Energy (DOE), NREL, and the Denver Public School (DPS) District. The CLOUT program is a weekly one-on-one tutoring experience between students and adult volunteers. Students augment their technical or science reading with activities related to the reading topics in technology or science.

Undergraduate

Research Participant Program

The Research Participant Program, managed by NREL's Human Resources Office, provides opportunities for qualified university faculty, students, and professional scientists and engineers to:

- Participate in the Laboratory's research and development programs.
- Initiate new areas of research.
- Establish a base for ongoing collaborations.

Appointments to the program are available at the undergraduate, graduate, postdoctoral, faculty, and research associate levels. Appointment periods, application procedures, and funding options vary.

Graduate

Student Internships

This category is designed for undergraduate and graduate students who are enrolled full-time in a U.S. college or university, and who have successfully completed at least the sophomore year of school by June of the current year and plan to continue full-time education the following fall term. Students can work 40 hours per week during the summer and breaks, and a maximum of 25

hours per week for undergraduate students and 30 hours per week for graduate students during the academic year. U.S. citizenship or U.S. permanent residency is required.

Oak Ridge National Laboratory

Pre College

Science Explorers Camp

Science Explorers camp is designed for 5th, 6th and 7th graders. The camp focuses on a variety of science topics approached through field explorations and hands-on activities. Campers will learn about insects, habitats, water, life science, weather, geology, astronomy and robots.

Junior Science

The Annual Junior Science and Humanities Symposium is sponsored by Oak Ridge National Laboratory, the University of Tennessee, the United States Army Research Office and the United State Naval Research Office.

The objectives of the national symposia are

- to promote research and experimentation in the sciences, mathematics, and engineering at the high school level; to recognize the significance of research in human affairs and the importance of humane and ethical principles in the application of research results;
- to search out talented youth and their teachers, recognize their accomplishments at symposia, and encourage their continued interest and participation in the sciences, mathematics, and engineering;
- to expand the horizons of research-oriented students by exposing them to opportunities in the academic, industrial, and governmental communities;
- to enlarge the number of future adults capable of conducting research and development; and (6) to encourage more active participation of females and other minorities in the sciences, mathematics, and engineering.

The ORNL Junior Science program typically consists and tours and presentations on ORNL research in life and engineering sciences technologies, advanced materials, environmental, physics, neutron sciences, robotics and high-performance computing.

Undergraduate

Nuclear Regulatory Commission Historically Black Colleges and Universities Student Research Participation

Opportunities to participate in ongoing Nuclear Regulatory Commission research and development, in the following research areas: computer science, engineering, earth or geosciences, health physics, materials science, mathematics, molecular/radiation biology,

performance and risk assessments, physical sciences, statistics-related to nuclear material control and accounting. Eligible participants include undergraduate and graduate students from Historically Black Colleges and Universities, U.S. citizens or legal permanent residents. The summer appointments last 10 to 12 weeks and some part-time appointments of one year exist.

Graduate

Minority Institutions Biological and Environmental Student Research Participation

This program provides opportunities to participate in research relating to health and the environment. The research areas focus on atmospheric science, biochemistry, biology, biophysics, bioremediation, biostatistics, chemistry, ecology, genetics, genomics, marine science, molecular and cellular biology, measurement science, molecular nuclear medicine, nuclear medicine, pathology, physics, physiology, radiation biology, structural biology, terrestrial sciences, toxicology, and other related life, biomedical, and environmental science disciplines. In order to be eligible for the program you must be a graduate student from Historically Black Colleges and Universities, tribal colleges, and Hispanic-serving institutions, U.S. citizens or permanent residents.

Pacific Northwest National Laboratory

Pre College

Battelle Scholarship Award

Washington State University at Tri-Cities, located in Richland, Washington administers a scholarship program established by the Battelle Memorial Institute Foundation for high school graduates of Benton and Franklin Counties in the State of Washington.
This program will fund an annual $2,000 scholarship for a student whose major area of study is science or engineering at the college or university of their choice. The scholarship is renewable for up to four (4) years. Recipients are selected on the basis of potential for leadership and scholastic achievement.

Bridges: A Post-High School Program

The Bridges program is intended for graduating high school students who live within and graduated from a high school within a 50 mile radius of the Tri-Cities (Richland, Pasco and Kennewick, Washington). Applicants must be eighteen years of age or older at the time they will begin their appointment. The appointment will begin on the decided upon date between the mentor and the participant. This is a summer only program, a "bridge" between high school graduation and beginning an undergraduate college degree program.
Student must have graduated high school before the fellowship begins.
Students must provide proof that they have been accepted to an institution of higher learning (2 or 4 years) before fellowship begins. Students cannot be assigned to or mentored by relatives, and cannot be in an assignment where a conflict of interest exists.

