Science

Proposed Appropriation Language

For Department of Energy expenses including the purchase, construction and acquisition of plant and capital equipment, and other expenses necessary for science activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or facility or for plant or facility acquisition, construction, or expansion, and purchase of not to exceed [49] *50* passenger motor vehicles for replacement only, including one law enforcement vehicle, [one ambulance,] *two ambulances*, and three buses, [$4,772,636,000,] *$4,941,682,000*, to remain available until expended [: Provided, That, of the amount appropriated in this paragraph, $93,686,593 shall be used for projects specified in the table that appears under the heading "Congressionally Directed Science Projects" in the text and table under this heading in the explanatory statement described in section 4 (in the matter preceding division A of this consolidated Act)]. *(Energy and Water Development and Related Agencies Appropriations Act, 2009.)*

Explanation of Change

Changes are proposed to reflect the FY 2010 funding and vehicle request.

Office of Science

Overview

Appropriation Summary by Program

	(dollars in thousands)			
	FY 2008 Current Appropriation	FY 2009 Original Appropriation	FY 2009 Additional Appropriation[a]	FY 2010 Request
Office of Science				
Basic Energy Sciences	1,252,756[b]	1,571,972	+555,406	1,685,500
Advanced Scientific Computing Research	341,774	368,820	+157,110	409,000
Biological and Environmental Research	531,063	601,540	+165,653	604,182
High Energy Physics	702,845[b]	795,726	+232,390	819,000
Nuclear Physics	423,671[b]	512,080	+154,800	552,000
Fusion Energy Sciences	294,933[b]	402,550	+91,023	421,000
Science Laboratories Infrastructure	66,861	145,380	+198,114	133,600
Science Program Direction	177,779	186,695	+1,600	213,722
Workforce Development for Teachers and Scientists	8,044	13,583	+12,500	20,678
Safeguards and Security	75,946	80,603	—	83,000
Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) (SC funding)	92,997[bc]	—	+19,004	—
Subtotal, Office of Science	3,968,669[b]	4,678,949	+1,587,600	4,941,682
Congressionally-directed projects	120,161	93,687	—	—
Unallocated Recovery Act funding	—	—	+12,400	—
SBIR/STTR (Other DOE funding)	47,241[d]	—	—	—
Subtotal, Office of Science	4,136,071[b]	4,772,636	+1,600,000	4,941,682
Coralville, Iowa project rescission	-44,569	—	—	—
Less security charge for reimbursable work	-5,605	—	—	—
Use of prior year balances	-3,014	-15,000	—	—
Total, Office of Science	4,082,883[b]	4,757,636	+1,600,000	4,941,682
Advanced Research Projects Agency-Energy (ARPA-E)	—	15,000	—	—
Total, Science Appropriation	4,082,883[b]	4,772,636	+1,600,000	4,941,682

[a] The Additional Appropriations column reflects the planned allocation of funding from the American Recovery and Reinvestment Act of 2009, P.L. 111–5. See the Department of Energy Recovery website at http://www.energy.gov/recovery for up-to-date information regarding Recovery Act funding.
[b] Includes $62,500,000 provided by the Supplemental Appropriations Act, 2008, P.L. 110–252, as follows: Basic Energy Sciences $13,500,000; High Energy Physics $32,000,000; Nuclear Physics $1,500,000; and Fusion Energy Sciences $15,500,000.
[c] Reflects funding reprogrammed within the Science total to support the SBIR and STTR programs.
[d] Reflects funding transferred from other DOE appropriation accounts to support the SBIR and STTR programs.

The Office of Science request for Fiscal Year (FY) 2010 is $4,941,682,000, an increase of $184,046,000, or 3.9%, over the FY 2009 appropriation of $4,757,636,000. Excluding Congressionally-directed projects and a reduction for use of prior year balances in FY 2009, the request is an increase of $262,733,000, or 5.6%, over the comparable FY 2009 level of $4,678,949,000.

The mission of the Office of Science is the delivery of scientific discoveries and major scientific tools to transform our understanding of nature and to advance the energy, economic, and national security of the United States. A key strategy for accomplishing this mission and a hallmark of the Office of Science and its predecessors for more than six decades has been the support of fundamental science challenges and projects that are of great scale. The earliest example is the Manhattan Project, created to address a critical national security need during World War II.

Today, the Office of Science continues this tradition by supporting significant major projects and preeminent national scientific user facilities to study the smallest constituents of matter, including some bits like dark matter, which are seen only indirectly by observing their influences; the most fleeting subatomic, atomic, molecular, and chemical transitions; and the atomic structure-function relationships of biological and inorganic materials that make up our observable world—all to transform our understanding nature and to use this new understanding to address the Department of Energy's missions in energy, economic, and national security. Over past two decades, these activities have helped spur the worldwide scientific revolutions in nanotechnology, biotechnology, and high-performance computing. Together, these revolutions provide the practical basis for addressing the Department's missions. Coming late in the 20th century, these revolutions are a fitting close to a century that began with the unraveling of the microscopic constituents of matter and the development of quantum mechanics, which describes how and why the very small world behaves differently from our macroscopic world.

Now, at the dawn of the 21st century, the Office of Science is called upon again to address critical societal challenges and key missions of the Department of Energy. Today's energy security challenges, coupled with global climate and environmental concerns, call for truly unprecedented levels of activity and dedication by the Office of Science and the scientific communities that it supports. Significant improvements in existing energy technologies are necessary. But, more importantly, developments of new energy technologies are essential. The 20th century witnessed revolutionary advances, bringing us remarkable discoveries such as high temperature superconductors, which transmit electricity without resistance, and carbon nanotubes, which combine the strength of steel with the mass of a feather. Both discoveries, though, were partly serendipitous. In the 21st century, we must take charge of the complexity of materials—both biological and inorganic—and replace serendipity with intention. To accomplish this will require sustained investments in exploratory and high-risk research in traditional and emerging disciplines, including the development of new tools and facilities; focused investments in high-priority research areas; and investments that train new generations of scientists and engineers to be leaders in the 21st century. The FY 2010 budget supports all three of these investment strategies.

As described in greater detail below, the Office of Science supports large-scale research programs in condensed matter and materials physics; chemistry; biology; climate and environmental sciences; applied mathematics and computational science; high energy physics and nuclear physics; and plasma physics and fusion energy sciences. The Office of Science also provides the nation's researchers with state-of-the-art user facilities—the large machines of modern science. Increasingly, they are first-of-a kind facilities, and they are in the billion-dollar-class range. These facilities offer capabilities that are unmatched anywhere in the world and enable U.S. researchers and industries to remain at the forefront of science, technology, and innovation. They include electron and proton accelerators and colliders for probing matter on scales from the subatomic to the macroscopic; the world's forefront neutron scattering facility and the world's best suite of synchrotron light sources for probing the structure and function of materials; and the world's largest and fastest computational resources devoted to the most challenging societal problems of our time. These facilities also include technologically advanced, large-scale field sites for investigating the effects of clouds on atmospheric radiation; comprehensively equipped nanoscience and molecular science centers; facilities for rapid genome sequencing and integrated environmental molecular sciences; and facilities for investigating the plasma state and its properties for stable fusion systems. Two new Energy Innovation Hubs, described further in the Basic Energy Sciences section below, are proposed in FY 2010; these Hubs will bring together teams of experts from multiple disciplines to focus on two grand challenges in energy: the creation of fuels directly from sunlight without the use of plants or microbes and advanced methods of electrical energy storage.

Today, the Office of Science supports investigators from more than 300 academic institutions and from all of the DOE laboratories. The FY 2010 Budget Request will support about 25,000 Ph.D.'s, graduate students, undergraduates, engineers, and technicians. Approximately 24,000 researchers from universities, national laboratories, industry, and international partners are expected to use the Office of Science scientific user facilities in FY 2010. The FY 2010 Request supports President's plan to increase Federal investment in the sciences and train students and researchers in critical fields, to invest in areas critical to our clean energy future, and to make the U.S. a leader on climate change.

Within the Science appropriation, the Office of Science has ten programs: Basic Energy Sciences (BES), Advanced Scientific Computing Research (ASCR), Biological and Environmental Research (BER), High Energy Physics (HEP), Nuclear Physics (NP), Fusion Energy Sciences (FES), Science Laboratories Infrastructure (SLI), Science Program Direction (SCPD), Workforce Development for Teachers and Scientists (WDTS), and Safeguards and Security (S&S).

The Office of Science is responsible for the oversight of ten of the DOE national laboratories: Ames National Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Princeton Plasma Physics Laboratory, SLAC National Accelerator Laboratory, and Thomas Jefferson National Accelerator Laboratory.

Program Overview

Basic Energy Sciences supports fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies and to support other aspects of DOE missions in energy, environment, and national security. BES-supported research disciplines—condensed matter and materials physics, chemistry, geosciences, and aspects of physical biosciences—provide the knowledge base for the control of the physical and chemical transformations of materials and the discovery and design of new materials with novel structures, functions, and properties. These disciplines drive new solutions and technologies in virtually every aspect of energy resources, production, conversion, transmission, storage, efficiency, and waste mitigation. BES also plans, designs, constructs, and operates scientific user facilities that use x-ray, neutron, and electron beam scattering to probe the most fundamental electronic and atomic properties of materials at extreme limits of time, space, and energy resolution. The world-class scientific user facilities supported by BES provide important capabilities for fabricating, characterizing, and transforming materials of all kinds from metals, alloys, and ceramics to fragile bio-inspired and biological materials. In FY 2010, investments continue to support the Energy Frontier Research Centers, focused on accelerating fundamental energy sciences, and single investigator and small groups. BES takes part in the Department's multi-disciplinary Energy Innovation Hubs, which focus on critical science and technology for high-risk, high-reward research to revolutionize how the U.S. produces, distributes, and uses energy. The Hubs will promote energy security and reduce greenhouse gas emissions. They will also strengthen the Nation's economy by coordinating teams of experts from multiple fields to blend technology development, engineering design, and energy policy. Finally, they will develop critical areas of expertise needed for the green economy. Two Energy Innovation Hubs are initiated by BES to focus on Fuels from Sunlight and on Batteries and Energy Storage. The BES Hubs are complimentary to the EFRCs and will assemble multidisciplinary teams from universities, national laboratories, and the private sector to advance state-of-the-art energy sciences and technology toward their fundamental limits in search of revolutionary changes in energy production and use; and will not include construction of buildings. DOE will encourage risk-taking by making the initial grant period five years, renewed thereafter for up to 10 years. Any funding after 10 years would be predicated on "raising the bar" above that needed for simple renewal. BES continues support for the operations of its suite of scientific user facilities and construction of the National Synchrotron Light Source II, and full operations of the Linac Coherent Light Source will begin in FY 2010.

Advanced Scientific Computing Research supports research to discover, develop, and deploy the computational and networking capabilities to analyze, model, simulate, and predict complex phenomena important to DOE. Scientific computing is particularly important for the solution of research problems that are unsolvable through traditional theoretical and experimental approaches or are too hazardous, time-consuming, or expensive to solve by traditional means. ASCR supports research in applied mathematics, computer science, advanced networking, and computational science (Scientific Discovery through Advanced Computing, SciDAC); as well as research and evaluation prototypes, and the operation of high performance computing systems and networks. In FY 2010, ASCR continues research efforts in SciDAC, applied mathematics, and computer science programs. The FY 2010 request supports continued operations of the Leadership Computing Facilities at Oak Ridge National Laboratory and Argonne National Laboratory. The total capacity of the National Energy Research Scientific Computing (NERSC) facility at Lawrence Berkeley National Laboratory will increase from 360 teraflops to approximately one petaflop with the acquisition and operation of NERSC-6. ESnet will deliver 100–400 gigabit per second (Gbs) connections among the Office of Science laboratories in FY 2010 from 40–60 Gbs in FY 2009.

Biological and Environmental Research supports research to explore the frontiers of genome-enabled biology; discover the physical, chemical, and biological drivers of climate change; and seek the molecular determinants of environmental sustainability and stewardship. BER-supported systems biology research uncovers Nature's secrets from the diversity of microbes and plants to understand how biological systems work, how they interact with each other, and how they can be manipulated to harness their processes and products that contribute to new strategies for producing new biofuels, cleaning up legacy waste, and sequestering carbon dioxide (CO_2). BER plays a vital role in supporting research on atmospheric processes, climate modeling, interactions between ecosystems and greenhouse gases (especially CO_2), and analysis of impacts of climatic change on energy production and use. Subsurface biogeochemistry research seeks to understand the role that subsurface biogeochemical processes play in determining the fate and transport of contaminants including heavy metals and radionuclides. In FY 2010, BER continues research in systems biology, radiochemistry, climate science, and subsurface biogeochemistry. Support is provided for the three DOE Bioenergy Research Centers started in FY 2007, the Joint Genome Institute, and operations of and capital equipment for the Environmental Molecular Science Laboratory. A new activity for climate model visualization is initiated in FY 2010 to develop onsite and remote-access tools for model development and evaluation. BER will also continue support for simulations and analyses needed for part of the Intergovernmental Panel on Climate Change Fifth Assessment.

High Energy Physics program supports research to understand how our universe works at its most fundamental level. This is accomplished by discovering the most elementary constituents of matter and energy, probing the interactions between them, and exploring the basic nature of space and time itself. HEP is focused on three scientific frontiers in particle physics: the Energy Frontier, the Intensity Frontier, and the Cosmic Frontier. Research includes theoretical and experimental studies by individual investigators and large collaborative teams: some who gather and analyze data from accelerator facilities in the U.S. and around the world; and others who develop and deploy ultra-sensitive ground- and space-based instruments to detect particles from space and observe astrophysical phenomena that advance our understanding of fundamental particle properties. HEP also invents new technologies to meet the challenges of research at the frontiers such as superconducting radio frequency technologies. The Tevatron Collider at Fermi National Accelerator Laboratory continues operations during FY 2010. Its record-breaking performance over the last few years means it remains competitive with the Large Hadron Collider (LHC) in Geneva, Switzerland, for significant discoveries. Support for LHC detector operations, maintenance, computing, and R&D continues in FY 2010 in order to maintain a U.S. leadership role in the LHC program. Construction continues for the NuMI Off-Axis Neutrino Appearance (NOνA) project to enable key measurements of neutrino properties. R&D for proposed new experiments using the NuMI beam and other auxiliary beamlines, such as the Long Baseline Neutrino oscillation experiment (LBNE) and the Muon to Electron Experiment (Mu2e), will be underway so these experiments can be ready for operation before the end of the next decade. Several national and international collaborative projects to pursue questions in dark matter, dark energy, and neutrino properties continue in FY 2010, including the Cryogenic Dark Matter Search at the Soudan Mine in Minnesota, the Dark Energy Survey experiment in Chile, and R&D for the Joint Dark Energy Mission, the Large Synoptic Survey Telescope, and R&D efforts for experiments that may be located in the National Science Foundation's proposed Deep Underground Science and Engineering Laboratory (DUSEL). HEP also continues supported for advanced accelerator and detector R&D and R&D in superconducting radio frequency technology applicable to a variety of future accelerator projects.

Nuclear Physics supports research to discover, explore, and understand all forms of nuclear matter. The fundamental particles that compose nuclear matter, quarks and gluons, are relatively well understood, but exactly how they fit together and interact to create different types of matter in the universe is still largely not understood. To accomplish this, NP supports experimental and theoretical research—along with the development and operation of particle accelerators and advanced technologies—to create, detect, and describe the different forms and complexities of nuclear matter that can exist in the universe, including those that are no longer found naturally. NP also provides stewardship of isotope production and technologies to advance important applications, research, and tools for that nation. The FY 2010 request supports core nuclear physics research at over 85 academic institutions and 9 of the DOE national laboratories. The request supports near optimal levels of operations at NP's four scientific user facilities: the Continuous Electron Beam Accelerator Facility (CEBAF), the Relativistic Heavy Ion Collider (RHIC), the Argonne Tandem Linac Accelerator System (ATLAS), and the Holifield Radioactive Ion Beam Facility (HRIBF). Construction for the 12 GeV CEBAF Upgrade project continues, as well as conceptual design and R&D for the proposed Facility for Rare Isotope Beams (FRIB). The request also supports several major items of equipment (MIEs) to address compelling scientific opportunities. In FY 2010, the Isotope Development and Production for Research Applications Program will focus on production on the isotope needs of stakeholders and research isotope priorities identified by the Nuclear Science Advisory Committee and community input.

