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 [30]*49* passenger motor vehicles for replacement only, [$4,055,483,000] *including one law enforcement vehicle, one ambulance, and three buses*, *$4,721,969,000*, to remain available until expended[: *Provided*, That of the funds made available in section 130 of division H (Miscellaneous Appropriations and Offsets) of the Consolidated Appropriations Act, 2004, Public Law 108-199, as amended by section 315 of Public Law 109-103, for the Coralville, Iowa, project, $44,569,000 is rescinded]. *(Energy and Water Development and Related Agencies Appropriations Act, 2008.)*

Explanation of Change

Changes are proposed to reflect the FY 2009 funding and vehicle request.

Science
Office of Science

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2007 Current Appropriation	FY 2008 Original Appropriation	FY 2008 Adjustments	FY 2008 Current Appropriation	FY 2009 Request
Science					
Basic Energy Sciences	1,221,380	1,281,564	-11,662[a]	1,269,902	1,568,160
Advanced Scientific Computing Research	275,734	354,398	-3,225[a]	351,173	368,820
Biological and Environmental Research	480,104[b]	549,397	-5,000[a]	544,397	568,540
High Energy Physics	732,434	694,638	-5,307[ac]	689,331	804,960
Nuclear Physics	412,330	436,700	-3,974[a]	432,726	510,080
Fusion Energy Sciences	311,664	289,180	-2,632[a]	286,548	493,050
Science Laboratories Infrastructure	41,986	65,456	+1,405[ad]	66,861	110,260
Science Program Direction	166,469	179,412	-1,633[a]	177,779	203,913
Workforce Development for Teachers and Scientists	7,952	8,118	-74[a]	8,044	13,583
Safeguards and Security	75,830	76,592	-646[a]	75,946	80,603
Small Business Innovation Research/ Technology Transfer (SC funding)	86,936[e]	—	—	—	—
Subtotal, Science	3,812,819[b]	3,935,455	-32,748[a]	3,902,707	4,721,969
Congressionally-directed projects	—	125,633	-2,010[f]	123,623	—
Small Business Innovation Research/ Technology Transfer (Other DOE funding)	39,319[g]	—	—	—	—
Subtotal, Science	3,852,138[bg]	4,061,088	-34,758[acdf]	4,026,330	4,721,969
Coralville, Iowa project rescission	—	-44,569	—	-44,569	—
Less security charge for reimbursable work	-5,605	-5,605	—	-5,605	—
Use of prior year balances	-9,920	—	-3,014	-3,014	—
Total, Science	3,836,613[g]	4,010,914	-37,772[af]	3,973,142	4,721,969

[a] Reflects a reduction for the 0.91% rescission in P.L. 110–161, the Energy and Water Development and Related Agencies Appropriations Act, 2008.
[b] Includes $9,920,000 that was reprogrammed from prior year balances to support the GTL Bioenergy Research Centers.
[c] Includes $1,014,000 that was reprogrammed from prior year balances to support Fermilab operations.
[d] Includes $2,000,000 that was reprogrammed from prior year balances to support the Modernization of Laboratories Facilities project at ORNL, as directed in the Conference Report for P.L. 110–161.
[e] Reflects funding reprogrammed within the Science total to support the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs.
[f] Reflects a reduction for the 1.6% rescission in P.L. 110–161.
[g] Reflects funding transferred from other DOE appropriation accounts to support the SBIR and STTR programs.

As part of the third year of the President's American Competitiveness Initiative, the Office of Science (SC) request for Fiscal Year (FY) 2009 is $4,721,969,000; an increase of $748,827,000, or 18.8%, over the FY 2008 appropriation.

The request funds investments in basic research that are important both to the future economic competitiveness of the United States and to the success of Department of Energy (DOE) mission areas in energy security and national security; advancing the frontiers of knowledge in the physical sciences and areas of biological, environmental, and computational sciences; and providing world-class research facilities for the Nation's science enterprise.

SC provides support for the basic research and scientific and technological capabilities that underpin the Department's technically complex mission. Part of this support is in the form of large-scale scientific user facilities. SC facilities represent a sophisticated suite of instrumentation and research capabilities that meet the diverse needs of about 21,000 researchers each year and enable U.S. scientists to remain at the forefront of scientific discovery and innovation. These facilities include the world's highest energy proton accelerator (the Tevatron at Fermi National Accelerator Laboratory); the world's forefront neutron scattering facility (the Spallation Neutron Source at Oak Ridge National Laboratory), and synchrotron light sources such as the Advanced Photon Source and the Advanced Light Source for probing the structure and function of materials. The Department's five Nanoscale Science Research Centers and the computational resources at the National Energy Research Scientific Computing Center and Leadership Computing Facilities offer technological capabilities to the research community that are unmatched anywhere in the world.