Undergraduate

LTE Undergraduate Student Positions

The undergraduate program offers summer and part-time appointments. Eligibility is limited to those students who have completed high school and who are admitted and in active status in an undergraduate program. This educational program is designed to complement the students' education with work experience related to their chosen field of study. There are appointments in both the technical and administrative fields. Appointments are available for full time during the summer (10-12 weeks) and school breaks, with the option to continue working part-time (20 hours per week) during the academic year. Students must have a GPA of 3.0 in their major, and 2.5 overall out of 4.0. Undergraduate appointments are available for up to one year, with options for renewal based on program requirements.

The National Security Internship Program (NSIP)

The National Security Internship Program (NSIP) is one of a wide range of education programs offered through Science and Engineering Education at Pacific Northwest National Laboratory (PNNL). The NSIP offers academically superior undergraduate and graduate students the chance to take part in national security-related science.

In addition to serving students, NSIP benefits PNNL and the nation by developing talented, creative researchers—the national security experts of tomorrow—who will augment the Laboratory's capabilities in key areas that include nuclear science, electrical engineering, computer science, physics and chemistry.

Graduate

PNNL National Visualization and Analytics Center (NVAC) Internship Program

NVAC, established in 2004 by the Department of Homeland Security, plays a pivotal role in countering future terrorist attacks in the U.S. and around the globe. NVAC, led by PNNL, is developing a national agenda to define the directions and priorities for future research and development programs focused on visual analytics tools.

Visual analytics tools, which are capable of creating images from complex multidimensional data, will enable analysts to effectively fuse and analyze the enormous, dynamic and complex information streams containing structured and unstructured text documents, measurements, images, and video data. Analysts can use these high-impact, practical tools to more effectively identify signs of terrorist attacks in their earliest stages and ultimately thwart terrorist plots before they can be carried out.

PNNL Nonproliferation Graduate Program

Explore a career in international security and nonproliferation through the National Nuclear Security Administration's (NNSA) ***Nonproliferation Graduate Program*** (NGP). Interns work within NNSA's Office of Defense Nuclear Nonproliferation on programs designed to detect, prevent, and reverse the proliferation of weapons of mass destruction, while mitigating the risks from nuclear operations. Administered by Pacific Northwest National Laboratory in Richland, WA, the 12 to 14 month, full-time intern program provides students with specialized training and

practical experience on projects and initiatives that contribute to a safer world. In addition to gaining valuable experience working with federal government programs, interns have opportunities to collaborate with the U.S. Department of Energy, National Laboratories, non-governmental organizations, and other government agencies.

Princeton Plasma Physics Laboratory

Pre College

Research Opportunities for High School Students

Opportunities exist for motivated high school students in the central New Jersey area to perform independent laboratory work in plasma physics. A limited number of paid internships are available in the summer. School-year internships are also available if you are able to receive school credit for your research.

Scientist-in-Residence Program

The Scientist-in-Residence program brings a PPPL scientist into an elementary school for an extended period. Working with teachers and administrators, we create a program tailored to the specific needs of the school that adhere to the New Jersey State
Science Standards.

Science on Saturday Lecture Series

A series of talks geared toward high school students but open to all, the program draws more than 300 students, teachers, parents, and community members each Saturday.
Topics are selected from the forefront of research in a variety of disciplines. The lectures are given by scientists, mathematicians, and other professionals involved in cutting-edge research. The program runs January through March.

Undergraduate

National Undergraduate Fellowship Program in Plasma Physics and Fusion Energy Sciences

The National Undergraduate Fellowship Program in Plasma Physics and Fusion Energy Sciences provides 25 outstanding undergraduates with an opportunity to conduct research in the disciplines that comprise the plasma sciences in general and fusion research in particular. The program is intended primarily for students completing their junior year majoring in physics or engineering, but highly motivated students completing their sophomore year are encouraged to apply as well. The nine-week long research projects are performed at one of the many participating universities and National Laboratories throughout the country. The goal of the Program is to stimulate students' interest in the fields relevant to fusion research while providing capable assistants for fusion research projects. In order that the students obtain a sufficient background to begin their research projects, the nine week project is preceded by a one week introductory course at the Princeton Plasma Physics Laboratory in the basic elements of plasma physics, after which the students travel to the sites of their research projects.

Graduate

PPPL Community Partnerships

PPPL provides a variety of education and outreach opportunities to students and the public. These include research opportunities for students and teachers; teacher professional development workshops; visits to schools demonstrating the beauty and complexity of plasmas; and participation in community events.

Sandia National Laboratory

Pre College

Physical Science Institute (PSI)

Working in the Physical Sciences Institute (PSI) at Sandia National Laboratories, graduate and undergraduate interns take physical science problems "hands on." Whether working among the energetic and talented microfluidics team to solve today's challenging chem-bio problems or collaborating with top researchers in the world renowned Combustion Research Facility (CRF) to develop ground-breaking diagnostic and remote sensing tools, PSI interns are immersed in a scientifically rich and dynamic research community. This program supports high school through Ph.D. .