Fusion Energy Sciences supports research to expand the fundamental understanding of matter at very high temperatures and densities and the scientific foundations needed to develop a fusion energy source. This is accomplished by studying plasmas under a wide range of temperature and density, developing advanced diagnostics to make detailed measurements of their properties, and creating theoretical/computational models to resolve the essential physics. FES operates scientific user facilities to enable world-leading research programs in high-temperature, magnetically confined plasmas, and to participate in the design and construction of ITER, the world's first facility for studying a sustained burning plasma. FES also supports enabling R&D to improve the components and systems that are used to build fusion facilities. The FY 2010 budget request funds the U.S Contributions to ITER project, including research and development of key components, long-lead procurements, personnel, and cash contribution to the ITER Organization. Research at the major experimental facilities in the FES program—the DIII-D tokamak, the Alcator C-Mod tokamak, and the National Spherical Torus Experiment (NSTX)—will continue to focus on providing solutions to key high-priority ITER issues and build a firm physics basis for ITER design and operation. The FY 2010 request will continue support for the Fusion Simulation Program computational initiative and the research at two plasma science centers selected in FY 2009. FES also continues to support the joint program in high energy density laboratory plasmas (HEDLP) with the National Nuclear Security Administration.

Workforce Development for Teachers and Scientists supports a range of opportunities to the Nation's science, mathematics, engineering, and technology (STEM) students and educators that will help the U.S. maintain its competitive edge. These opportunities help inspire students to pursue STEM fields of study and aim to increase the pipeline of skilled scientists and engineers who can successfully pursue careers in areas that will support the development of a sustainable, clean energy future; support our national security; and contribute to U.S scientific discovery and innovation. WDTS supports programs that place undergraduate students into world class research environments to improve their content knowledge and to help them understand how to be successful as researchers and teachers of STEM fields. WDTS also supports professional development experiences for K-12 and undergraduate faculty who teach STEM subjects by providing them with mentor-intensive research experiences that teach them not only content knowledge, but also how to translate lessons learned in the laboratory into classroom practice. WDTS also supports competitions at the middle school and high school levels, such as the National Science Bowl®, that are designed to reward and recognize high-potential science and engineering students. In addition to supporting these core activities, WDTS will continue an Office of Science graduate fellowship program in FY 2010.This program was initiated with the Recovery Act funds. The graduate fellowships will be competitively awarded and will provide support for three years to graduate students pursuing advanced science and engineering degrees with an interest in energy, environment, and basic research.

High-Risk, High-Return Research[a]

The Office of Science programs incorporate high-risk, high-return research elements in all of its research portfolios. Because advancing the frontiers of science also depends on the continued availability of state-of-the-art scientific facilities, the Office of Science constructs and operates national scientific facilities and instruments that comprise the world's most sophisticated suite of research capabilities.

Effective program management is critical to the support of high-risk, high-return research. The Office of Science program managers are experts in their respective fields and communicate program research priorities and interests to the scientific community; select proposal reviewers that are open to bold ideas; provide guidance to merit reviewers—including guidance on consideration of high-risk, high-return research; and make recommendations on proposal selection, weighing inputs from peer review with programmatic relevance, potential impact, and overall portfolio balance. Committees of Visitors review

[a] In compliance with reporting requirements in America COMPETES (P.L. 110–69, section 1008).

program portfolios triennially to assess, among other things, the balance and impact of the portfolios, including an assessment of high-risk, high-return research.

The fraction of high-risk, high-return activities is not easy to quantify, because such research is integrated within program portfolios. However, several mechanisms are used to identify and develop the "high-return" research topics, including Federal advisory committees, program and topical workshops, interagency working groups, National Academy of Sciences (NAS) studies, and special Office of Science Program solicitations. The results of these activities have identified opportunities for new, compelling research. As examples, some of these opportunities are captured in the following reports: *New Frontiers of Science in Radiochemistry and Instrumentation for Radionuclide Imaging* workshop report (2009); *New Science for a Secure Energy Future*, by the Basic Energy Sciences Advisory Committee (2008); *Identifying Outstanding Grand Challenges in Climate Change Research* workshop report (2008); *The Potential Impact of High-End Capability Computing (HECC) on Four Illustrative Fields of Science and Engineering*, by the National Research Council (2008); and *The Frontiers of Nuclear Science*, by the Nuclear Sciences Advisory Committee (2007).

Basic & Applied R&D Coordination

Coordination between the Department's basic research and applied technology programs is a high priority for the Secretary of Energy. The Department has a responsibility to coordinate its basic and applied research programs in headquarters to enable effective basic-applied R&D integration by the science and technology communities (e.g., national laboratories, universities, and private companies) that support the DOE mission. Office of Science efforts have focused on improving communication and collaboration between federal program managers and within the S&T communities, and increasing opportunities for collaborative research efforts targeted towards the interface of scientific research and technology development to ultimately accelerate DOE mission and national goals.

The Office of Science coordinates its basic research efforts with the Department's applied technology offices by using scientific and technical workshops; structured targeted research efforts driven by program manager-level coordination between the basic and applied R&D programs; joint program planning or joint program reviews; jointly funded or jointly coordinated solicitations; shared grantee/contractor meetings and conferences to bring the research communities together; and portfolio assessment efforts by structured working groups guided by DOE senior management.

Coordination between the basic and applied programs is also enhanced through joint programs, jointly-funded scientific facilities, and the program management activities of the DOE Small Business Innovation Research (SBIR) and Small Business Technology Research Programs (STTR). Additionally, co-funding research activities and facilities at the DOE laboratories and funding mechanisms that encourage broad partnerships (e.g., the Funding Opportunity Announcement) are also means by which the Office of Science facilitates greater communication and research integration within the S&T communities.

The Office of Sciences has engaged in on-going and productive coordination efforts with the DOE applied technology programs over the past decade in a number of research areas including, but not limited to biofuels derived from biomass; solar energy utilization; hydrogen production, storage, and use; building technologies, including solid-state lighting; advanced fuel cycle technologies; vehicle technologies; and improving efficiencies in industrial processes. Over the past couple of years, basic-applied R&D coordination efforts have increased in the areas of carbon dioxide capture and storage, characterization of radioactive waste, catalysis, materials under extreme conditions, electrical energy storage for transportation and grid-level storage, high energy density laboratory plasmas, production of radioactive and stable isotopes, and applied mathematics for optimization of complex systems such as fossil fuel power generation, the nuclear fuel cycle, and power grid control and grid modernization.

SC Funding for Selected Administration Priorities

	(dollars in thousands)		
	FY 2008	FY 2009	FY 2010
President's Plan for Science and Innovation	4,082,883	4,757,636	4,941,682
Climate Change Science Program	128,191	167,810	165,288
Climate Change Technology Program	511,669	620,253	638,717
Networking and Information Technology Research and Development	371,353	399,521	446,988
National Nanotechnology Initiative	193,902	299,964	326,542

President's Plan for Science and Innovation

The President's Plan for Science and Innovation encompasses the entire Office of Science budget, as part of a strategy to double overall basic research funding at select agencies over 10 years.

Climate Change Research

U.S. Climate Change Research is currently organized into the Climate Change Science Program (CCSP) and the Climate Change Technology Program (CCTP). The CCSP includes the interagency U.S. Global Change Research Program (USGCRP), proposed by the first President Bush in 1989 and codified by Congress in the Global Change Research Act of 1990 (P.L. 101–606).

- **Climate Change Science Program**: The BER Climate and Environmental Sciences subprogram (excluding the Climate Change Mitigation element which focuses on carbon sequestration in the terrestrial biosphere and activities transferred from the former Environmental Remediation subprogram) represents DOE's contribution to the CCSP. SC investments supported under the Climate Change Science Program in global and regional climate modeling, combined with measurement and observational experiments, can improve understanding of global carbon cycling and impacts, inform carbon management strategies, and help plan for future energy resource needs.
- **Climate Change Technology Program**: In support of the U.S. Climate Change Technology Program, the Department of Energy analyzed its energy technology portfolio across program areas to determine what actions could be taken to reduce greenhouse gas emission (GHG) intensities. The technical planning goal for this analysis was to develop a portfolio of technology options that, if deployed worldwide, could put global GHG emissions on a trajectory to achieve atmospheric concentrations of carbon between 450 to 550 parts per million (ppm). Programs were selected for the new climate change technology portfolio based on their potential to reduce carbon (in billions of tons of carbon) emissions into the atmosphere between FY 2015–2100.

Networking and Information Technology Research and Development

SC computing activities (including high-end computing infrastructure, applications, and R&D; large scale networking activities; and the Computational Sciences Graduate Fellowship) are coordinated with other Federal efforts through the National Information Technology Research and Development (NITRD) subcommittee of the National Science and Technology Council and its Technology Committee. The

NITRD Subcommittee provides active coordination for the multiagency NITRD Program. The Subcommittee is made up of representatives from each of the participating NITRD agencies and from OMB, OSTP, and the National Coordination Office for IT R&D.

National Nanotechnology Initiative

Research programs and facilities supported by SC are the predominant DOE components of the National Nanotechnology Initiative, which is coordinated across the Federal government by the Nanoscale Science, Engineering, and Technology Subcommittee under the Committee on Technology of the National Science and Technology Council. The SC investment in FY 2010 continues to support full operation of the five Nanoscale Science Research Center user facilities and an extensive array of individual university grants and laboratory research programs. The Energy Frontier Research Centers, larger collaborative efforts in which a portion of the activity relates to nanoscale science, are also continued. Nanoscience funding increases are due partly to small increases across all of these mechanisms, which include activities related to solar energy conversion, chemical imaging, nuclear energy, ultrafast science, instrumentation for characterization, and other areas. However, much of the increase in FY 2010 results from the initiation of Energy Innovation Hubs focusing on electrical energy storage and solar fuels, in which it is anticipated that a fraction of the activity will be appropriately characterized as nanoscience.

Energy Innovation Hubs

SC takes part in the Department's multi-disciplinary Energy Innovation Hubs, which focus on critical science and technology for high-risk, high-reward research to revolutionize how the U.S. produces, distributes, and uses energy. The Hubs will promote energy security and reduce greenhouse gas emissions. They will also strengthen the Nation's economy by coordinating teams of experts from multiple fields to blend technology development, engineering design, and energy policy. Finally, they will develop the critical areas of expertise needed for the green economy.

The Hubs support the Secretary of Energy's goal to improve coordination between basic and applied research and technology development and engineering design, and will include teams of experts from multiple disciplines and blend basic scientific research, technology development, engineering design, and energy policy to create an energy portfolio that is efficient and scalable in a timely manner. Basic Energy Sciences will support two Hubs, one focused on Fuels from Sunlight and one on Batteries and Energy Storage. Similar to the DOE Bioenergy Research Centers; universities, national labs, and the private sector—or partnerships among those groups—will be eligible to apply. Proposals will be selected based on external merit review and awards will provide support for research activities, not construction of new buildings. DOE will encourage risk-taking by making the initial grant period five years, renewed thereafter for up to 10 years. Any funding after 10 years would be predicated on "raising the bar" above that needed for simple renewal.

Regaining ENERGY Science and Engineering Edge (RE-ENERGYSE)

The Department is undertaking a broad educational effort that cuts across program offices to inspire students and workers to pursue careers in science, engineering, and entrepreneurship related to clean energy and other fields important to the Department's mission. RE-ENERGYSE is a new initiative to focus on a number of critical areas that will build the foundation of a vibrant American workforce to participate in the green economy and advance science and innovation in the U.S. SC is supporting the initiative with a new graduate fellowship program ($5,000,000 requested in WDTS) that will support 50–60 U.S. students pursing advanced degrees in SC mission-relevant fields.

Scientific Workforce

Workforce development is an important element of the Office of Science mission to help ensure a science-trained workforce, including researchers, engineers, science educators, and technicians. The research programs and projects at the national laboratories, universities, and research institutes actively integrate undergraduate and graduate students and post-doctoral investigators into their work. This "hands-on" approach is important for the development of the next generation of scientists, engineers, and science educators.

	FY 2008	FY 2009	FY 2010
Estimated Number of University Grants			
BES	1,000	1,200	1,300
ASCR	211	224	260
BER	447	480	475
HEP	200	200	200
NP	184	190	200
FES	246	236	246
Total, Estimated Number of University Grants	2,288	2,530	2,681
Estimated Number of Ph.D.s Supported			
BES	4,610	5,840	6,300
ASCR	698	735	766
BER	1,624	1,820	1,795
HEP	1,660	1,685	1,690
NP	1,098	1,040	1,110
FES	835	832	836
Total, Estimated Number of Ph.D.s Supported	10,525	11,952	12,497
Estimated Number of Graduate Students Supported			
BES	1,490	2,000	2,200
ASCR	495	533	563
BER	429	485	480
HEP	585	595	595
NP	493	490	510
FES	326	325	327
Total, Estimated Number of Graduate Students Supported	3,818	4,428	4,675

Mission Readiness of Office of Science Laboratories

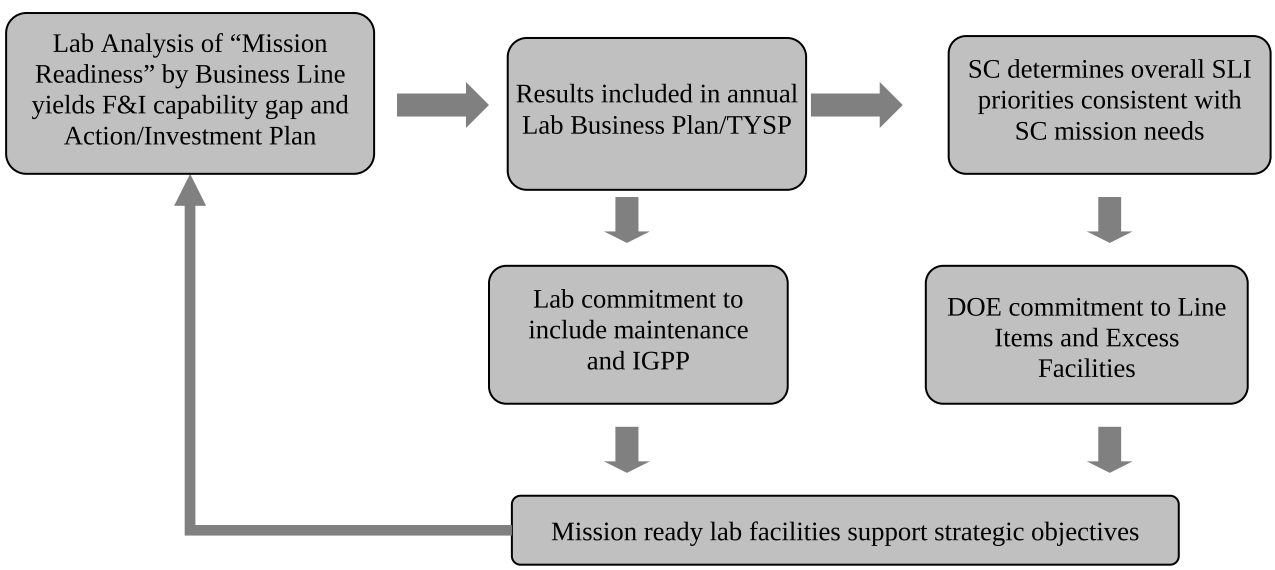
The mission readiness of a laboratory's facilities and infrastructure is the capability of those assets to enable delivery of the scientific mission assigned to that laboratory. Ensuring continued mission readiness into the future is the focus of the SC Facilities and Infrastructure program.

The infrastructure of the Office of Science's national laboratories is aging, with nearly half of active facility space 40 years old or older. Despite past investments, many laboratory facilities and utility systems are not adequate to support the scientific mission in the future because they do not meet the requirements of a modern research facility. The Infrastructure Modernization Initiative includes a portfolio of projects funded through the SLI budget that will provide modern laboratory space, renovate space that does not meet research needs, replace facilities that are no longer cost effective to renovate or operate, modernize utility systems to prevent failures and ensure efficiency, and/or remove excess facilities to allow safe and efficient operations. These investments will revitalize SC's ten laboratories over the next ten years.