The centerpiece of the American Competitiveness Initiative is President Bush's strong commitment to double investments over 10 years in key Federal agencies that support basic research programs in the physical sciences and engineering: SC, the National Science Foundation, and the Department of Commerce's National Institute for Standards and Technology core activities. While the American Competitiveness Initiative encompasses all SC funding, SC also supports other Presidential initiatives and priorities, such as the Advanced Energy Initiative, the Hydrogen Fuel Initiative, the National Nanotechnology Initiative, the Climate Change Science Program, the Climate Change Technology Program, Networking and Information Technology Research and Development, and ITER, an international nuclear fusion project.

Within the Science appropriation, SC 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).

SC supports basic research and technological capabilities that drive scientific discovery and innovation in the U.S. and underpin the Department's mission areas in energy, the environment, and national security. Seeking answers to fundamental scientific questions will result in a diverse array of practical applications as well as some revolutionary advances. Important contributions to meeting DOE's applied mission needs are expected through developments in materials and chemical sciences, especially at the nanoscale. Research in materials sciences will lead to the development of materials that improve efficiency, economy, environmental acceptability, and safety of energy generation, conversion, transmission, storage, and use. Research in chemistry will lead to the development of advances such as efficient combustion systems with reduced emissions of pollutants; new solar photoconversion processes; improved catalysts for the production of fuels and chemicals, and better separations and analytical methods for applications in energy processes, environmental remediation, and waste management. The science, technology, and knowledge base developed from the Genomics: GTL program on understanding and harnessing the capabilities of microbial and plant systems may lead to cost-effective methods for producing new biofuels, better methods for the clean-up of legacy wastes, and tools for modifying concentrations of atmospheric carbon dioxide (CO_2) or for evaluating environmental impacts.

Computational modeling and simulation can improve our understanding of and sometimes predict the behavior of complex systems, as well as lead to the development of solutions to research problems that are insoluble by traditional and experimental approaches, or are too hazardous, time-consuming, or expensive to solve by traditional means. This includes challenges such as understanding the fundamental processes associated with fluid flow and turbulence, chemical reactivity, climate modeling and prediction, molecular structure and processes in living cells, subsurface biogeochemistry, and astrophysics.

Fusion, a fundamentally new source of energy under development, has the potential to provide a significant fraction of the world's energy by the end of the century. The international ITER project is a bold next step in fusion research, designed to produce, control, and sustain a burning plasma, where fusion processes generate sufficient energy to maintain the temperature of the plasma. Through investments in high-energy physics and nuclear physics, SC has historically provided the Nation with fundamental knowledge about the laws of nature as they apply to the basic constituents of matter and the forces between them. These investments in high energy and nuclear physics have enabled the U.S. to maintain a leading role in the development of technologies in areas such as nuclear energy, materials, semiconductors, nuclear medicine, and national security, and technologies such as the accelerator technologies leading to high-power x-ray light sources and advanced imaging techniques have been important to other fields of science.

SC's support for research at more than 300 colleges and universities nationwide and access to DOE's leading-edge research facilities provides valuable research and training opportunities for America's scientists, engineers, and science educators, contributing to the advancement of U.S. science and innovation and the development of the Nation's future workforce.

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. Science 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 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 as follows:

Basic Energy Sciences (BES) contributes to Strategic Goals 3.1 and 3.2 by producing advances in the core disciplines of basic energy sciences—materials sciences, chemistry, geosciences, and physical biosciences. The scientific discoveries at the frontiers of these disciplines impact energy resources, production, conservation, efficiency, and the mitigation of adverse impacts of energy production and use—discoveries that will help accelerate progress toward long-term energy independence, economic growth, and a sustainable environment. BES also provides the Nation's researchers with world-class scientific user facilities, including a reactor and two accelerator-based neutron sources such as the Spallation Neutron Source; four operating light sources plus the Linac Coherent Light Source—an x-ray free electron laser currently under construction—and the National Synchrotron Light Source–II; five Nanoscale Science Research Centers; and three electron beam micro-characterization centers. These facilities 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 2009, investments continue in basic research for the hydrogen economy, for solar energy conversion, and areas of forefront science such as ultrafast chemistry and materials, single-atom imaging and chemical imaging, emergent behavior, and complex systems, and support increases for activities related to electrical energy storage and for materials sciences and chemistry underpinning advanced nuclear energy systems.