Undergraduate

Sandia Institute for Modeling and Simulation

The Sandia Institute for Modeling and Simulation (SIMS) gives students an exciting opportunity to conduct engineering research, design, and development in support of exploratory computer and software engineering. Interns will explore and contribute to national security projects in the areas of enterprise modeling and parallel simulation, distributed sensor systems, mobile device applications, and ad hoc wireless networking. These technologies are applied in support of U.S. Department of Homeland Security (DHS) and Department of Energy (DOE) National Nuclear Security Agency (NNSA) national security missions. This program supports undergraduate through graduate school. .

Graduate

Engineering Sciences Summer Institute (ESSI)

Through the Engineering Sciences Summer Institute (ESSI), graduate students and university faculty members participate in a summer research experience in the field of applied mechanics. Our top engineers serve as mentors, and participants attend a series of presentations on related topics such as finite element analysis, materials modeling, and the behavior of materials. This highly acclaimed program culminates with a one-week symposium involving Sandia technical staff members, students, faculty members, and representatives from potential participating colleges and universities around the country.

Stanford Linear Accelerator Center

Pre College

SLAC Youth Opportunity Program

The SLAC Youth Opportunity Program is a 10-week program for students between the ages of 16-22 whose total family income does not exceed a predetermined amount. Since some may be able to participate in outreach for credit, each participant will be evaluated upon completion of his/her assignment. These positions are full time. We will not be able to accommodate students enrolled in summer school or other activities.

IISME (Industry Initiatives for Science and Math Education)

IISME (Industry Initiatives for Science and Math Education) is a consortium of companies, research laboratories, and government organizations in the San Francisco Bay Area that provides summer fellowships to K-14 teachers within their workplaces, each teacher with a mentor. A variety of support systems are in place each summer and additional efforts are made during the year, all to promote the transfer of what is learned in the summer to the classrooms in the fall. IISME's program is a model for over 75 such programs, commonly referred to as SWEPTs, which operate in various parts of the country. IISME also supports this SWEPT Network directly in a variety of ways.

Undergraduate

Historically Black Colleges and Universities (HBCUs)

This program awards grants to historically black colleges and universities (HBCUs) to address community development needs in their localities. The HBCU Program helps HBCUs expand their role and effectiveness in helping their communities with neighborhood revitalization, housing, and economic development. HUD views HBCUs as key partners in rebuilding America's neighborhoods, and annually invites HBCUs to compete for funds to assist in revitalization efforts. While the education of African American youth is their primary mission, HBCUs play many other important roles in the nation, such as serving as economic anchors to their communities. In 1994, HUD established a similar program called Community Outreach Partnership Centers, which is open to colleges and universities nationwide.

Graduate

Graduate Thesis Work at SLAC

Many graduate students are part of the research team at SLAC. Students wishing to consider graduate study involving research in high energy physics or accelerator physics at SLAC should apply to the Stanford University Physics Department. University faculty members from other institutions who are part of any SLAC research program as User groups also bring graduate students to participate in their work at SLAC. Students from other universities with research groups working at SLAC also participate in research here. There are over 100 universities currently participating in SLAC research.

Thomas Jefferson National Accelerator Facility

Pre College

Becoming Enthusiastic About Math and Science

The BEAMS - Becoming Enthusiastic About Math and Science - program is a vehicle to bring classes of sixth, seventh, and eighth school students with their teachers to Jefferson Lab for interactions with Jefferson Lab staff via science and math interactive activities. BEAMS targets the middle schools in Newport News with the largest at-risk student populations.

The goals of BEAMS are to:

- redress the problem that minorities and females are lost from the science, mathematics, engineering and technology career pipeline long before they reach college and to
- strengthen the motivation and academic preparation of students so they graduate from high school as scientifically literate citizens ready for further education or a worthwhile career.

Undergraduate

Science Undergraduate Laboratory Internships

This program places students in paid internships in Science and Engineering at any of several Department of Energy facilities. Many of the participants in the program have decided on a career in science and engineering because of the nature of the experience. Students work with scientists or engineers on projects related to the laboratories' research programs. The different laboratories each offer different research opportunities. The summer programs at the various laboratories will run from late May to mid-August. The exact start date will depend on the laboratory and will be given to participants who have been accepted at that specific laboratory. Students are required to participate for the full term of the program.

Graduate

SURA / Jefferson Lab Graduate Fellowship Program

SURA fellowships are intended to encourage graduate students to undertake research at the Jefferson Lab by offering financial support beyond that regularly provided to a graduate student as a research assistant at his or her home institution.

Eligible graduate students are those who are or plan to be enrolled full-time in a SURA member university doctoral program relevant to a program of the Jefferson Lab. Students may apply at any stage of their graduate career, as well as while an undergraduate senior. Awards are limited to two years. Students must re-apply and compete for a second year award.

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