In order to evaluate current and projected future mission readiness, SC laboratories are implementing a new Mission Readiness Assessment Process. This process (see below) assures that facility and infrastructure investments support SC scientific mission goals, and serves as the basis of the infrastructure strategy described in the SC Annual Laboratory Plans.

Mission Readiness Assessment Process

Driven by Science—executed through budget and contract commitments



The process results in core capability gap analyses and needed investments via DOE capital line item investments or other means. The resulting facilities and infrastructure strategies are provided within the Annual Laboratory Plans using standardized tables. This process is also consistent with recommendations of the National Research Council in their 2004 Report, "Intelligent Sustainment and Renewal of Department of Energy Facilities and Infrastructure".

The Annual Laboratory Plans prepared in 2008 incorporated the basic components of the Mission Readiness protocols by specifically tying proposed future investments to laboratory business lines. Since that time, all ten SC laboratories have begun full implementation of the Mission Readiness Assessment

Process. As implementation moves forward, peer reviews of each laboratory's Mission Readiness Assessment Process are being coordinated and implemented to provide verification that the process is being appropriately implemented.

The investments will not only improve SC's mission readiness but will also reduce SC's deferred maintenance backlog thereby improving SC's overall Asset Condition Index.

Contractor Pension Plan Funding

Funding is requested to reimburse the costs of DOE contractor contributions to defined-benefit pension plans as required by the Employee Retirement Income Security Act (ERISA), as amended by the Pension Protection Act of 2006, and consistent with Departmental direction. The Pension Protection Act amended ERISA to require accelerated funding of defined benefit pension plans so that the plans become 100% funded in 2011. Most contractors that manage and operate DOE's laboratories are contractually required to assume sponsorship of any existing contractor defined benefit pension plans for incumbent employees who work and retire from these sites and facilities. Increased contributions began to be required for some of these plans as a result of the downturn in investment values in FY 2009. Whether additional funding will be needed in future years will depend on the funded status of the plans based on plan investment portfolios managed by the contractors as sponsors of the plans.

Strategic Themes and Goals and GPRA Unit Program Goals

The Department's Strategic Plan identifies five Strategic Themes (one each for nuclear, energy, science, management, and environmental aspects of the mission) plus 16 Strategic Goals that tie to the Strategic Themes. The Office of Science (SC) supports the following goals:

Strategic Theme 3, Scientific Discovery and Innovation: Strengthening U.S. scientific discovery, economic competitiveness, and improving quality of life through innovations in science and technology.

- Strategic Goal 3.1, Scientific Breakthroughs: Achieve the major scientific discoveries that will drive U.S. competitiveness; inspire America; and revolutionize our approaches to the Nation's energy, national security, and environmental quality challenges.
- Strategic Goal 3.2, Foundations of Science: Deliver the scientific facilities, train the next generation of scientists and engineers, and provide the laboratory capabilities and infrastructure required for U.S. scientific primacy.

The programs funded by the Science appropriation have the following six Government Performance and Results Act (GPRA) Unit Program Goals:

- GPRA Unit Program Goal 3.1/2.50.00: Advance the Basic Science for Energy Independence—Provide the scientific knowledge and tools to achieve energy independence, securing U.S. leadership and essential breakthroughs in basic energy sciences.
- GPRA Unit Program Goal 3.1/2.51.00: Deliver Computing for Accelerated Progress in Science—Deliver forefront computational and networking capabilities to scientists nationwide that enable them to extend the frontiers of science, answering critical questions that range from the function of living cells to the power of fusion energy.
- GPRA Unit Program Goal 3.1/2.48.00: Harness the Power of Our Living World—Provide the biological and environmental discoveries necessary to clean and protect our environment, offer new energy alternatives, and fundamentally change the nature of medical care to improve human health.
- GPRA Unit Program Goal 3.1/2.46.00: Explore the Fundamental Interactions of Energy, Matter, Time, and Space—Understand the unification of fundamental particles and forces and the mysterious

forms of unseen energy and matter that dominate the universe, search for possible new dimensions of space, and investigate the nature of time itself.

- GPRA Unit Program Goal 3.1/2.47.00: Explore Nuclear Matter, from Quarks to Stars—Understand the evolution and structure of nuclear matter, from the smallest building blocks, quarks, and gluons; to the stable elements in the Universe created by stars; to unique isotopes created in the laboratory that exist at the limits of stability and possess radically different properties from known matter.
- GPRA Unit Program Goal 3.1/2.49.00: Bring the Power of the Stars to Earth—Answer the key scientific questions and overcome enormous technical challenges to harness the power that fuels our sun.

Contribution to Strategic Goals

Six of the programs within the Science appropriation directly contribute to Strategic Goals 3.1 and 3.2: Basic Energy Sciences, Advanced Scientific Computing Research, Biological and Environmental Research, High Energy Physics, Nuclear Physics, and Fusion Energy Sciences.

Means and Strategies

Each of the six SC programs support fundamental, innovative, peer-reviewed research to create new knowledge in areas important to SC and program missions, and support the design, construction, and operation of a wide array of scientific user facilities essential for advancing the frontiers of research in relevant areas of science and technology and providing the Nation scientific tools to remain at the forefront of innovation and competitiveness. All research projects and facilities undergo regular peer review and merit evaluation based on procedures set down in 10 CFR 605 for the extramural grant program and under a similar process for the laboratory programs and scientific user facilities. All new projects are selected through peer review and merit evaluation.

SC programs ensure effective management processes for cost-effective investments and timely delivery of projects. SC programs utilize input from the scientific community to ensure progress is made and opportunities are identified. Programs also form mutually beneficial partnerships with programs sharing common goals. The basic science supported by each SC program is coordinated with the activities of other programs within SC, with programs of the DOE applied technology offices and the National Nuclear Security Administration, and with programs of other Federal agencies. SC also promotes the transfer of the results of its basic research to contribute to DOE missions in areas of energy, environment, and national security. Program-specific means and strategies are described in detail in the individual program budget narrative sections under "Program Planning and Management."

External factors, in addition to budgetary constraints, that affect the level of performance include changing mission needs as described by the DOE and SC mission statements and strategic plans; evolving scientific opportunities as determined, in part, by scientific workshops and proposals received by researchers; results of external program reviews and international benchmarking activities of entire fields or sub-fields, such as those performed by the National Academy of Sciences; unanticipated failures in critical components of scientific user facilities or major research programs; and strategic and programmatic decisions made by non-DOE funded domestic research activities and by major international research and technology entities.

Validation and Verification

Progress against established plans is evaluated by periodic internal and external performance reviews. These reviews provide an opportunity to verify and validate performance. Monthly, quarterly, semiannual, and annual reviews consistent with specific program management plans are performed to ensure technical progress, cost and schedule adherence, and responsiveness to program requirements

Office of Science

Funding by Site by Program

	(dollars in thousands)		
	FY 2008	FY 2009	FY 2010
Ames Laboratory			
Basic Energy Sciences	19,981	20,423	21,126
Advanced Scientific Computing Research	1,466	1,472	600
Biological and Environmental Research	500	500	—
Workforce Development for Teachers and Scientists	220	415	541
Safeguards and Security	944	974	980
Total, Ames Laboratory	23,111	23,784	23,247
Ames Site Office			
Science Program Direction	587	600	618
Argonne National Laboratory			
Basic Energy Sciences	183,637	182,130	193,534
Advanced Scientific Computing Research	43,970	41,664	54,528
Biological and Environmental Research	27,040	27,937	29,247
High Energy Physics	13,335	12,856	11,003
Nuclear Physics	26,121	27,056	28,708
Fusion Energy Sciences	83	40	40
Science Laboratories Infrastructure	389	—	10,000
Workforce Development for Teachers and Scientists	1,155	825	964
Safeguards and Security	8,562	8,514	8,694
Total, Argonne National Laboratory	304,292	301,022	336,718
Argonne Site Office			
Science Program Direction	4,201	3,928	4,299
Berkeley Site Office			
Science Program Direction	4,644	3,962	4,567

	(dollars in thousands)		
	FY 2008	FY 2009	FY 2010
Brookhaven National Laboratory			
Basic Energy Sciences	137,216	195,531	236,804
Advanced Scientific Computing Research	730	390	200
Biological and Environmental Research	20,145	19,433	18,869
High Energy Physics	46,701	43,314	24,796
Nuclear Physics	169,467	179,694	187,593
Science Laboratories Infrastructure	8,200	14,882	46,387
Workforce Development for Teachers and Scientists	575	825	1,050
Safeguards and Security	10,859	11,349	11,530
Total, Brookhaven National Laboratory	393,893	465,418	527,229
Brookhaven Site Office			
Science Program Direction	4,295	3,714	5,436
Chicago Office			
Basic Energy Sciences	190,427	178,280	175,159
Advanced Scientific Computing Research	57,143	52,626	51,492
Biological and Environmental Research	151,467	142,895	96,199
High Energy Physics	129,168	133,966	130,059
Nuclear Physics	67,119	65,429	69,568
Fusion Energy Sciences	146,519	146,049	147,144
Science Laboratories Infrastructure	1,506	—	—
Science Program Direction	26,716	26,837	33,600
Workforce Development for Teachers and Scientists	15	—	—
Safeguards and Security	1,992	1,600	—
Congressionally Directed Projects	111,612	69,676	—
SBIR/STTR	140,238	—	—
Total, Chicago Office	1,023,922	817,358	703,221

	(dollars in thousands)		
	FY 2008	FY 2009	FY 2010
Fermi National Accelerator Laboratory			
Advanced Scientific Computing Research	270	360	260
High Energy Physics	351,484	374,449	398,872
Nuclear Physics	560	292	—
Workforce Development for Teachers and Scientists	170	240	420
Safeguards and Security	2,201	1,734	3,383
Total, Fermi National Accelerator Laboratory	354,685	377,075	402,935
Fermi Site Office			
Science Program Direction	2,512	2,416	2,695
Golden Field Office			
Workforce Development for Teachers and Scientists	655	523	880
Idaho National Laboratory			
Basic Energy Sciences	407	214	221
Biological and Environmental Research	1,703	1,885	1,717
Fusion Energy Sciences	2,371	2,222	2,222
Workforce Development for Teachers and Scientists	86	79	140
Total, Idaho National Laboratory	4,567	4,400	4,300
Lawrence Berkeley National Laboratory			
Basic Energy Sciences	131,469	138,691	131,529
Advanced Scientific Computing Research	101,594	89,786	96,178
Biological and Environmental Research	110,688	104,248	119,490
High Energy Physics	53,412	59,988	46,142
Nuclear Physics	24,756	25,498	33,340
Fusion Energy Sciences	4,796	4,856	4,856
Science Laboratories Infrastructure	17,417	29,956	34,027
Workforce Development for Teachers and Scientists	635	686	897
Safeguards and Security	4,985	5,006	5,059
Total, Lawrence Berkeley National Laboratory	449,752	458,715	471,518

	(dollars in thousands)		
	FY 2008	FY 2009	FY 2010
Lawrence Livermore National Laboratory			
Basic Energy Sciences	4,071	3,270	3,387
Advanced Scientific Computing Research	16,631	11,748	11,305
Biological and Environmental Research	23,903	23,162	13,898
High Energy Physics	560	795	788
Nuclear Physics	1,509	1,575	1,022
Fusion Energy Sciences	13,150	12,534	12,538
Workforce Development for Teachers and Scientists	17	83	345
Total, Lawrence Livermore National Laboratory	59,841	53,167	43,283
Los Alamos National Laboratory			
Basic Energy Sciences	29,304	32,608	33,148
Advanced Scientific Computing Research	4,248	3,420	2,470
Biological and Environmental Research	19,709	17,770	10,303
High Energy Physics	423	248	248
Nuclear Physics	11,769	17,168	18,221
Fusion Energy Sciences	3,612	2,981	3,399
Workforce Development for Teachers and Scientists	50	210	345
Total, Los Alamos National Laboratory	69,115	74,405	68,134
National Energy Technology Laboratory			
Basic Energy Sciences	300	—	—
Workforce Development for Teachers and Scientists	589	734	857
Total, National Energy Technology Laboratory	889	734	857
National Renewable Energy Laboratory			
Basic Energy Sciences	7,171	5,773	5,980
Advanced Scientific Computing Research	796	581	372
Biological and Environmental Research	1,438	1,497	1,136
Workforce Development for Teachers and Scientists	35	50	50
Total, National Renewable Energy Laboratory	9,440	7,901	7,538
New Brunswick Laboratory			
Science Program Direction	6,644	6,583	6,981

	(dollars in thousands)		
	FY 2008	FY 2009	FY 2010
Oak Ridge Institute for Science and Education			
Basic Energy Sciences	2,060	1,600	1,600
Advanced Scientific Computing Research	1,082	1,000	—
Biological and Environmental Research	5,342	4,396	4,053
High Energy Physics	304	400	250
Nuclear Physics	1,228	1,238	703
Fusion Energy Sciences	1,631	1,748	1,400
Workforce Development for Teachers and Scientists	2,250	3,506	3,604
Safeguards and Security	1,679	1,617	1,626
Total, Oak Ridge Institute for Science and Education	15,576	15,505	13,236
Oak Ridge National Laboratory			
Basic Energy Sciences	307,468	312,456	328,986
Advanced Scientific Computing Research	98,622	94,073	95,958
Biological and Environmental Research	64,886	67,504	60,160
High Energy Physics	85	—	—
Nuclear Physics	25,090	35,445	33,776
Fusion Energy Sciences	46,028	141,214	152,084
Science Laboratories Infrastructure	9,535	25,103	—
Safeguards and Security	7,652	8,895	8,895
Total, Oak Ridge National Laboratory	559,366	684,690	679,859
Oak Ridge National Laboratory Site Office			
Science Program Direction	—	—	4,439
Oak Ridge Office			
Biological and Environmental Research	50	—	—
Science Laboratories Infrastructure	5,040	5,079	5,214
Science Program Direction	43,274	44,948	42,305
Safeguards and Security	18,649	18,699	19,237
Total, Oak Ridge Office	67,013	68,726	66,756

	(dollars in thousands)		
	FY 2008	FY 2009	FY 2010
Office of Scientific and Technical Information			
Basic Energy Sciences	100	106	106
Advanced Scientific Computing Research	100	106	106
Biological and Environmental Research	367	373	373
High Energy Physics	100	106	110
Nuclear Physics	100	106	—
Fusion Energy Sciences	100	106	106
Science Laboratories Infrastructure	—	2,500	—
Science Program Direction	—	8,916	8,916
Workforce Development for Teachers and Scientists	120	105	240
Safeguards and Security	630	490	490
Total, Office of Scientific and Technical Information	1,617	12,914	10,447
Pacific Northwest National Laboratory			
Basic Energy Sciences	18,169	17,821	18,427
Advanced Scientific Computing Research	5,806	6,055	2,284
Biological and Environmental Research	94,710	98,961	103,907
Nuclear Physics	150	—	—
Fusion Energy Sciences	1,053	900	1,326
Science Laboratories Infrastructure	24,773	52,775	—
Workforce Development for Teachers and Scientists	715	1,221	1,412
Safeguards and Security	11,153	11,163	11,163
Total, Pacific Northwest National Laboratory	156,529	188,896	138,519
Pacific Northwest Site Office			
Science Program Direction	5,186	5,264	6,150
Princeton Plasma Physics Laboratory			
Advanced Scientific Computing Research	1,154	740	688
High Energy Physics	230	230	230
Fusion Energy Sciences	72,436	70,318	70,219
Workforce Development for Teachers and Scientists	155	315	506
Safeguards and Security	2,368	2,075	2,104
Total, Princeton Plasma Physics Laboratory	76,343	73,678	73,747