Advanced Scientific Computing Research (ASCR) contributes to Strategic Goals 3.1 and 3.2 by advancing fundamental mathematics and computer science research that enables simulation and prediction of complex physical, chemical, and biological systems; providing the forefront computational capabilities needed by researchers to enable them to extend the frontiers of science; and delivering the fundamental networking research and facilities that link scientists across the nation to the Department-sponsored computing and experimental facilities. ASCR and its predecessors have been leaders in the computational sciences for several decades and supports research in applied mathematics, computer science, specialized algorithms, and scientific software tools that advance scientific discovery and are essential for research programs across SC and the Department. In FY 2009 the Leadership Computing Facilities (LCFs) at the Oak Ridge and Argonne national laboratories and the National Energy Research Scientific Computing Center at Lawrence Berkeley National Laboratory will continue to be supported. Beginning in FY 2009, the ASCR computing facilities will develop and implement a unified approach to supporting and maintaining software, languages, and tools that are critical to effective utilization of the machines. Support continues for research efforts in Scientific Discovery through Advanced Computing and the core research programs that enable researchers to deliver forefront science by more effectively utilizing the capabilities of the LCFs. Increases in core research in Applied Mathematics and Computer Science in FY 2009 will be targeted on long-term research needs, including support for a new joint Applied Mathematics-Computer Science Institute to focus on the challenges of computing at extreme scales that blur the boundaries between these disciplines, and for new efforts in the mathematics of large datasets.

Biological and Environmental Research (BER) contributes to Strategic Goals 3.1 and 3.2 by advancing research in genomics and systems biology of microbes and plants to harness their capabilities for energy and environmental solutions; by developing models to predict climate over decades to centuries; by developing science-based methods for cleaning up environmental contaminants and for long-term stewardship of the sites; by providing regulators with a stronger scientific basis for developing future radiation protection standards; and by advancing research in radiochemistry and imaging instrumentation and development of an artificial retina. In FY 2009, BER continues the Genomics: GTL program, supporting research at the interface of the biological, physical, and computational sciences to enable biotechnology-based solutions for DOE's energy security and environmental mission goals, including support for the three Bioenergy Research Centers started in FY 2007 and the Joint Genome Institute. The environmental remediation program continues to support fundamental research at the interfaces of biology, chemistry, geology, hydrology, and physics for solutions to environmental contamination challenges, and provides support for the Environmental Molecular Sciences Laboratory. BER leads the Department‘s participation in the interagency Climate Change Science Program, focusing on understanding the principal uncertainties of the causes and effects of climate change, including abrupt climate change, understanding the global carbon cycle, developing predictive models for climate change over decades to centuries, and supporting basic research for biological sequestration of carbon. In FY 2009, support increases for research to advance the science of climate and Earth system modeling and increase the spatial resolution of climate models.

High Energy Physics (HEP) contributes to Strategic Goals 3.1 and 3.2 by advancing understanding of the basic constituents of matter, deeper symmetries in the laws of nature at high energies, and mysterious phenomena that are commonplace in the universe, such as dark energy and dark matter. HEP uses particle accelerators and very sensitive detectors to study fundamental particle interactions at the highest possible energies as well as non-accelerator studies of cosmic particles using experiments conducted deep underground, on mountains, or in space. In FY 2009, HEP places a high priority on the operations, upgrades, and infrastructure of the two major HEP user facilities, the Tevatron Collider and the Neutrinos at the Main Injector (NuMI) beam line at Fermilab. After a very successful eight-year run, operation of the SLAC B-factory are completed in FY 2008. Funding is provided in FY 2009 to support significant analysis of data collected at the B-factory and for safe ramp-down of the facility. With completion of the scientific missions of the B-factory and Tevatron Collider by the end of this decade, the longer-term HEP program continues support for the development of new cutting-edge facilities in targeted areas (such as neutrino physics) that will establish a U.S. leadership role in these areas in the next decade, when the centerpiece of the world HEP program will be at the Large Hadron Collider