	FY 2008	FY 2009	FY 2010
	(dollars in thousands)		
Princeton Site Office			
Science Program Direction	1,840	1,726	2,055
Sandia National Laboratories			
Basic Energy Sciences	35,139	32,817	34,099
Advanced Scientific Computing Research	6,395	6,189	6,137
Biological and Environmental Research	2,060	1,870	1,300
Nuclear Physics	300	275	—
Fusion Energy Sciences	2,560	2,290	2,290
Workforce Development for Teachers and Scientists	150	470	786
Congressionally Directed Projects	7,114	—	—
Total, Sandia National Laboratories	53,718	43,911	44,612
Savannah River National Laboratory			
Basic Energy Sciences	398	300	300
Biological and Environmental Research	754	622	363
Fusion Energy Sciences	40	—	—
Workforce Development for Teachers and Scientists	—	—	100
Total, Savannah River National Laboratory	1,192	922	763
SLAC National Accelerator Laboratory			
Basic Energy Sciences	183,901	212,384	177,178
Advanced Scientific Computing Research	200	200	200
Biological and Environmental Research	4,843	5,150	4,150
High Energy Physics	103,427	87,551	91,231
Science Laboratories Infrastructure	—	—	8,900
Workforce Development for Teachers and Scientists	160	180	215
Safeguards and Security	2,566	2,558	2,615
Total, SLAC National Accelerator Laboratory	295,097	308,023	284,489
Stanford Site Office			
Science Program Direction	2,499	2,748	2,830

	(dollars in thousands)		
	FY 2008	FY 2009	FY 2010
Thomas Jefferson National Accelerator Facility			
Advanced Scientific Computing Research	100	100	100
Biological and Environmental Research	600	600	600
High Energy Physics	830	1,840	1,895
Nuclear Physics	95,069	117,811	117,044
Science Laboratories Infrastructure	—	3,700	27,687
Workforce Development for Teachers and Scientists	292	486	516
Safeguards and Security	1,626	1,325	1,346
Total, Thomas Jefferson National Accelerator Facility	98,517	125,862	149,188
Thomas Jefferson Site Office			
Science Program Direction	1,995	1,828	2,225
Washington Headquarters			
Basic Energy Sciences	1,538	237,568	323,916
Advanced Scientific Computing Research	1,467	58,310	86,122
Biological and Environmental Research	858	82,737	138,417
High Energy Physics	2,786	79,983	113,376
Nuclear Physics	433	40,493	62,025
Fusion Energy Sciences	554	17,292	23,376
Science Laboratories Infrastructure	1	11,385	1,385
Science Program Direction	73,386	73,225	86,606
Workforce Development for Teachers and Scientists	—	2,630	6,810
Safeguards and Security	80	4,604	5,878
Congressionally Directed Projects	—	24,011	—
Total, Washington Headquarters	81,103	632,238	847,911
Waste Isolation Pilot Plant			
Congressionally Directed Projects	1,435	—	—
Total, Science	4,136,071	4,772,636	4,941,682

Major Changes or Shifts by Site

Argonne National Laboratory

- **Advanced Scientific Computing Research**: The Leadership Computing Facility will be fully operational at 500 teraflops and will provide open high-performance computing capability with low electrical power consumption to enable scientific advances.
- **Science Laboratories Infrastructure**: The Energy Sciences Building project is initiated to provide safe, efficient, and modern space for research and development. This project will fill that need by providing environmentally stable, specialized, and flexible space that will replace some of the oldest and least effective research space for energy-related sciences.

Brookhaven National Laboratory

- **Science Laboratories Infrastructure**: The Renovate Science Laboratories—Phase II project is initiated to modernize obsolete and unsuitable laboratory space in Building 510 (Physics) and Building 555 (Chemistry), allowing continue support of research in Basic Energy Sciences, Nuclear Physics, and High Energy Physics.

Lawrence Berkeley National Laboratory

- **Biological and Environmental Research**: The Joint BioEnergy Institute at Lawrence Berkeley National Laboratory will be fully operational in FY 2009.
- **High Energy Physics**: Funding was provided in the FY 2009 Appropriation for the Berkeley Lab Laser Acceleration Project (BELLA). BELLA will further advance the world-leading laser-driven plasma acceleration program at the L'Oasis laboratory, with a focus on exploring concepts for cascading GeV wakefield accelerating modules, a promising path to higher gradients and energies in compact particle accelerators. L'Oasis has already accelerated high-quality electron beams to energy exceeding 1 GeV in a one-meter long structure. BELLA will initially improve this by a factor of ten, to 10 GeV.

Los Alamos National Laboratory

- **Nuclear Physics**: Radioisotope related activities at the Isotope Production Facility (IPF) are transferred from the Office of Nuclear Energy to SC in FY 2009.

Oak Ridge National Laboratory

- **Advanced Scientific Computing Research**: The Leadership Computing Facility will be fully operational at one petaflop and will provide open high-performance computing capability to enable scientific advances.
- **Biological and Environmental Research**: The BioEnergy Science Center at the Oak Ridge National Laboratory will be fully operational in FY 2009.
- **Fusion Energy Sciences**: Funding for the U.S. Contributions to ITER MIE Project is increased in FY 2010 by $11.0M.

Oak Ridge National Site Office

- **Science Program Direction**: Federal oversight of contract performance at the Oak Ridge National Laboratory is realigned to the Oak Ridge National Laboratory Site Office from the Oak Ridge Office.

Oak Ridge Office

- **Science Program Direction**: Federal oversight of contract performance at the Oak Ridge National Laboratory is realigned from the Oak Ridge Office to the Oak Ridge National Laboratory Site Office.

Princeton Plasma Physics Laboratory

- **Fusion Energy Sciences**: The FY 2009 Congressional Request included funding for NCSX Research ($692,000) and the NCSX MIE project ($19,560,000). Due to cancellation of the project in May 2008, closeout costs were provided for in FY 2008, and the FY 2009 funding has been redirected to provide increases in facilities operations and upgrades ($16,823,000) and experimental plasma research on smaller-scale stellarators ($3,429,000). One of the upgrades that was started in FY 2009 and will continue in FY 2010 is to enhance the capability of the National Spherical Torus Experiment at PPPL.

SLAC National Accelerator Laboratory

- **Basic Energy Sciences**: FY 2010 marks the completion of construction for the Linac Coherent Light Source (LCLS) project. The LCLS will begin its first full year of operations as a DOE user facility in FY 2011.
- **High Energy Physics**: In FY 2010, SLAC plans to complete construction of the Facility for Accelerator Science and Experimental Test Beams (FACET) and begin preparations for the first round of experiments in which electrons are accelerated by plasma wakefields. Much of the work on advanced accelerator concepts at SLAC is done in collaboration with universities funded by the Accelerator Science research activity. The ultimate goal of this effort will be demonstration of efficient accelerating structures with gradients well above 100 MeV/m that could be incorporated into future accelerators.
- **Science Laboratories Infrastructure**: The Research Support Building and Infrastructure Modernization project is initiated to replace substandard modular buildings and trailers that are well beyond their intended useful life with a new Research Support Building to allow collocation of the Accelerator Science and Technology program at the laboratory. The project will also modernize three existing buildings onsite.

Site Description

Ames Laboratory

The Ames Laboratory is a program dedicated laboratory (Basic Energy Sciences). The laboratory is located on the campus of the Iowa State University, in Ames, Iowa, and consists of 12 buildings (327,664 gross square feet of space) with the average age of the buildings being 41 years. DOE does not own the land. Ames conducts fundamental research in the physical, chemical, and mathematical sciences associated with energy generation and storage; and is a national center for the synthesis, analysis, and engineering of rare-earth metals and their compounds.

- **Basic Energy Sciences**: Ames supports experimental and theoretical research on rare earth elements in novel mechanical, magnetic, and superconducting materials. Ames scientists are experts on magnets, superconductors, and quasicrystals that incorporate rare earth elements. Ames also supports theoretical studies for the prediction of molecular energetics and chemical reaction rates and provides leadership in analytical and separations chemistry. Ames is home to the Materials Preparation Center, which is dedicated to the preparation, purification, and characterization of rare-earth, alkaline-earth, and refractory metal and oxide materials.
- **Advanced Scientific Computing Research**: Ames conducts research in computer science and participates on Scientific Discovery through Advanced Computing (SciDAC) science application teams.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of security systems, security officers, personnel security, program management, material control and accountability, and cyber security.

Ames Site Office

The Ames Site Office provides the single federal presence with responsibility for contract performance at the Ames Laboratory. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Argonne National Laboratory

The Argonne National Laboratory (ANL) in Argonne, Illinois, is a multiprogram laboratory located on 1,500 acres in suburban Chicago. The laboratory consists of 100 buildings (4.6 million gross square feet of space) with an average building age of 37 years.

- **Basic Energy Sciences**: ANL is home to research activities in broad areas of materials and chemical sciences. It is also the site of three user facilities—the Advanced Photon Source (APS), the Center for Nanoscale Materials (CNM), and the Electron Microscopy Center (EMC) for Materials Research.
  - The **Advanced Photon Source** is one of only three third-generation, hard x-ray synchrotron radiation light sources in the world. The 1,104-meter circumference facility—large enough to house a baseball park in its center—includes 34 bending magnets and 34 insertion devices, which generate a capacity of 68 beamlines for experimental research. Instruments on these beamlines attract researchers to study the structure and properties of materials in a variety of disciplines, including condensed matter physics, materials sciences, chemistry, geosciences, structural biology, medical imaging, and environmental sciences.
  - The **Electron Microscopy Center for Materials Research** provides *in-situ* high-voltage and intermediate voltage high-spatial resolution electron microscope capabilities for direct observation of ion-solid interactions during irradiation of samples with high-energy ion beams. The EMC employs both a tandem accelerator and an ion implanter in conjunction with a transmission electron microscope for simultaneous ion irradiation and electron beam microcharacterization. The unique combination of two ion accelerators and an electron microscope permits direct, real-time, *in-situ* observation of the effects of ion bombardment of materials. Research at EMC includes microscopy based studies on high-temperature superconducting materials, irradiation effects in metals and semiconductors, phase transformations, and processing related structure and chemistry of interfaces in thin films.

- The **Center for Nanoscale Materials** provides capabilities for developing new methods for self assembly of nanostructures, exploring the nanoscale physics and chemistry of nontraditional electronic materials, and creating new probes for exploring nanoscale phenomena. The CNM is organized around six scientific themes: nanomagnetism, bio-inorganic hybrids, nanocarbon, complex oxides, nanophotonics, and theory and simulation.

▪ **Advanced Scientific Computing Research**: ANL conducts basic research in mathematics and computer science, as well as research in advanced computing software tools. ANL also participates in scientific application partnerships and contributes to a number of the SciDAC science application teams. Further, it participates in both SciDAC Centers for Enabling Technologies and SciDAC Institutes that focus on specific software challenges confronting users of petascale computers. The ANL Leadership Computing Facility provides the computational science community with a world-leading computing capability dedicated to breakthrough science and engineering. The Leadership Computing Facility provides resources, including a 500 teraflop IBM Blue Gene/P system, which make computationally intensive projects of the largest scales possible.

▪ **Biological and Environmental Research**: ANL conducts research on the molecular control of genes and gene pathways in microbes in addition to biological and geochemical research that supports environmental remediation. ANL operates beamlines for protein crystallography at the APS and also supports a growing community of users in environmental sciences.

  In support of climate change research, ANL has oversight responsibility for coordinating the overall infrastructure operations of all three stationary Atmospheric Radiation Measure (ARM) Climate Research Facility (ACRF) sites to ensure consistency, data quality, and site security and safety. This includes infrastructure coordination of communications, data transfer, and instrument calibration. ANL also provides the site manager for the Southern Great Plains site who is responsible for coordinating the day-to-day operations and manages the deployment and operation of the ACRF second mobile facility. ANL conducts research on aerosol processes and properties, and develops and applies software to enable efficient long-term climate simulations on distributed-memory multiprocessor computing platforms. In conjunction with Oak Ridge National Laboratory, Pacific Northwest National Laboratory, and six universities, ANL is a participating laboratory in the Carbon Sequestration in Terrestrial Ecosystems (CSiTE) consortium, focusing on research to understand the processes controlling the rate of soil carbon accretion.

▪ **High Energy Physics**: ANL has unique capabilities in the areas of engineering, detector technology, and advanced accelerator and computing techniques. ANL continues to participate in the Tevatron and neutrino research programs at Fermi National Accelerator Laboratory (Fermilab) and analysis of data from these experimental programs will continue for several years. Other major ANL activities include work on the ATLAS (A Large Toroidal LHC Apparatus) experiment at the Large Hadron Collider, advanced accelerator R&D using the Argonne Wakefield Accelerator, and an important role in collaboration with Fermilab in the development of superconducting radio frequency technology for future accelerators and development of new detector technologies.

  - The **Argonne Wakefield Accelerator** is an R&D testbed that focuses on the physics and technology of high-gradient, dielectric-loaded structures for accelerating electrons. Two approaches are being pursued: a collinear, electron-beam driven dielectric-loaded wakefield accelerator; and a two-beam accelerator. The goal is to identify and develop techniques which may lead to more efficient, compact, and inexpensive particle accelerators for future HEP applications. Research activities at this facility include: the development of materials/coatings for high gradient research; dielectric-loaded and photonic band gap accelerating structures; lefthanded meta-materials, high-power/high-brightness electron beams, and advanced beam diagnostics.

- **Nuclear Physics**: ANL operates and runs the R&D program for the Argonne Tandem Linac Accelerator System (ATLAS) national user facility, the world's premiere stable beam facility. Other activities include an on-site program of research using laser techniques (Atom Trap Trace Analysis); research programs at the Thomas Jefferson National Accelerator Facility (TJNAF), Fermilab, Relativistic Heavy Ion Collider (RHIC), and Deutsches Elektronen-Synchrotron (DESY) in Germany investigating the structure of the nucleon; R&D for the Facility for Rare Isotope Beams (FRIB); theoretical calculations and investigations in subjects supporting the experimental research programs in Medium Energy and Low Energy physics; and data compilation and evaluation activities as part of the National Nuclear Data Program.
  - The **Argonne Tandem Linac Accelerator System** national user facility provides variable energy and precision beams of stable ions from protons through uranium at energies near the Coulomb barrier (up to 10 MeV per nucleon) using a superconducting linear accelerator. Most work is performed with stable heavy-ion beams; however, about 10 to 20 percent of the beams are rare isotope beams. The ATLAS facility features a wide array of experimental instrumentation, including a world-leading ion-trap apparatus, the Advanced Penning Trap. The Gammasphere detector, coupled with the Fragment Mass Analyzer, is a unique world facility for measurement of nuclei at the limits of angular momentum (high-spin states). ATLAS staff are world leaders in superconducting linear accelerator technology, with particular application in rare isotope beam facilities. The combination of versatile beams and powerful instruments enables about 400 users annually at ATLAS to conduct research in a broad program in nuclear structure and dynamics, nuclear astrophysics, and fundamental interaction studies. The capabilities of ATLAS are being augmented by the fabrication of the CAlifornium Rare Ion Beam Upgrade (CARIBU) as a source to provide new capabilities in neutron-rich radioactive beams. A new instrument, the Helical Orbital Spectrometer (HELIOS), employs a new concept to study reactions with radioactive beams from CARIBU.
- **Fusion Energy Sciences**: ANL contributes a small effort in basic plasma science.
- **Science Laboratories Infrastructure**: SLI enables DOE research missions at ANL by funding line item construction to maintain the general purpose infrastructure and the cleanup and removal of excess facilities.
- **Safeguards and Security**: This program provides protection of special nuclear materials, classified matter, government property, and other vital assets from unauthorized access, theft, diversion, sabotage, espionage, and other hostile acts that may cause risks to national security, the health and safety of DOE and contractor employees, the public, or the environment.

Argonne Site Office

The Argonne Site Office provides the single federal presence with responsibility for contract performance at ANL. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Berkeley Site Office

The Berkeley Site Office provides the single federal presence with responsibility for contract performance at the Lawrence Berkeley National Laboratory. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Brookhaven National Laboratory

The Brookhaven National Laboratory (BNL) is a multiprogram laboratory located on 5,300 acres in Upton, New York. The laboratory consists of 334 SC buildings (4.0 million gross square feet of space) with an average building age of 38 years. BNL creates and operates major facilities available to university, industrial, and government personnel for basic and applied research in the physical, biomedical, and environmental sciences, and in selected energy technologies.

- **Basic Energy Sciences**: BNL conducts research efforts in materials and chemical sciences as well as efforts in geosciences and biosciences. It is also the site of two BES supported user facilities—the National Synchrotron Light Source (NSLS) and the Center for Functional Nanomaterials (CFN).
  - The **National Synchrotron Light Source** consists of two distinct electron storage rings. The x-ray storage ring is 170 meters in circumference and can accommodate 60 beamlines or experimental stations, and the vacuum-ultraviolet (VUV) storage ring can provide 25 additional beamlines around its circumference of 51 meters. Synchrotron light from the x-ray ring is used to determine the atomic structure of materials using diffraction, absorption, and imaging techniques. Experiments at the VUV ring help understand the atomic and electronic structure as well as the magnetic properties of a wide array of materials.
  - The **Center for Functional Nanomaterials** focuses on understanding the chemical and physical response of nanomaterials to make functional materials such as sensors, activators, and energy-conversion devices. It also provides clean rooms, general laboratories, and wet and dry laboratories for sample preparation, fabrication, and analysis. Equipment includes that needed for laboratory and fabrication facilities for e-beam lithography, transmission electron microscopy, scanning probes and surface characterization, material synthesis and fabrication, and spectroscopy.
- **Advanced Scientific Computing Research**: BNL conducts basic research in applied mathematics and participates on SciDAC science application teams. It also participates in SciDAC Centers for Enabling Technologies that focus on specific software challenges confronting users of petascale computers.
- **Biological and Environmental Research**: BNL operates beam lines for protein crystallography at the NSLS for use by the national biological research community, research in biological structure determination, and research into new instrumentation for detecting x-rays and neutrons. Research is also conducted in support of metabolic synthesis and conversion and on the molecular mechanisms of cell responses to low doses of radiation. BNL conducts molecular radiochemistry and imaging and instrumentation research, developing advanced technologies for biological imaging. BNL scientists support the subsurface biogeochemical research program in the area of subsurface contaminant fate and transport.
  - Climate change research includes the operation of the ACRF External Data resource that provides atmospheric system research investigators with data from non-ACRF sources, including satellite and ground-based systems. BNL scientists form an important part of the atmospheric system research science team, including providing special expertise in analyzing atmospheric field campaign data and aerosol research.

- BNL scientists play a leadership role in the operation of the Free-Air Carbon Dioxide Enrichment (FACE) experiment at the Duke Forest which seeks to understand how plants respond to elevated carbon dioxide concentrations in the atmosphere.

▪ **High Energy Physics**: BNL has unique resources in the engineering and technology for future accelerators and detectors, advanced computational resources, and the Accelerator Test Facility. BNL serves as the host laboratory for the U.S. ATLAS collaboration, which participates in the research of the ATLAS detector at the Large Hadron Collider. BNL manages the program of maintenance and operations for the ATLAS detector, operates the primary U.S. analysis facility for ATLAS data, and is developing an analysis support center for U.S. based users. The group also contributes to the leadership and management of the U.S. International Linear Collider R&D effort.

  BNL researchers have a leadership role in the Reactor Neutrino experiment in Daya Bay, China, BNL physicists are also involved in other neutrino physics efforts including research at the Neutrinos at the Main Injector (NuMI) facility with the Main Injector Neutrino OScillation (MINOS) experiment at Fermilab and R&D and planning for possible future accelerator-based neutrino experiments.

  - The BNL **Accelerator Test Facility** is a user facility that supports a broad range of advanced accelerator R&D. The core capabilities include a high-brightness photoinjector electron gun, a 70 MeV linac, high power lasers synchronized to the electron beam to a picosecond level, four beam lines, and a sophisticated computer control system. Participating researchers come from universities, national laboratories, and industries. Experiments carried out in this facility are proposal-driven and are typically in the areas involving interactions of high power electromagnetic radiation and high brightness electron beams, including laser acceleration of electrons and free-electron lasers. Other topics include the development of electron beams with extremely high brightness, photo-injectors, electron beam and radiation diagnostics, and computer controls.

▪ **Nuclear Physics**: Research activities include: use of relativistic heavy ion beams and polarized protons in the Relativistic Heavy Ion Collider (RHIC) to investigate hot, dense nuclear matter and to understand the internal "spin" structure of the proton, respectively—parts of which are coordinated with the RIKEN BNL Research Center funded by Japan; development of future detectors for RHIC; R&D of beam-cooling accelerator technology aimed at increasing the RHIC beam luminosity; conducting R&D directed towards research with neutrinos; a theory program emphasizing RHIC heavy ion and "spin" physics; and data compilation and evaluation at the National Nuclear Data Center (NNDC) that is the central U.S. site for these national and international efforts.

  - The **Relativistic Heavy Ion Collider** facility uses the Tandem Van de Graaff, Booster Synchrotron, and Alternating Gradient Synchrotron (AGS) accelerators in combination to inject beams into two rings of superconducting magnets of almost 4 kilometers circumference with 6 intersection regions where the beams can collide. RHIC can accelerate and collide a variety of heavy ions, including gold beams, up to an energy of 100 GeV per nucleon. RHIC is being used to search for and characterize hot, dense nuclear matter such as the predicted "quark-gluon plasma," a form of nuclear matter thought to have existed microseconds after the "Big Bang." It can also collide polarized protons with beams of energy up to 250 GeV per nucleon—a unique capability. Two detectors are supported to provide complementary measurements, with some overlap in order to cross-calibrate the measurements: the Solenoidal Tracker at RHIC (STAR) and the Pioneering High-Energy Nuclear Interacting Experiment (PHENIX).

- The **Alternating Gradient Synchrotron** provides high intensity pulsed proton beams up to 33 GeV on fixed targets and secondary beams of kaons, muons, pions, and anti-protons. The AGS is the injector of (polarized) proton and heavy-ion beams into RHIC, and its operations are supported by the NP Heavy Ion subprogram as part of the RHIC facility. The AGS is also utilized for radiation damage studies of electronic systems for NASA-supported work and work for other agencies.
- The **Booster Synchrotron**, part of the RHIC injector, provides heavy-ion beams to a dedicated beam line (NASA Space Radiation Laboratory) for biological and electronic systems radiation studies funded by NASA. The incremental costs for these studies are provided by NASA.
- The **Tandem Van de Graaff** accelerators which serve as injectors for the Booster Synchrotron are being replaced by a modern, compact Electron Beam Ion Source (EBIS) and linac system which promises greater efficiency, greater reliability, and lower maintenance costs as well as the potential for future upgrades. The EBIS is a joint DOE/NASA project and will be completed in FY 2010.
- The **National Nuclear Data Center** is the central U.S. site for national and international nuclear data and compilation efforts. The U.S. Nuclear Data program is the United States' repository for information generated in low- and intermediate-energy nuclear physics research worldwide. This information consists of both bibliographic and numeric data. The NNDC is a resource for a very broad user community in all aspects of nuclear technology, with relevance to homeland security and advanced fuel cycles for nuclear reactors. Nuclear Data program-funded scientists at U.S. national laboratories and universities contribute to the activities and responsibilities of the NNDC.
- The **Brookhaven Linear Isotope Producer (BLIP)** at BNL uses a linear accelerator that injects 200 million-electron-volt (MeV) protons into the 33 giga-electron-volt (GeV) Alternating Gradient Synchrotron. Isotopes produced, such as strontium-82, germanium-68, copper-67, and others, are used in medical diagnostic and therapeutic applications and other scientific research.

▪ **Science Laboratories Infrastructure**: SLI enables DOE research missions at BNL by funding line item construction to maintain the general purpose infrastructure, and the cleanup and removal of excess facilities.

▪ **Safeguards and Security**: S&S activities at BNL are focused on protective forces, cyber security, personnel security, security systems, information security, program management, and material control and accountability.

Brookhaven Site Office

The Brookhaven Site Office provides the single federal presence with responsibility for contract performance at BNL. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Chicago Office

The Chicago (CH) Office supports the Department's programmatic missions in science and technology, national nuclear security, energy resources, and environmental quality by providing expertise and assistance in such areas as contract management, procurement, project management, engineering, facilities and infrastructure, property management, construction, human resources, financial management, general and patent law, environmental protection, quality assurance, integrated safety management, integrated safeguards and security management, nuclear material control and accountability, and emergency management. CH directly supports site offices responsible for program management oversight of six major management and operating laboratories—Ames Laboratory, Argonne National Laboratory, Lawrence Berkeley National Laboratory, Brookhaven National Laboratory, Fermi National Accelerator Laboratory, and Princeton Plasma Physics Laboratory—and one government-owned and government-operated Federal laboratory, New Brunswick Laboratory. Additionally, the administrative, business, and technical expertise of CH is shared SC-wide through the Integrated Support Center concept. CH serves as SC's grant center, administering grants to 272 colleges/universities in all 50 states, Washington, D.C., and Puerto Rico, as determined by the DOE-SC program offices as well as non-SC offices.

Basic Energy Sciences: BES funds research at 173 academic institutions located in 48 states.

- **Advanced Scientific Computing Research**: ASCR funds research at over 70 academic institutions supporting over 130 principal investigators.
- **Biological and Environmental Research**: BER funds research at over 200 institutions, including colleges, universities, private industry, and other federal and private research institutions located in 45 states, Washington, DC, and Puerto Rico.
- **High Energy Physics**: HEP supports about 300 research groups at more than 100 colleges and universities located in 36 states, Washington, D.C., and Puerto Rico.
- **Nuclear Physics**: NP funds 185 research grants at 87 colleges and universities located in 34 states and the District of Columbia.
- **Fusion Energy Sciences**: FES funds research grants and cooperative agreements at more than 50 colleges and universities located in approximately 30 states.
- **Safeguards and Security**: S&S at CH provides for contractor protective forces for the Fermi National Accelerator Laboratory and Homeland Security Presidential Directive-12 implementation cost and maintenance.

Fermi National Accelerator Laboratory

Fermi National Accelerator Laboratory is a program-dedicated laboratory (High Energy Physics) located on a 6,800-acre site in Batavia, Illinois. The laboratory consists of 355 buildings (2.2 million gross square feet of space) with an average building age of 42 years. Fermilab is the largest U.S. laboratory for research in high-energy physics and is second in size only to CERN, the European Laboratory for Particle Physics. About 2,000 scientific users, scientists from universities and laboratories throughout the U.S. and around the world, use Fermilab for their research. Fermilab's mission is that of the high-energy physics program: to understand matter at its deepest level, to identify its fundamental building blocks, and to understand how the laws of nature determine their interactions.

- **Advanced Scientific Computing Research**: Fermilab participates in some SciDAC science application teams relevant to physics research, accelerator modeling, and distributed data. Fermilab also participates in SciDAC Centers for Enabling Technologies that focus on specific software challenges confronting users of petascale computers.
- **High Energy Physics**: Fermilab is the principal experimental facility for HEP. Fermilab operates the **Tevatron** accelerator and colliding beam facility, which consists of a four-mile ring of superconducting magnets and two large multi-purpose detectors and is capable of accelerating protons and antiprotons to an energy of one trillion electron volts (1 TeV). The Tevatron Collider is the highest energy proton accelerator in the world, and will remain so until the Large Hadron

Collider (LHC) begins operation at CERN in 2009. The laboratory supports two Tevatron experiments, CDF and DZero, together home to about 1,500 physicists from Fermilab and other national labs, U.S. universities, and foreign universities and research institutes.

- The Tevatron complex includes the **Neutrinos at the Main Injector (NuMI)** beamline, the world's highest intensity neutrino beam facility, which started operation in 2005. NuMI provides a controlled beam of neutrinos to the Main Injector Neutrino OScillation (MINOS) experiment located in the Soudan Mine in Minnesota. New experiments (Minerva and NOvA) that will make further use of the NuMI beam began fabrication in FY 2008.
- Fermilab is host laboratory for the U.S. Compact Muon Solenoid (CMS) collaboration, which conducts research using the CMS detector at the LHC. Fermilab manages the program of maintenance and operations for the CMS detector and operates the primary U.S. data analysis center for CMS. Fermilab is also the host laboratory for the LHC Accelerator Research Program which manages U.S. accelerator physicists' efforts on the commissioning, operations, and upgrades of the LHC.
- Fermilab is a leading national laboratory for research and development of future particle accelerator technologies. For example, the large scale infrastructure needed for the fabrication, processing, and testing of superconducting radio frequency (RF) cavities and cryomodules is being built at Fermilab. This includes horizontal and vertical test stands for cavity testing, high quality clean rooms and well-equipped rigging areas for assembly of cryomodules. Fermilab is the lead U.S. laboratory coordinating the national R&D program in this area.
- Fermilab also has an active program in particle astrophysics and cosmology. Fermilab is leading the development and fabrication of a camera to be used in the Dark Energy Survey, has significant participation in research on the direct detection of dark matter and ultra high energy cosmic rays, and is doing R&D towards next generation dark energy experiments.
- Fermilab also has a significant program for R&D on advanced detector components for a variety of physics applications. The laboratory maintains and operates a fixed target beam for testing of detector elements. The facility hosts both university and international groups.

▪ **Safeguards and Security**: The S&S program maintains security officers and operations to protect personnel and the facility, cyber security, program management, security systems, and material control and accountability programs to accurately account for the facility's special nuclear materials.

Fermi Site Office

The Fermi Site Office provides the single federal presence with responsibility for contract performance at Fermilab. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Idaho National Laboratory

Idaho National Laboratory (INL) is a multiprogram laboratory located on 572,000 acres in Idaho Falls, Idaho. Within the laboratory complex are nine major applied engineering, interim storage, and research and development facilities.

▪ **Basic Energy Sciences**: INL supports studies to understand and improve the life expectancy of material systems used in engineering.

- **Biological and Environmental Research**: INL is conducting research in subsurface biogeochemical research related to clean up of the nuclear weapons complex with an emphasis on understanding coupled processes affecting contaminant transport.
- **Fusion Energy Sciences**: Research at INL focuses on the safety aspects of magnetic fusion concepts for existing and future machines, such as a burning plasma experiment, and further developing the domestic fusion safety database using existing collaborative arrangements to conduct work on international facilities. In addition, INL has expanded their research and facilities capabilities to include tritium science activities at the Safety and Tritium Applied Research (STAR) national user facility—a small tritium laboratory where the fusion program can conduct tritium material science, chemistry, and safety experiments. INL also coordinates safety codes and standards within the ITER program.
- **Nuclear Physics:** The Advanced Test Reactor is supported for the production of select isotopes for the Isotope Program, such as Gd-153, an important isotope for applications such as positron emission tomography (PET) imaging.

Lawrence Berkeley National Laboratory

The Lawrence Berkeley National Laboratory (LBNL) is a multiprogram laboratory located in Berkeley, California, on a 200-acre site adjacent to the Berkeley campus of the University of California. The laboratory consists of 106 buildings (1.7 million gross square feet of space) with an average building age of 39 years. LBNL is dedicated to performing leading-edge research in the biological, physical, materials, chemical, energy, and computer sciences. The land is leased from the University of California.

- **Basic Energy Sciences**: LBNL is home to major research efforts in materials and chemical sciences as well as to efforts in geosciences, engineering, and biosciences. It is also the site of three Basic Energy Sciences supported user facilities—the Advanced Light Source (ALS), the National Center for Electon Microscopy (NCEM), and the Molecular Foundry.
  - The **Advanced Light Source** provides vacuum-ultraviolet light and x-rays for probing the electronic and magnetic structure of atoms, molecules, and solids, such as those for high-temperature superconductors. The high brightness and coherence of the ALS light are particularly suited for soft x-ray imaging of biological structures, environmental samples, polymers, magnetic nanostructures, and other inhomogeneous materials. Other uses of the ALS include holography, interferometry, and the study of molecules adsorbed on solid surfaces. The pulsed nature of the ALS light offers special opportunities for time resolved research, such as the dynamics of chemical reactions. Shorter wavelength x-rays are also used at structural biology experimental stations for x-ray crystallography and x-ray spectroscopy of proteins and other important biological macromolecules. The ALS User Support Building (USB) will provide high-quality user support space in sufficient quantity to accommodate the very rapid growth in the number of ALS users and to accommodate projected future expansion of beamlines, instruments and accelerator upgrades. The USB will contain staging areas for ALS experiments, space for a long beamline that will extend from the floor of the ALS into the USB, and temporary office space for visiting users.
  - The **National Center for Electron Microscopy** provides instrumentation for high-resolution, electron-optical microcharacterization of atomic structure and composition of metals, ceramics, semiconductors, superconductors, and magnetic materials. This facility contains one of the highest resolution electron microscopes in the U.S., the Transmission Electron Aberration Corrected Microscope.