(LHC) at CERN (the European Organization for Nuclear Research). HEP increases funding for university and laboratory based research to support U.S. researchers participating in the physics discoveries enabled by the LHC, and continues to provide support for operations and maintenance of the U.S.-built systems that are part of the LHC detectors. Support for International Linear Collider (ILC) R&D continues, but the U.S. role in the global R&D effort is reduced, resulting in a more focused but still robust program that emphasizes technical areas where the U.S. has unique or world-leading capabilities, and positions the U.S. to play a significant role in the ILC, if governments decide to proceed with project. In other accelerator technology R&D areas, funding is increasing, to begin implementation of a strategic plan for technology R&D. Specific areas targeted for increased support are short-term R&D focused on development of high-intensity proton sources; mid-term R&D directed at development of superconducting radiofrequency structures, in view of their potential for a wide range of applications; and long-term R&D on advanced accelerator technologies with the potential to provide transformational changes. The latter effort includes fabrication of a new test facility for advanced particle acceleration concepts. An upgrade of the world-leading Cryogenic Dark Matter Search is planned to begin in FY 2009, jointly funded with the National Science Foundation; and R&D continues for conceptual design for a Joint Dark Energy Mission (JDEM) space-based satellite. HEP and NASA will move forward with a joint competition and concept selection for JDEM in FY 2009, with a planned start for fabrication in FY 2010. In addition, non-accelerator-based elementary particle physics research continues in FY 2009, as does R&D for the next-generation ground- and space-based experiments to further explore the nature of dark energy.

Nuclear Physics (NP) contributes to Strategic Goals 3.1 and 3.2 by supporting peer-reviewed scientific research to advance knowledge and provide insights into the nature of energy and matter, and, in particular, to investigate the fundamental forces which hold the nucleus together and determine the detailed structure and behavior of the atomic nuclei. NP builds and supports world-leading scientific facilities and state-of-the-art instruments necessary to carry out its basic research agenda of fundamental nuclear physics and train a workforce relevant to the Department's missions for nuclear-related national security, energy, and environmental quality. World-leading efforts on studies of hot, dense nuclear matter and the origin of the proton spin with beams at the Relativistic Heavy Ion Collider (RHIC) will continue in FY 2009, and funds are provided to complete the Electron Beam Ion Source, which will provide RHIC with more cost-effective, reliable operations. The studies of hot, dense nuclear matter include NP enhancements to existing LHC experiments. Operation of the Continuous Electron Beam Accelerator Facility (CEBAF) continues, providing beams to better understand the structure of the nucleon. Support for construction of the 12 GeV CEBAF Upgrade is initiated in FY 2009. NP supports efforts in nuclear structure/astrophysics, fundamental interactions, and neutrinos, which include operations and related research at the Argonne Tandem Linac Accelerator System (ATLAS) and the Holifield Radioactive Ion Beam Facility (HRIBF). Funds are provided in FY 2009 for R&D and conceptual design activities for a U.S facility for rare isotope beams which will enable world-leading research opportunities in nuclear structure, nuclear astrophysics, and fundamental studies. The Fundamental Neutron Physics Beamline and neutron Electric Dipole Moment experiment will provide capabilities for studies of the fundamental properties of neutrons and to search for new physics beyond the Standard Model. Support is provided for U.S. participation in the Cryogenic Underground Observatory for Rare Events (CUORE) experiment, important for establishing the neutrino mass and determining whether the neutrino is its own antiparticle. Theoretical research is important in all program areas, and NP supports the nuclear data program, which collects, evaluates, and disseminates nuclear physics data. NP increase support in FY 2009 for basic research in the characterization of radioactive waste through advanced fuel cycle activities. Starting in FY 2009, NP assumes responsibilities for research, development, and production of stable and radioactive isotopes, previously under the DOE Office of Nuclear Energy, important for science, energy, national security applications.