- The **Molecular Foundry** provides users with instruments, techniques, and collaborators to enhance the study of the synthesis, characterization, and theory of nanoscale materials. Its focus is on the multidisciplinary development and understanding of both “soft” (biological and polymer) and “hard” (inorganic and microfabricated) nanostructured building blocks and the integration of these building blocks into complex functional assemblies. Scientific themes include inorganic nanostructures; nanofabrication; organic, polymer, and biopolymer nanostructures; biological nanostructures; imaging and manipulation of nanostructures; and theory of nanostructures. The facility offers expertise in a variety of techniques for the study of nanostructures, including electronic structure and excited-state methods, *ab initio* and classical molecular dynamics, quantum transport, and classical and quantum Monte Carlo approaches.

▪ **Advanced Scientific Computing Research**: LBNL conducts basic research in mathematics and computer science, as well as research in advanced computing software tools. LBNL also participates in several SciDAC science application teams, and both SciDAC Centers for Enabling Technologies and SciDAC Institutes that focus on specific software challenges confronting users of petascale computers. LBNL manages the ESnet. ESnet is one of the worlds most effective and progressive science-related computer networks that provides worldwide access and communications to Department of Energy facilities. LBNL is also the site of the National Energy Research Scientific Computing Center (NERSC), which provides a range of high-performance, state-of-the-art computing resources that are a critical element in the success of many SC research programs.

▪ **Biological and Environmental Research**: LBNL is the lead national laboratory that manages the **Joint Genome Institute (JGI)**, the principal goal of which is high-throughput DNA sequencing techniques. The laboratory also conducts research on the molecular mechanisms of cell responses to low doses of radiation and on microbial systems biology research as part of Genomic Science. LBNL operates beamlines for determination of protein structure at the ALS for use by the national and international biological research community. The ALS also supports and is used by a growing environmental science community.

  LBNL supports subsurface biogeochemical research and provides geophysical, biophysical, and biochemical research capabilities for field sites and is participating in the NSF/DOE Environmental Molecular Sciences Institute at Pennsylvania State University.

  LBNL conducts research on carbon cycling and carbon sequestration on terrestrial ecosystems to understand the processes controlling the exchange of CO_2 between terrestrial ecosystems and the atmosphere. It also conducts research on biological and ecological responses to climatic and atmospheric changes.

  It also develops scalable implementation technologies that allow widely used climate models to run effectively and efficiently on massively parallel processing supercomputers.

  - The **Joint BioEnergy Institute (JBEI)** at LBNL, one of three Genomic Science Bioenergy Research Centers, is focused on model plant systems (*Arabidopsis* and rice) for which the laboratory capabilities are well developed. Early results on their more tractable genomics will be shifted to potential bioenergy feedstock plants. The JBEI is experimenting with *E. Coli* and yeast, two workhorse microbes for conversion, as well as the use of ionic liquids for deconstruction of biomass material. JBEI is also investigating biological production of alternatives to ethanol that would be better substitutes for gasoline and diesel.

▪ **High Energy Physics**: LBNL has unique capabilities in the areas of superconducting magnet R&D, engineering and detector technology, laser driven particle acceleration, the design of advanced electronic devices, computational resources, and the design of modern, complex software codes for HEP experiments. LBNL participates in the research of the ATLAS detector at the Large Hadron Collider, and has a leading role in providing the software and computing infrastructure for ATLAS. LBNL physicists are also involved in neutrino physics research using reactor-produced neutrinos, and provide management expertise to the Reactor Neutrino experiment at Daya Bay, China.

LBNL also has an active program in particle astrophysics and cosmology, providing leadership in the development of innovative detector technologies and in the application of high energy physics analysis methods to astronomical observations. LBNL physicists lead ongoing studies of dark energy using supernovae and baryon acoustic oscillations; this science team continues R&D for a space-based dark energy mission. LBNL operates the Microsystems Lab where new detector technologies have been developed for collider physics research and new devices to study dark energy and the cosmic microwave background. LBNL is also host to the annually updated Particle Data Group, which coordinates compilation and synthesis of high-energy physics experimental data into compendia which summarize the status of all major subfields of HEP.

- **Nuclear Physics**: LBNL supports a variety of activities focused primarily in the low energy and heavy ion NP subprograms. These include fabrication of a next-generation gamma-ray detector system, GRETINA; research with the STAR detector located at BNL's RHIC facility; development of future detector systems for RHIC; operation of the Parallel Distributed Systems Facility aimed at heavy ion and low energy physics computation; fabrication of a detector upgrade for the ALICE detector heavy ion program at the Large Hadron Collider (LHC) in Europe; research at the KamLAND detector in Japan that is performing neutrino studies; development and fabrication of next generation neutrino detectors, including leading the effort on U.S. participation in the Cryogenic Underground Observatory for Rare events (CUORE) experiment in Italy; a theory program with an emphasis on relativistic heavy ion physics; data compilation and evaluation activities supporting the National Nuclear Data Center at BNL; and R&D with the development of electron-cyclotron resonance (ECR) ion sources for the Facility for Rare Isotope Beams (FRIB). The 88-Inch Cyclotron at LBNL is a facility for testing electronic circuit components for radiation "hardness" to cosmic rays, supported by the National Reconnaissance Office and the U.S. Air Force, and for a small in-house research program supported by NP.

- **Fusion Energy Sciences**: LBNL has been conducting research in developing ion beams for applications to high energy density laboratory plasmas (HEDLP) in the near term (4 to 10 years) and inertial fusion energy in the long term. Currently the laboratory has two major experimental systems for doing this research: the Neutralized Drift Compression Experiment and the High Current Experiment. Both experiments are directed at answering the question of how ion beams can be produced with the intensity required for research in HEDLP and inertial fusion energy sciences. LBNL conducts this research together with the Lawrence Livermore National Laboratory and Princeton Plasma Physics Laboratory through the Heavy Ion Fusion Science Virtual National Laboratory.

- **Science Laboratories Infrastructure**: SLI enables DOE research missions at LBNL by funding line item construction to maintain the general purpose infrastructure and the cleanup and removal of excess facilities.

- **Safeguards and Security**: S&S at LBNL provides physical protection of personnel and laboratory facilities through utilization of security officers, security systems, cyber security, program management, personnel security, and material control and accountability for special nuclear material.

Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory (LLNL) is a multiprogram laboratory located on 821 acres in Livermore, California. This laboratory was built in Livermore as a weapons laboratory 42 miles from the campus of the University of California at Berkeley to take advantage of the expertise of the university in the physical sciences.

- **Basic Energy Sciences**: LLNL supports research in materials sciences and in geosciences research on the sources of electromagnetic responses in crustal rocks, seismology theory and modeling, the mechanisms and kinetics of low-temperature geochemical processes and the relationships among reactive fluid flow, geochemical transport, and fracture permeability.
- **Advanced Scientific Computing Research**: LLNL participates in base applied mathematics and computer science research. LLNL also participates in several SciDAC science application teams and both SciDAC Centers for Enabling Technologies and SciDAC Institutes that focus on specific software challenges confronting users of petascale computers.
- **Biological and Environmental Research**: LLNL is one of the major national laboratory partners that support the Joint Genome Institute (JGI), the principal goal of which is high-throughput DNA sequencing. LLNL is also developing new biocompatible materials and microelectronics for the artificial retina project and conducts research on the molecular mechanisms of cell responses to low doses of radiation.

  Through the program for Climate Model Diagnosis and Intercomparison, LLNL provides the international leadership to develop and apply diagnostic tools to evaluate and improve the performance of climate models. Virtually every climate modeling center in the world participates in this unique program. It also conducts research to improve understanding of the climate system, particularly the climate effect of clouds and aerosol properties and processes and climate change feedbacks on carbon cycling.
- **High Energy Physics**: HEP supports experimental physics research and technology R&D at LLNL, using unique capabilities of the laboratory primarily in the areas of engineering and detector technology and advanced accelerator R&D.
- **Nuclear Physics**: The LLNL program supports research in relativistic heavy ion physics as part of the PHENIX collaboration at RHIC and the ALICE experiment at the LHC, in nuclear data and compilation activities, in R&D for neutrino-less double beta decay experiments, and on theoretical nuclear structure studies.
- **Fusion Energy Sciences**: LLNL works with LBNL and PPPL through the Heavy-Ion Fusion Virtual National Laboratory in advancing the physics of heavy ion beams as a driver for inertial fusion energy in the long term and high energy density laboratory plasmas in the near term. It also conducts research on fast ignition concepts for applications in research on high energy density physics and inertial fusion energy. The LLNL program also includes collaborations with General Atomics on the DIII-D tokamak and benchmarking of fusion physics computer models with experiments such as DIII-D. LLNL carries out research in the simulation of turbulence and its effect on transport of heat and particles in magnetically confined plasmas. In addition, LLNL carries out research in support of plasma chamber and plasma-material interactions.

Los Alamos National Laboratory

Los Alamos National Laboratory (LANL) is a multiprogram laboratory located on 30,413 acres in Los Alamos, New Mexico.

- **Basic Energy Sciences**: LANL is home to efforts in materials sciences, chemical sciences, geosciences, and engineering. LANL research includes work on strongly correlated electronic materials, high-magnetic fields, microstructures, deformation, alloys, bulk ferromagnetic glasses, mechanical properties, metastable phases and microstructures, alkaline fuel cells, and bioinspired molecular assemblies for energy conversion. Research is also supported to understand the electronic structure and reactivity of actinides the chemistry of plutonium and other light actinides in both near-neutral pH conditions and under strongly alkaline conditions relevant to radioactive wastes, and the physical electrochemistry fundamental to energy storage systems. In the areas of geosciences, experimental and theoretical research is supported on rock physics, seismic imaging, the physics of the earth's magnetic field, fundamental geochemical studies of isotopic equilibrium/disequilibrium, and mineral-fluid-microbial interactions.

  LANL is also the site of two BES supported user facilities: the Manuel Lujan Jr. Neutron Scattering Center (Lujan Center) and the Center for Integrated Nanotechnologies (CINT).

  - The **Manuel Lujan Jr. Neutron Scattering Center** provides an intense pulsed source of neutrons to a variety of spectrometers for neutron scattering studies. The Lujan Center features instruments for measurement of high-pressure and high-temperature samples, strain measurement, liquid studies, and texture measurement. The facility has extensive experience in handling actinide samples. The Lujan Center is part of the Los Alamos Neutron Science Center (LANSCE), which is comprised of a high-power 800-MeV proton linear accelerator, a proton storage ring, production targets to the Lujan Center and the Weapons Neutron Research facility, and a variety of associated experiment areas and spectrometers for national security research and civilian research.

  - The **Center for Integrated Nanotechnologies** is devoted to establishing the scientific principles that govern the design, performance, and integration of nanoscale materials. Through its core facility in Albuquerque, New Mexico, and its gateways to both Sandia National Laboratories and Los Alamos National Laboratory, CINT provides access to tools and expertise to explore the continuum from scientific discovery to the integration of nanostructures into the microworld and the macroworld. CINT supports five scientific thrusts that serve as synergistic building blocks for integration research: nano-bio-micro interfaces, nanophotonics and nanoelectronics, complex functional nanomaterials, nanomechanics, and theory and simulation.

- **Advanced Scientific Computing Research**: LANL conducts basic research in mathematics and computer science and in advanced computing software tools. LANL also participates in several SciDAC science application teams and both SciDAC Centers for Enabling Technologies and SciDAC Institutes, which focus on specific software challenges confronting users of petascale computers.

- **Biological and Environmental Research**: LANL is one of the major national laboratory partners that support the JGI, the principal goal of which is high-throughput DNA sequencing and studies on the biological functions associated with newly sequenced human DNA. One of LANL's roles in the JGI involves the production of high quality "finished" DNA sequence. It also conducts research on the molecular mechanisms of cell responses to low doses of radiation and on the molecular control of genes and gene pathways in microbes. Activities in structural biology include the operation of an experimental station for protein crystallography at LANSCE for use by the national biological research community. LANL conducts research in optical imaging as part of the artificial retina project

In support of BER's climate change research, LANL manages the day-to-day operations at the Tropical Western Pacific Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) site. In addition, LANL manages the deployment and operation of the ACRF mobile facility. LANL also has a crucial role in the development, optimization, and validation of coupled sea ice and oceanic general circulation models and coupling them to atmospheric general circulation models for implementation on massively parallel computers.

LANL is participating in the NSF/DOE Environmental Molecular Sciences Institute at Pennsylvania State University.

- **High Energy Physics**: HEP supports theoretical physics research at LANL, using unique capabilities of the laboratory in high-performance computing for advanced simulations.
- **Nuclear Physics**: NP supports a broad program of research at LANL including: a program of neutron beam research that utilizes beams from the LANSCE facility to make fundamental physics measurements; the fabrication of an experiment to search for the electric dipole moment of the neutron to be located at the Fundamental Neutron Physics Beamline at the Spallation Neutron Source (SNS); a research and development effort in relativistic heavy ions using the PHENIX detector at RHIC and development of next generation instrumentation for RHIC; research directed at the study of the quark substructure of the nucleon in experiments at Fermilab and the "spin" structure of nucleons at RHIC using polarized proton beams; measurement of oscillations of anti-neutrinos with the Mini Booster Neutrino Experiment (MiniBooNE) and reporting results on the properties of neutrinos and R&D directed at future studies of the properties of neutrinos; a broad program of theoretical research; and nuclear data and compilation activities as part of the U.S. Nuclear Data program.
  - At LANL, the 100 MeV Isotope Production Facility (IPF) produces radioactive isotopes, such as germanium-68, a calibration source for positron emission tomography (PET) scanners; strontium-82, the parent of rubidium-82, used in cardiac PET imaging; and arsenic-73, used as a biomedical tracer.
- **Fusion Energy Sciences**: LANL has developed a substantial experimental system for research in magnetized target fusion, one of the major innovative confinement concepts and a thrust area in magnetized high energy density laboratory plasmas. The laboratory leads research in a high-density, compact plasma configuration called field reversed configuration. LANL supports the creation of computer codes for modeling the stability of magnetically confined plasmas, including tokamaks and innovative confinement concepts. The work also provides theoretical and computational support for the Madison Symmetric Torus experiment, a proof-of-principle experiment in reversed field pinch at the University of Wisconsin in Madison. LANL develops advanced diagnostics for the National Spherical Torus Experiment (NSTX) at PPPL and other fusion experiments, such as the rotating magnetic field as a current drive mechanism for the Field Reversed Configuration Experiment at the University of Washington in Seattle. The laboratory is also doing research in inertial electrostatic confinement, another innovative confinement concept. LANL also supports the tritium processing activities needed for ITER.

National Renewable Energy Laboratory

The National Renewable Energy Laboratory (NREL) is a program-dedicated laboratory located on 632 acres in Golden, Colorado. NREL's focus is on renewable energy technologies such as photovoltaics and other means of exploiting solar energy. It is the world leader in renewable energy technology development. Since its inception in 1977, NREL's mission is to develop renewable energy and energy efficiency technologies and transfer these technologies to the private sector.

- **Basic Energy Sciences**: NREL supports basic research efforts on overcoming semiconductor doping limits, novel and ordered semiconductor alloys, and theoretical and experimental studies of properties of advanced semiconductor alloys for prototype solar cells. It also supports research addressing the fundamental understanding of solid-state, artificial photosynthetic systems. This research includes the preparation and study of novel dye-sensitized semiconductor electrodes, characterization of the photophysical and chemical properties of quantum dots, and study of charge carrier dynamics in semiconductors.
- **Advanced Scientific Computing Research**: NREL participates in SciDAC science application teams including efforts focused on computational nanoscience and computational biology.
- **Biological and Environmental Research:** NREL conducts research on the biological production of hydrogen and is a partner in the Oak Ridge National Laboratory-led Genomic Science BioEnergy Science Center.

New Brunswick Laboratory

The New Brunswick Laboratory (NBL) is a government-owned, government-operated center for analytical chemistry and measurement science of nuclear materials. In this role, NBL performs measurements of the elemental and isotopic compositions for a wide range of nuclear materials. The NBL is the U.S. Government's Nuclear Materials Measurements and Reference Materials Laboratory and the National Certifying Authority for nuclear reference materials and measurement calibration standards. NBL provides reference materials, measurement and interlaboratory measurement evaluation services, and technical expertise for evaluating measurement methods and safeguards measures in use at other facilities for a variety of Federal program sponsors and customers. The NBL also functions as a Network Laboratory for the International Atomic Energy Agency. The NBL is administered through and is a part of the Chicago Office.

Oak Ridge Institute for Science and Education

The Oak Ridge Institute for Science and Education (ORISE), operated by Oak Ridge Associated Universities (ORAU), is located on a 169-acre site in Oak Ridge, Tennessee. Established in 1946, ORAU is a university consortium leveraging the scientific strength of major research institutions to advance science and education by partnering with national laboratories, government agencies, and private industry. ORISE focuses on scientific initiatives to research health risks from occupational hazards, assess environmental cleanup, respond to radiation medical emergencies, support national security and emergency preparedness, and educate the next generation of scientists.

- **Basic Energy Sciences**: ORISE provides administrative support for panel reviews and site reviews. It also assists with the administration of topical scientific workshops and provides administrative support for other activities such as for the reviews of construction projects.
- **Advanced Scientific Computing Research**: ORISE provides administrative support for panel reviews, site reviews, and Advanced Scientific Computing Advisory Committee meetings. It also assists with the administration of topical scientific workshops.
- **Biological and Environmental Research**: ORISE coordinates research fellowship programs and coordinates activities associated with the peer review of research proposals and applications.

- **High Energy Physics**: ORISE provides support to the HEP program in the area of program planning and review.
- **Nuclear Physics**: ORISE supports the Holifield Radioactive Ion Beam Facility (HRIBF) and its research program through a close collaboration with university researchers using HRIBF.
- **Fusion Energy Sciences**: ORISE supports the operation of the Fusion Energy Sciences Advisory Committee and administrative aspects of some FES program peer reviews. It also acts as an independent and unbiased agent to administer the FES Graduate and Postgraduate Fellowship programs.
- **Science Laboratories Infrastructure**: SLI enables the cleanup and removal of excess facilities at ORISE.
- **Safeguards and Security**: S&S at ORISE provides physical protection by employing unarmed security officers for the purpose of protecting government-owned assets. The program includes information security, program management, personnel security, protective forces, security systems, and cyber security.
- **Workforce Development:** ORISE manages the DOE-NSF program supporting graduate students to attend the Lindau Meeting of Nobel Laureates.

Oak Ridge National Laboratory

The Oak Ridge National Laboratory (ORNL) is a multiprogram laboratory located on a 21,000 acre reservation at Oak Ridge, Tennessee. The laboratory's 1,100 acre main site on Bethel Valley Road contains 241 buildings (3.7 million gross square feet of space) with an average building age of 40 years. Scientists and engineers at ORNL conduct basic and applied research and development to create scientific knowledge and technological solutions that strengthen the nation's leadership in key areas of science; increase the availability of clean, abundant energy; restore and protect the environment; and contribute to national security. ORNL provides world-class scientific research capability while advancing scientific knowledge through such major Departmental initiatives as the Spallation Neutron Source (SNS), the supercomputing program, nanoscience research, complex biological systems, and ITER. In the defense mission arena, programs include those which protect our Homeland and National Security by applying advanced science and nuclear technology to the Nation's defense. Through the Nuclear Nonproliferation program, ORNL supports the development and coordination of domestic and international policy aimed at reducing threats, both internal and external, to the U.S. from weapons of mass destruction. ORNL also supports various Energy Efficiency and Renewable Energy programs and facilitates the R&D of energy efficiency and renewable energy technologies.

- **Basic Energy Sciences**: ORNL is home to major research efforts in materials and chemical sciences with additional programs in engineering and geosciences. ORNL has perhaps the most comprehensive materials research program in the country. It is also the site of four BES supported user facilities—the Spallation Neutron Source (SNS), the High Flux Isotope Reactor (HFIR), Shared Research Equipment (SHaRE) User Facility, and the Center for Nanophase Materials Sciences (CNMS).
  - The **Spallation Neutron Source** is a next-generation short-pulse spallation neutron source for neutron scattering that is significantly more powerful (by about a factor of 10) than any other spallation neutron source in existence. The SNS consists of a linac-ring accelerator system that delivers short (microsecond) proton pulses to a target/moderator system where neutrons are produced by a process called spallation. The neutrons produced are then used for neutron

scattering experiments. Specially designed scientific instruments use these pulsed neutron beams for a wide variety of investigations. There is initially one target station that can accommodate 24 instruments; the potential exists for adding more instruments and a second target station.

- The **High Flux Isotope Reactor** is a light-water cooled and moderated reactor that operates at 85 megawatts to provide state-of-the-art facilities for neutron scattering, materials irradiation, and neutron activation analysis and is the world's leading source of elements heavier than plutonium for research, medicine, and industrial applications. The neutron scattering experiments at HFIR reveal the structure and dynamics of a wide range of materials. The neutron-scattering instruments installed on the four horizontal beam tubes are used in fundamental studies of materials of interest to solid-state physicists, chemists, biologists, polymer scientists, metallurgists, and colloid scientists. A number of improvements at HFIR have increased its neutron scattering capabilities to 14 state-of-the-art neutron scattering instruments on the world's brightest beams of steady-state neutrons.
- The **Shared Research Equipment User Facility** makes available state-of-the-art electron beam microcharacterization facilities for collaboration with researchers from universities, industry and other government laboratories. Most SHaRE projects seek correlations at the microscopic or atomic scale between structure and properties in a wide range of metallic, ceramic, and other structural materials. A diversity of research projects have been conducted, such as the characterization of magnetic materials, catalysts, semiconductor device materials, high temperature superconductors, and surface-modified polymers.
- The **Center for Nanophase Materials Sciences** integrates nanoscale science with neutron science; synthesis science; and theory, modeling, and simulation. Scientific themes include macromolecular complex systems, functional nanomaterials such as carbon nanotubes, nanoscale magnetism and transport, catalysis and nano building blocks, and nanofabrication.

▪ **Advanced Scientific Computing Research**: ORNL conducts basic research in mathematics and computer science, as well as research in advanced computing software tools. ORNL also participates in several SciDAC science application teams, and both SciDAC Centers for Enabling Technologies and SciDAC Institutes that focus on specific software challenges confronting users of petascale computers. The Leadership Computing Facility (LCF) at ORNL is operating the world's most powerful unclassified scientific research high performance computer, a one petaflop Cray Baker system that takes the total capability to 1.64 petaflops peak performance.

▪ **Biological and Environmental Research**: ORNL has a leadership role in research focused on the ecological aspects of global environmental change. It supports basic research through ecosystem-scale manipulative experiments in the field, laboratory experiments involving model ecosystems exposed to global change factors, and development and testing of computer simulation models designed to explain and predict effects of climatic change on the structure and functioning of terrestrial ecosystems. ORNL is the home of a Free-Air CO_2 Enrichment (FACE) experiment which facilitates research on terrestrial carbon processes and the development of terrestrial carbon cycle models. It also houses the ACRF archive, providing data to atmospheric system research scientists and to the general scientific community. ORNL, in conjunction with ANL and PNNL and six universities, plays a principle role in the Carbon Sequestration in Terrestrial Ecosystems (CSiTE) consortium which is focusing on research to enhance the capacity, rates, and longevity of carbon sequestration in terrestrial ecosystems. ORNL scientists provide improvement in formulations and numerical methods necessary to improve climate models.

ORNL scientists make important contributions to the subsurface biogeochemical research activities, providing special leadership in microbiology applied in the field. ORNL also manages environmental remediation sciences research, including a field site for research on advancing the understanding and predictive capability of coupled hydrologic, geochemical, and microbiological processes that control the *in situ* transport, remediation, and natural attenuation of metals, radionuclides, and co-contaminants at multiple scales ranging from the molecular to the watershed.

ORNL is one of the major national laboratory partners that support the JGI, the principal goal of which is high-throughput DNA sequencing. One of ORNL's roles in the JGI involves the annotation (assigning biological functions to genes) of completed genomic sequences and mouse genetics. ORNL conducts research on widely used data analysis tools and information resources that can be automated to provide information on the biological function of newly discovered genes identified in high-throughput DNA sequencing projects. ORNL conducts microbial systems biology research as part of Genomic Science. The **BioEnergy Science Center (BESC)** at ORNL, one of three Genomic Science Bioenergy Research Centers, is focusing attention on two prime candidate feedstock plants, the poplar tree and switchgrass, as well as engineering microbes to enable more efficient biomass conversion by combining several steps.

- **Nuclear Physics**: The major effort at ORNL is the research, development, and operations of the Holifield Radioactive Ion Beam Facility (HRIBF) that is operated as a national user facility. Also supported are a relativistic heavy ion group that is involved in a research program using the PHENIX detector at RHIC and ALICE at the LHC; the development of and research with the Fundamental Neutron Physics Beamline (FNPB) at the Spallation Neutron Source (SNS); a theoretical nuclear physics effort that emphasizes investigations of nuclear structure and astrophysics; nuclear data and compilation activities that support the national nuclear data effort; and a technical effort involved in rare isotope beam development. Enriched stable isotopes are processed at ORNL materials and chemical laboratories. Radioactive isotopes are chemically processed and packaged in hot cells in a radiochemical laboratory and the Radiochemical Engineering Development Center (REDC).

  - The **Holifield Radioactive Ion Beam Facility** is the only radioactive nuclear beam facility in the U.S. to use the isotope separator on-line (ISOL) method and is used annually by about 250 scientists for studies in nuclear structure, dynamics, and astrophysics using radioactive beams. HRIBF accelerates secondary radioactive beams to higher energies (up to 10 MeV per nucleon) than any other facility in the world with a broad selection of ions. HRIBF conducts R&D on targets and ion sources and low energy ion transport for radioactive beams. The capabilities of HRIBF were augmented by the fabrication of the High Power Test Laboratory (HPTL) which provides capabilities unique in the world for the development and testing of new ion source techniques. The fabrication of a second source and transport beam-line (IRIS2) for radioactive ions will improve efficiency and reliability.

  - The **Fundamental Neutron Physics Beamline** (FNPB) at the Spallation Neutron Source (SNS) provides high intensity pulsed beams of cold and ultracold neutrons for fundamental research with neutrons. A new external building as part of the facility will accommodate precision instrumentation to measure the electric dipole moment of the neutron.

  - The **National Nuclear Data Center** is located at ORNL and supports the NP program in the coordination of production, sales and distribution of isotopes across the Nation.

- **Fusion Energy Sciences**: ORNL develops a broad range of components that are critical for improving the research capability of fusion experiments located at other institutions and that are essential for developing fusion as an environmentally acceptable energy source. The laboratory is a leader in fusion materials science, in the theory of heating of plasmas by electromagnetic waves, antenna design, and design and modeling of pellet injectors to fuel the plasma and control the density of plasma particles. The laboratory is also the site of the Controlled Fusion Atomic Data Center and its supporting research programs. While some ORNL scientists are located full-time at off-site locations, others carry out their collaborations with short visits to the host institutions, followed by extensive computer communications from ORNL for data analysis and interpretation, and theoretical studies. ORNL is also a leader in stellarator theory. ORNL hosts the U.S. ITER Project Office and is the lead laboratory managing the U.S. Contributions to ITER Major Item of Equipment (MIE) project.

- **Science Laboratories Infrastructure**: SLI enables DOE research missions at ORNL by funding line item construction to maintain the general purpose infrastructure and the cleanup and removal of excess facilities.
- **Safeguards and Security**: S&S at ORNL includes security systems, information security, cyber security, personnel security, material control and accountability, and program management. Program planning functions at the laboratory provide for short- and long-range strategic planning, and special safeguards plans associated with both day-to-day protection of site-wide security interests and preparation for contingency operations.

Oak Ridge National Laboratory Site Office

The Oak Ridge National Laboratory Site Office provides the single federal presence with responsibility for contract performance at ORNL. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Oak Ridge Office

The Oak Ridge (OR) Office directly provides corporate support (i.e., procurement, legal, finance, budget, human resources, and facilities and infrastructure) to site offices responsible for program management oversight of four major management and operating laboratories—Oak Ridge National Laboratory, Pacific Northwest National Laboratory, SLAC National Accelerator Laboratory, and Thomas Jefferson National Accelerator Facility. OR also oversees the OR Reservation and other DOE facilities in the City of Oak Ridge. Together on the Reservation and in the City of Oak Ridge there are 35 buildings (237,416 square feet) with an average age of 50 years and a total replacement plant value (RPV) of $42.0 million. The RPV of the roads and other structures on the Reservation is $68.6 million. The administrative, business, and technical expertise of OR is shared SC-wide through the Integrated Support Center concept. The OR Manager is also the single federal official with responsibility for contract performance at the Oak Ridge Institute for Science and Education (ORISE). The Manager provides on-site presence for ORISE with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

- **Science Laboratories Infrastructure**: The Oak Ridge Landlord subprogram maintains Oak Ridge Reservation infrastructure such as roads outside plant fences as well as DOE facilities in the town of Oak Ridge, payment in lieu of taxes (PILT), and other needs related to landlord responsibilities.
- **Safeguards and Security**: S&S provides for contractor protective forces for the Federal office building, OSTI, ORISE, and ORNL. This includes protection of a category 1 Special Nuclear Material Facility, Building 3019. Activities include security systems, information security, and personnel security.

Office of Scientific and Technical Information

The Office of Scientific and Technical Information (OSTI) fulfills the Department's legislative mandate to provide public access to the unclassified results of DOE's research programs. OSTI also collects, protects, and provides secure access to DOE's classified research outcomes. OSTI has built broad collaborations both within the U.S. and internationally to enable a single point of access to nearly 400 million pages of scientific information. Within the U.S., Science.gov offers simultaneous searching of federal science databases and websites, while WorldWideScience.org performs the same functionality across the R&D results of over 50 countries.

- **Science Laboratories Infrastructure**: SLI enables DOE research missions at OSTI by funding line item construction to maintain the general purpose infrastructure.

Pacific Northwest National Laboratory

Pacific Northwest National Laboratory (PNNL) is a DOE multiprogram laboratory located in Richland, Washington that supports DOE's science, national security, energy, and homeland security missions. PNNL operates the William R. Wiley Environmental Molecular Sciences Laboratory (EMSL)—a 224,463 square feet national scientific user facility constructed by DOE that houses 425 people. PNNL also utilizes 23 Federal facilities in the 300 Area of the Hanford Reservation (543,000 square feet of space that house nearly 600 people). These facilities provide nearly 50% of the PNNL's laboratory space and 100% of its nuclear and radiological facilities. In addition, PNNL operates facilities on land owned by its parent organization, Battelle Memorial Institute (494,000 square feet), and leases an additional 775,500 square feet of office space in the Richland area occupied by approximately 2,100 staff.

- **Basic Energy Sciences**: PNNL supports research in interfacial and surface chemistry, inorganic molecular clusters, analytical chemistry, and applications of theoretical chemistry to understanding surface. Geosciences research includes theoretical and experimental studies to improve our understanding of phase change phenomena in microchannels. Also supported is research on stress corrosion and corrosion fatigue, interfacial dynamics during heterogeneous deformation, irradiation assisted stress corrosion cracking, bulk defect and defect processing in ceramics, chemistry and physics of ceramic surfaces, and interfacial deformation mechanisms in aluminum alloys.
- **Advanced Scientific Computing Research**: PNNL conducts basic research in mathematics and computer science, as well as research in advanced computing software tools. PNNL also participates in several SciDAC science application teams and both SciDAC Centers for Enabling Technologies and SciDAC Institutes that focus on specific software challenges confronting users of petascale computers.
- **Biological and Environmental Research**: PNNL is home to EMSL, a national scientific user facility that is an integrated experimental and computational resource for discovery and technological innovation in the environmental molecular sciences to support the needs of DOE and the nation. EMSL provides unique ultra high field mass spectrometry and nuclear magnetic resonance spectrometry instruments, a high performance computer, and a variety of other cutting edge analytical capabilities for use by the national research community.