Fusion Energy Sciences (FES) contributes to Strategic Goals 3.1 and 3.2 by advancing the theoretical and experimental understanding of plasma and fusion science and the means for confining plasmas to yield energy. Advances in plasma physics and associated technologies will bring the U.S. closer to making fusion energy a part of the Nation's energy solution. In addition to supporting fundamental research into the nature of fusion plasmas, FES supports the operation of a set of unique and diversified domestic experimental facilities and close collaborations with international partners on specialized facilities abroad in order to test and extend our theoretical understanding and computer models—ultimately leading to improved predictive capabilities for fusion plasmas. The FES research program, including experiments on major facilities and theory and computer modeling activities, will emphasize burning plasma research in support of preparation for the ITER scientific program. In FY 2009, the FES program will begin to develop identify critical scientific issues and missions for the next stage in the U.S. fusion research program during the ITER era which will keep it at the forefront of fusion and plasma sciences in the future. Funding is currently provided for continued fabrication of the National Compact Stellarator Experiment at the Princeton Plasma Physics Laboratory, however, a decision on the project's future will be made in FY 2008 as the project cost and schedule have changed significantly since the initial project baseline was established. FES increases support for efforts in the area of high energy density laboratory plasmas (HEDLP) as part of the HEDLP Joint Program with the National Nuclear Security Administration. FES will also initiate a Fusion Simulation Project in FY 2009 to take advantage of the many recent improvements in computational and computing capabilities for the development of a world-leading predictive plasma simulation code that can be applied to burning plasmas of the type that will be necessary for fusion energy producing power plants.

External factors that affect SC's level of performance include:

- changing mission needs as described by the DOE and SC mission statements and strategic plans;
- scientific opportunities as determined, in part, by new discoveries, proposal pressure, and scientific workshops;
- results of external program reviews and international benchmarking activities of entire fields or subfields, such as those performed by the National Academy of Sciences (NAS);
- unanticipated failures in critical components of scientific facilities that cannot be mitigated in a timely manner; and
- strategic and programmatic decisions made by non-SC funded domestic research activities and by major international research centers

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 held to ensure technical progress, cost and schedule adherence, and responsiveness to program requirements.

Funding by Strategic and GPRA Unit Program Goal

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Strategic Goals 3.1, Scientific Breakthroughs and 3.2, Foundations of Science			
GPRA Unit Program Goal 3.1/2.50.00, Advance the Basic Science for Energy Independence (BES)	1,221,380	1,269,902	1,568,160
GPRA Unit Program Goal 3.1/2.51.00, Deliver Computing for Accelerated Progress in Science (ASCR)	275,734	351,173	368,820
GPRA Unit Program Goal 3.1/2.48.00, Harness the Power of Our Living World (BER)	480,104	544,397	568,540
GPRA Unit Program Goal 3.1/2.46.00, Explore the Fundamental Interactions of Energy, Matter, Time, and Space (HEP)	732,434	689,331	804,960
GPRA Unit Program Goal 3.1/2.47.00, Explore Nuclear Matter, from Quarks to Stars (NP)	412,330	432,726	510,080
GPRA Unit Program Goal 3.1/2.49.00, Bring the Power of the Stars to Earth (FES)	311,664	286,548	493,050
Subtotal, Strategic Goals 3.1 and 3.2 (Science)	3,433,646	3,574,077	4,313,610
All Other			
Science Laboratories Infrastructure	41,986	66,861	110,260
Program Direction	166,469	177,779	203,913
Workforce Development for Teachers and Scientists	7,952	8,044	13,583
Safeguards and Security	75,830	75,946	80,603
Small Business Innovation Research/Technology Transfer	126,255	—	—
Congressionally-directed projects	—	123,623	—
Total, All Other	418,492	452,253	408,359
Total, Strategic Goals 3.1 and 3.2 (Science)	3,852,138	4,026,330	4,721,969

Program Assessment Rating Tool (PART)

The Department implemented a tool to evaluate selected programs. PART was developed by the Office of Management and Budget (OMB) to provide a standardized way to assess the effectiveness of the Federal Government's portfolio of programs. The structured framework of the PART provides a means through which programs can assess their activities differently than through traditional reviews.

In the FY 2005 PART review, OMB assessed six SC programs: ASCR, BES, BER, FES, HEP, and NP. Program scores ranged from 82–93%. Three programs—BES, BER, and NP—were assessed "Effective." Three programs—ASCR, FES, and HEP—were assessed "Moderately Effective." In general the FY 2005 assessment found that these SC Programs have developed a limited number of adequate performance measures. These measures have been incorporated into this Budget Request, grant solicitations, and the performance plans of senior managers. As appropriate, they are being incorporated into the performance-based contracts of management and operating (M&O) contractors.