  PNNL conducts a wide variety of subsurface biogeochemical research, with emphases on biogeochemistry and fate and transport of radionuclides. PNNL is participating in the NSF/DOE Environmental Molecular Sciences Institutes at Pennsylvania State University. It also conducts research into new instrumentation for microscopic imaging of biological systems.

PNNL provides expertise in research on aerosol properties and processes and in field campaigns for atmospheric sampling and analysis of aerosols. PNNL also conducts climate modeling research to improve the simulations of both precipitation through representation of sub-grid orography and the effect of aerosols on climate at regional to global scales. The Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) technical office is located at PNNL, as is the project manager for the ACRF engineering activity; this provides invaluable logistical, technical, and scientific expertise for the program. PNNL manages the ARM Aerial Facility (AAF) as well. PNNL also conducts research on improving atmospheric system research methods and models for assessing the costs and benefits of climate change and of various different options for mitigating and/or adapting to such changes. PNNL, in conjunction with ANL and ORNL and six universities, plays an important role in the CSiTE consortium, focusing on the role of soil microbial processes in carbon sequestration. PNNL also conducts research on the integrated assessment of global climate change.

PNNL is one of the major national laboratory partners that support the JGI, the principal goal of which is high-throughput DNA sequencing. One of PNNL's roles in the JGI involves proteomics research (identifying all the proteins found in cells). PNNL conducts research on the molecular mechanisms of cell responses to low doses of radiation and on the development of high throughput approaches for characterizing all of the proteins (the proteome) being expressed by cells under specific environmental conditions. PNNL conducts microbial systems biology research as part of Genomic Science.

- **Fusion Energy Sciences**: PNNL has focused on research on materials that can survive in a fusion neutron environment. Experienced scientists and engineers at PNNL provide leadership in the evaluation of ceramic matrix composites for fusion applications and support work on ferrite steels as part of the U.S. fusion materials team.
- **Nuclear Physics**: NP supports modest R&D efforts aimed at exploring production mechanisms for isotopes, and for the processing of select isotopes important to the U.S.
- **Science Laboratories Infrastructure**: SLI enables DOE research missions at PNNL by funding line item construction to maintain the general purpose infrastructure and the cleanup and removal of excess facilities.
- **Safeguards and Security**: The PNNL S&S program consists of program management, physical security systems, protection operations, information security, cyber security, personnel security, and material control and accountability.

Pacific Northwest Site Office

The Pacific Northwest Site Office provides the single federal presence with responsibility for contract performance at PNNL. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Princeton Plasma Physics Laboratory

Princeton Plasma Physics Laboratory (PPPL) is a program-dedicated laboratory located on 88 acres in Plainsboro, New Jersey. The laboratory consists of 34 buildings (754,196 gross square feet of space) with an average building age of 34 years.

- **Advanced Scientific Computing Research**: PPPL participates in SciDAC science application teams related to fusion science.

- **High Energy Physics**: HEP supports a small theoretical research effort at PPPL using unique capabilities of the laboratory in the area of advanced accelerator R&D.
- **Fusion Energy Sciences**: PPPL is the only DOE laboratory devoted primarily to plasma and fusion science. The laboratory hosts experimental facilities used by multi-institutional research teams and also sends researchers and specialized equipment to other fusion facilities in the United States and abroad. PPPL is the host for the National Spherical Torus Experiment (NSTX), which is an innovative toroidal confinement device, closely related to the tokamak. PPPL scientists and engineers have significant involvement in the DIII-D and Alcator C-Mod tokamaks and the NSF Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas, as well as several large tokamak facilities abroad, including the Joint European Torus in the United Kingdom, and the Korean Superconducting Tokamak Reactor Advanced Research in Korea. This research is focused on developing the scientific understanding and innovations required for an attractive fusion energy source. PPPL scientists are also involved in several basic plasma science experiments, ranging from magnetic reconnection to plasma processing. PPPL also has a large theory group that does research in the areas of turbulence and transport, equilibrium and stability, wave-plasma interaction, and heavy ion accelerator physics. PPPL, LBNL, and LLNL currently work together in advancing the physics of heavy ion drivers for research in high energy density laboratory plasmas through the Heavy Ion Fusion Science Virtual National Laboratory. Through its association with Princeton University, PPPL provides high quality education in fusion-related sciences, having produced more than 200 Ph.D. graduates since its founding in 1951.
- **Safeguards and Security**: S&S at PPPL provides for protection of special nuclear materials, government property, and other vital assets from unauthorized access, theft, diversion, sabotage, or other hostile acts. The program consists of security officers, security systems, cyber security, and program management.

Princeton Site Office

The Princeton Site Office provides the single federal presence with responsibility for contract performance at PPPL. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Sandia National Laboratories

Sandia National Laboratories (SNL) is a multiprogram laboratory located on 3,700 acres in Albuquerque, New Mexico (SNL/NM), with additional sites in Livermore, California (SNL/CA), and Tonopah, Nevada.

- **Basic Energy Sciences**: SNL is home to significant research efforts in materials and chemical sciences with additional programs in engineering and geosciences. SNL has a historic emphasis on electronic components needed for Defense Programs. The laboratory has very modern facilities in which unusual microcircuits and structures can be fabricated out of various semiconductors. It is also the site of the Center for Integrated Nanotechnologies (CINT).
  - The **Center for Integrated Nanotechnologies** is devoted to establishing the scientific principles that govern the design, performance, and integration of nanoscale materials. Through its core facility in Albuquerque, New Mexico, and its gateways to both Sandia National Laboratories and Los Alamos National Laboratory, CINT provides access to tools and expertise to explore the continuum from scientific discovery to the integration of nanostructures into the microworld and the macroworld. CINT supports five scientific thrusts that serve as synergistic building blocks

for integration research: nano-bio-micro interfaces, nanophotonics and nanoelectronics, complex functional nanomaterials, nanomechanics, and theory and simulation.

- **Advanced Scientific Computing Research**: SNL conducts basic research in mathematics and computer science, as well as research in advanced computing software tools. SNL also participates in several SciDAC science application teams and both SciDAC Centers for Enabling Technologies and SciDAC Institutes, which focus on specific software challenges confronting users of petascale computers.
- **Biological and Environmental Research**: In support of BER's climate change research, SNL provides the site manager for the North Slope of Alaska ACRF site who is responsible for day-to-day operations at that site. In addition, SNL conducts climate modeling research on modifying the Community Atmospheric Model (CAM) to support new dynamical cores and improve its scalability for implementation on high-system computing systems. The laboratory conducts advanced research and technology development in robotics, smart medical instruments, microelectronic fabrication of the artificial retina, and computational modeling of biological systems.
- **Fusion Energy Sciences**: SNL plays a lead role in developing components for fusion devices through the study of plasma interactions with materials, the behavior of materials exposed to high heat fluxes, and the interface of plasmas and the walls of fusion devices. Material samples and prototypes are tested in SNL's Plasma Materials Test Facility, which uses high-power electron beams to simulate the high heat fluxes expected in fusion environments. Materials and components are exposed to tritium-containing plasmas in the Tritium Plasma Experiment located in the STAR facility at INL. Sandia supports a wide variety of domestic and international experiments in the areas of tritium inventory removal, materials postmortem analysis, diagnostics development, and component design and testing. SNL serves an important role in the design and analysis activities related to the ITER first wall components, including related R&D.

Savannah River National Laboratory

The Savannah River National Laboratory (SRNL) is a multiprogram laboratory located on approximately 34 acres in Aiken, South Carolina. SRNL provides scientific and technical support for the site's missions, working in partnership with the site's operating divisions.

Biological and Environmental Research: SRNL scientists support environmental remediation sciences research program in the area of subsurface contaminant fate and transport.

SLAC National Accelerator Laboratory

The SLAC National Accelerator Laboratory is located on 426 acres of Stanford University land in Menlo Park, California. SLAC is a laboratory dedicated to the design, construction, and operation of state-of-the-art electron accelerators and related experimental facilities for use in high-energy physics and photon science and has operated the two mile long Stanford Linear Accelerator (linac) since 1966. SLAC consists of 144 buildings (1.8 million gross square feet of space) with the average age of 31 years. SLAC houses the Kavli Institute for Particle Astrophysics and Cosmology (KIPAC), which is an independent laboratory of Stanford University.

- **Basic Energy Sciences**: SLAC is home to research activities in materials and chemical sciences. It is also the site of two user facilities—the Stanford Synchrotron Radiation Light source (SSRL) and the Linac Coherent Light Source (LCLS).

- The **Stanford Synchrotron Radiation Light source** is a DOE user facility for researchers from industry, government laboratories, and universities. These include astronomers, biologists, chemical engineers, chemists, electrical engineers, environmental scientists, geologists, materials scientists, and physicists. A research program is conducted at SSRL with emphasis in both the x-ray and ultraviolet regions of the spectrum. SSRL scientists are experts in photoemission studies of high-temperature superconductors and in x-ray scattering. The SPEAR 3 upgrade at SSRL provided major improvements that increase the brightness of the ring for all experimental stations.
- The **Linac Coherent Light Source** is a user facility that provides laser-like radiation in the x-ray region of the spectrum that is 10 billion times greater in peak power and peak brightness than any existing coherent x-ray light source. The SLAC linac will provide high-current, low-emittance 5–15 GeV electron bunches at a 120 hertz repetition rate. A long undulator bunches the electrons and leads to self-amplification of the emitted x-ray radiation at the LCLS, which constitutes the world's first free electron laser user facility.

- **Advanced Scientific Computing Research**: SLAC participates in SciDAC science application teams relevant to physics research, accelerator modeling, and distributed data.
- **Biological and Environmental Research**: SLAC operates nine SSRL beamlines for structural molecular biology. This program involves synchrotron radiation-based research and technology developments in structural molecular biology that focus on protein crystallography, x-ray small angle scattering diffraction, and x-ray absorption spectroscopy for determining the structures of complex proteins of many biological consequences. Beamlines at SSRL also support a growing environmental science user community.
- **High Energy Physics**: From 1999 to 2008, SLAC operated the **B-factory,** consisting of PEP-II, a high energy asymmetric electron-positron collider, and BaBar, a multi-purpose detector, for high-precision studies of CP symmetry violation in the B meson system. The BaBar detector collaboration includes about 600 physicists from SLAC and other national laboratories, U.S. universities, and foreign universities and research institutes. Ramp-down and decommissioning and decontamination activities started in FY 2009 and will continue for a number of years.

  SLAC participates in the research program of the ATLAS detector at the Large Hadron Collider, and is also working at the Cosmic Frontier of particle astrophysics. SLAC led construction of the primary instrument for the Fermi Gamma-ray Space Telescope (FGST) which was launched into earth orbit in 2008, and is home to the data operations center that manages the scientific data collection from the satellite. SLAC physicists and a user community will analyze the FGST data through 2012. SLAC is leading the R&D for a camera to be used in the proposed Large Synoptic Survey Telescope, which is a next-generation ground-based dark energy experiment. SLAC and Stanford University are also home to the Kavli Institute for Particle Astrophysics and Cosmology, which brings together researchers studying a broad range of fundamental questions about the universe, from theoretical astrophysics to dark matter and dark energy. High Energy Physics supports research at Kavli aimed primarily at exploring astrophysical phenomena to test new ideas in particle physics.

  SLAC is a major contributor to the leadership and development of advanced accelerator technologies. The laboratory is at the forefront of damping ring and beam delivery designs, required to ensure the beam brightness and precision control needed for future accelerators. SLAC also represents the center of expertise for design, fabrication, and testing of radio frequency power systems used to energize the accelerator components. The laboratory also participates in R&D for advanced detector technologies, with emphasis on software, simulation, and electronics.

- **Science Laboratories Infrastructure**: SLI enables DOE research missions at SLAC by funding line item construction to maintain the general purpose infrastructure and the cleanup and removal of excess facilities.
- **Safeguards and Security**: S&S at SLAC focuses on reducing the risk to DOE national facilities and assets. The program consists primarily of security officers, security systems, program management, and cyber security program elements.

Stanford Site Office

The Stanford Site Office provides the single federal presence with responsibility for contract performance at SLAC. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Thomas Jefferson National Accelerator Facility

Thomas Jefferson National Accelerator Facility (TJNAF) is a program dedicated laboratory located on 206 acres in Newport News, Virginia, focused on the exploration of nuclear and nucleon structure. The laboratory consists of 63 buildings (684,221 gross square feet of space) with an average building age of 17 years, 2 state-leased buildings, 17 real property trailers, and 14 other structures and facilities.

- **Advanced Scientific Computing Research**: TJNAF participates in SciDAC science application teams relevant to physics research, accelerator modeling, and distributed data.
- **Biological and Environmental Research**: BER supports the development of advanced imaging instrumentation at TJNAF that will ultimately be used in the next generation medical imaging systems.
- **High Energy Physics**: HEP supports an R&D effort at TJNAF on accelerator technology, using the unique expertise of the laboratory in the area of superconducting radiofrequency systems for particle acceleration.
- **Nuclear Physics**: The centerpiece of TJNAF is the **Continuous Electron Beam Accelerator Facility (CEBAF)**, a unique international electron-beam user facility for the investigation of nuclear and nucleon structure based on the underlying quark substructure. The facility has an international user community of about 1,300 researchers. Polarized electron beams up to 5.7 GeV can be provided by CEBAF simultaneously to three different experimental halls. Hall A is designed for spectroscopy and few-body measurements. Hall B has a large acceptance detector, CLAS, for detecting multiple charged particles coming from a scattering reaction. Hall C is designed for flexibility to incorporate a wide variety of different experiments. Its core equipment consists of two medium resolution spectrometers for detecting high momentum or unstable particles. The G0 detector in Hall C allows a detailed mapping of the strange quark contribution to nucleon structure. Also in Hall C, a new detector, Q-weak, is being fabricated to measure the weak charge of the proton by a collaboration of laboratory and university groups, in partnership with the NSF. TJNAF supports a group that does theoretical calculations and investigations in subjects supporting the experimental research programs in Medium Energy Physics. TJNAF research and engineering staff are world experts in superconducting radio frequency accelerator technology; their expertise is being used in the construction of the 12 GeV CEBAF Upgrade project. The 12 GeV CEBAF Upgrade project initiated construction activities in FY 2009 and will provide researchers with the opportunity to study quark confinement, one of the greatest mysteries of modern physics.

- **Science Laboratories Infrastructure**: SLI enables DOE research missions at TJNAF by funding line item construction to maintain the general purpose infrastructure and the cleanup and removal of excess facilities.
- **Safeguards and Security**: TJNAF has security officers that provide 24-hour services for the accelerator site and after-hours property protection security for the entire site. Other security programs include cyber security, program management, material control and accountability, and security systems.

Thomas Jefferson Site Office

The Thomas Jefferson Site Office provides the single federal presence with responsibility for contract performance at TJNAF. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Washington Headquarters

SC Headquarters, located in the Washington, D.C. area, supports the SC mission by funding Federal staff responsible for SC-wide issues, operational policy, scientific program development, and management functions supporting a broad spectrum of scientific disciplines and program offices. These program offices include ASCR, BES, BER, FES, HEP, and NP, and also include activities conducted by the Workforce Development for Teachers and Scientists program. Additionally, support is included for management of workforce program direction and infrastructure through policy, technical, and administrative support staff responsible for budget and planning; general administration; information technology; infrastructure management; construction management; safeguards and security; and environment, safety, and health within the framework set by the Department. Funded expenses include salaries, benefits, travel, general administrative support services and technical expertise, as well as other costs funded through interdepartmental transfers and interagency transfers.

Waste Isolation Pilot Plant

The Waste Isolation Pilot Plant is a deep geologic repository for the permanent disposal of radioactive waste; and is located in Eddy County in southeastern New Mexico, 26 miles southeast of Carlsbad.