The Annual Performance Targets are tracked through the Department's Joule system and reported in the Department's Annual Performance and Accountability Report. Roadmaps with detailed information on tracking progress toward the long-term measures have been developed with the Scientific Advisory Committees and links to these reports are provided on SC's PART website. The Scientific Advisory Committees are reviewing progress toward those measures vis-à-vis the roadmaps every three to five years. The first reviews were conducted during FY 2006 and early FY 2007. Links to the results of these reviews are provided on SC's PART website as they become available.

OMB did not complete a PART for any SC Programs for the FY 2009 Budget, but has provided SC with recommendations to further improve performance. The improvement plan action items for the current fiscal year may be found at http://ExpectMore.gov (search by program name).

SC has incorporated this feedback from OMB into the FY 2009 Budget Request decision process, and will continue to take the necessary steps to improve performance.

High-Risk, High-Return Research[a]

SC supports high-risk, high-return research as an essential part of its strategy to successfully accomplish the DOE's mission in areas of energy, environment, national security, and scientific discovery. Whether aimed at grand challenge, discovery-driven, or use-inspired science, SC programs incorporate high-risk, high-return research elements and ideas that challenge current thinking to make the fundamental breakthroughs necessary to accomplish mission and program goals. Every SC program considers a significant fraction of its supported activities to be high-risk, high-return. Because this research is integrated within research portfolios and projects, and there are many interconnected and collaborative efforts within and between the programs, it is not possible to quantitatively separate out the funding contributions to particular experiments or theoretical studies that are high-risk, high-return.

SC programs use several mechanisms to help identify and develop the "high-return" research topics and enabling technologies that form the basis of their portfolios, including Federal advisory committees, program and topical workshops, interagency working groups, National Academy of Sciences (NAS) studies, and special SC Program solicitations. Likewise, SC is evaluated periodically through Committee of Visitors reviews and NAS studies that consider, as part of those reviews, how well programs are supporting high-risk, high-return research as part of their overall portfolio.

Researchers funded through the Office of Science are working on some of the most pressing scientific and technical challenges of our age:

- Harnessing the power of microbial communities and plants for energy production from renewable sources, carbon sequestration, and environmental remediation;
- Expanding the frontiers of nanotechnology to develop materials with unprecedented properties for widespread potential scientific, energy, and industrial applications;
- Pursuing the breakthroughs in materials science, nanotechnology, biotechnology, and other fields needed to make solar energy more cost-effective;
- Demonstrating the scientific and technological feasibility of creating and controlling a sustained burning plasma to generate energy, as the next step toward making fusion power a commercial reality;

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

- Using advanced computation, simulation, and modeling to understand and predict the behavior of complex systems beyond the reach of some of the most powerful experimental probes, with potentially transformational impacts on a broad range of scientific and technological undertakings;
- Understanding the origin of the universe and nature of dark matter and dark energy; and
- Resolving key uncertainties and expanding the scientific foundation needed to understand, predict, and assess the potential effects of atmospheric carbon dioxide on climate and the environment.

Pushing the frontiers of science depends on the continued availability of the most advanced scientific facilities for U.S. researchers. SC builds and operates national scientific facilities and instruments that make up the world's most sophisticated suite of research capabilities. To stay at the forefront of research capabilities SC invests in the research and development towards new instruments and facilities that continue to push the envelope of what is technically possible. For example, advanced accelerator and detector R&D for next generation accelerator-based scientific research facilities, such as synchrotron and neutron sources and high-energy particle colliders, is a priority high-risk, high-return research area supported across several SC programs. Basic research investments are also leading to state-of-the-art high-throughput instrumentation for genomics and systems biology as well as for probes for imaging ultrafast science at the nanoscale.

DOE understands the sense of Congress that, even within its annual basic research budget, funding high-risk, high-reward basic research projects requires attention. SC will establish a working group during FY 2008 to evaluate how SC's merit review criteria and program management practices promote the support of high-risk, high-return research and identify the need for and potential mechanisms for improving such support. The working group will also look at strategies to better communicate to the scientific community the high-risk, high-return research areas that are essential to accomplishing SC's mission-driven goals for the Department.

SC Funding for Selected Administration Priorities

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
American Competitiveness Initiative	3,836,613	3,973,142	4,721,969
Advanced Energy Initiative	495,021	508,376	788,111
Hydrogen Fuel Initiative	36,388	36,388	60,400
Climate Change Science Program	125,758	128,363	145,940
Climate Change Research Initiative	22,460	23,672	23,672
Climate Change Technology Program	486,525	498,965	833,301
Networking and Information Technology Research and Development	301,478	380,295	401,399
National Nanotechnology Initiative	195,511	199,534	300,259
ITER (TPC)	60,000	10,626	214,500

American Competitiveness Initiative

The American Competitiveness Initiative encompasses the entire SC budget, as part of a strategy to double overall basic research funding at select agencies over the FY 2006 level by FY 2016. The FY 2009 request is consistent with the planned profile for this initiative. The American Competitiveness Initiative is described further at http://www.whitehouse.gov/stateoftheunion/2006/aci/aci06-booklet.pdf.

Advanced Energy Initiative

SC research activities serve as an enabling function to provide a strong scientific underpinning for options identified in DOE's energy technology portfolio. SC investments today in fundamental basic research in the physical, chemical, biological, and environmental sciences can lead to the transformational breakthroughs essential for the future technologies that could change the way energy is produced, transformed, and used to meet global energy demands while limiting greenhouse gas emissions and environmental impacts. Advances in areas such as materials science, catalysis and chemical transformations, genomics and biochemistry, condensed matter physics, computational sciences, and geosciences can have game-changing impacts on the development of new transportation fuels and vehicle technologies; nuclear, hydrogen-based, and low-emission fossil-based energy technologies; electrical energy storage and transmission; efficient building technologies; and strategies for carbon capture and storage.. The FY 2009 SC request under the Advanced Energy Initiative is for $788,111,000, and supports basic research in the areas of solar energy, biomass, hydrogen, and fusion.

Hydrogen Fuel Initiative

In FY 2009, $60,400,000 is requested for basic research activities to realize the potential of a hydrogen economy. The research program is based on the BES workshop report "Basic Research Needs for the Hydrogen Economy" that can be found at http://www.science.doe.gov/production/bes/hydrogen.pdf. The 2003 report highlights the gap between our present capabilities for hydrogen production, storage, and use and those required for a competitive hydrogen economy. Detailed findings and research directions identified during the workshop are presented in the report.

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), and the current Administration's Climate Change Research Initiative (CCRI). The CCRI is a set of cross-agency activities initiated in FY 2003 in areas of high priority climate change research.

- **Climate Change Science Program**: In FY 2009, the BER Climate Change Research subprogram (excluding the Climate Change Mitigation element which focuses on carbon sequestration in the terrestrial biosphere) represents DOE's contribution to the CCSP (USGCRP and CCRI). 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. The BER request for CCSP for FY 2009 is $145,940,000.
- **Climate Change Research Initiative**: In FY 2009, BER will continue to contribute to the CCRI from four programs: Terrestrial Carbon Processes, Climate Change Prediction, ARM, and Integrated Assessment. Activities will be focused on helping to resolve the magnitude and location of the North American carbon sink; deployment and operation of a mobile ARM facility to provide data on the effects of clouds and aerosols on the atmospheric radiation budget in regions and locations of opportunity where data is lacking or sparse; using advanced climate models to simulate potential effects of natural and human-induced climate forcing on global and regional climate and the potential effects on climate of alternative options for mitigating increases in human forcing of climate, including abrupt climate change; and developing and evaluating assessment tools needed to

study costs and benefits of potential strategies for reducing net carbon dioxide emissions. BER's FY 2009 CCRI request is $23,672,000

- **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. SC funding for the CCTP includes the FES program and activities within BES, BER, and NP. The FY 2009 SC CCTP request is $833,301,000.

Networking and Information Technology Research and Development

The activities funded by SC 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. The FY 2009 SC request for NITRD is $401,399,000.

National Nanotechnology Initiative

In FY 2009, there are significant shifts in the nanoscale science and engineering research activities contributing to the SC investments in research at the nanoscale and a substantial overall increase in funding. All five Nanoscale Science Research Centers are in full operation. Funding for research at the nanoscale increases very significantly owing to increases in funding for activities related to the hydrogen economy, solar energy conversion, advanced nuclear energy systems, electrical energy storage, fundamental studies of materials at the nanoscale, and instrumentation for characterizing materials at the nanoscale. The FY 2009 SC request for the National Nanotechnology Initiative is $300,259,000.

ITER

ITER, an experiment to study and demonstrate the scientific and technical feasibility of fusion power, is a multi-billion dollar international research project that will, if successful, move towards developing fusion's potential as a commercially viable, clean, long-term source of energy near the middle of the century. Funding for the U.S. Contributions to ITER project increases in FY 2009 and provides for the U.S. "in-kind" hardware contributions, U.S. personnel to work at the ITER site, and funds for the U.S. share of common expenses such as infrastructure, hardware assembly, installation, and contingency. The FY 2009 SC request for ITER is $214,500,000.

Basic and Applied R&D Coordination

SC continues to coordinate basic research efforts in many areas with the Department's applied technology offices and with the National Nuclear Security Administration through collaborative processes established over the last several years. Coordination areas include energy production from conventional and alternate sources, energy conversion, energy storage and transmission, efficient energy use, waste mitigation, and national security. Specific areas include biofuels derived from biomass; solar and other renewable energy; hydrogen production, storage, and use; materials under extreme environments for the needs of energy technologies and for national security; solid-state lighting and other research promoting efficient building technologies; the Advanced Fuel Cycle, Generation IV Nuclear Energy Systems; vehicle technologies; and improving efficiencies in industrial processes. The Department's July 2006 report *DOE Strategic Research Portfolio Analysis and Coordination Plan* identified 21 additional areas of opportunity for coordination that have great potential to increase mission success. SC supports basic research and coordination efforts that underpin nearly all 21 areas, and six areas are highlighted in the FY 2009 SC budget request for enhanced R&D coordination: Advanced Mathematics for Optimization of Complex Systems, Control Theory, and Risk Assessment; Electrical Energy Storage; Carbon Dioxide Capture and Storage; Characterization of Radioactive Waste; Predicting High Level Waste System Performance over Extreme Time Horizons; and High Energy Density Laboratory Plasmas. SC has sponsored scientific workshops corresponding to these focus areas in collaboration with related DOE program offices, which identified high priority basic research areas necessary for improved understanding and revolutionary breakthroughs. Other areas are being developed for increased emphasis in coming years, including materials under extreme environments, which crosscuts many areas in the Department's applied technology offices and in the National Nuclear Security Administration.

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Applied mathematics for optimization of complex systems, control theory, and risk assessment			
Advanced Scientific Computing Research	—	1,900	2,000
Electrical Energy Storage			
Basic Energy Sciences	—	—	33,938
Carbon Dioxide Capture and Storage			
Basic Energy Sciences	5,915	5,915	10,915
Advanced Scientific Computing Research	—	976	976
Biological and Environmental Research	16,841	16,874	17,374
Total, Carbon Dioxide Capture and Storage	22,756	23,765	29,265
Characterization of Radioactive Waste			
Basic Energy Sciences	—	—	8,492
Biological and Environmental Research	—	—	1,500
Nuclear Physics	200	200	6,603
Total, Characterization of Radioactive Waste	200	200	16,595
Predicting High Level Waste System Performance over Extreme Time Horizons			
Basic Energy Sciences	—	—	8,492

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
High Energy Density Laboratory Plasmas			
Fusion Energy Sciences	15,459	15,942	24,636
Total, Basic and Applied R&D Coordination	38,415	41,807	114,926

Advanced Mathematics for Optimization of Complex Systems, Control Theory, and Risk Assessment: ASCR supports basic research in advanced mathematics for optimization of complex systems, control theory, and risk assessment. A recommendation from the workshop focused on this subject indicated additional research emphasis in advanced mathematics could benefit the optimization of fossil fuel power generation; the nuclear fuel lifecycle; and power grid control. Such research could increase the likelihood for success in DOE strategic initiatives including FutureGen and the modernization of the power grid.

Electrical Energy Storage: About 15% of the BES funding requesting to support basic research in electrical energy storage (EES) is targeted for a formally coordinated program with DOE applied technology offices. The workshop report on this focus area noted that revolutionary breakthroughs in EES have been singled out as perhaps the most crucial need for this nation's secure energy future. The report concluded that the breakthroughs required for tomorrow's energy storage needs will be realized with fundamental research to understand the underlying processes involved in EES. The knowledge gained will in turn enable the development of novel EES concepts that incorporate revolutionary new materials and chemical processes. Such research will accelerate advances in developing novel battery concepts for hybrid and electric cars and will also help facilitate successful utilization and integration of renewable, intermittent power sources such as solar, wind, and wave energy into the utility sector, making these energy sources base load competitive.

Carbon Dioxide Capture and Storage: BES and BER support basic research in carbon dioxide capture and storage. The storage portion of this R&D coordination focus area was a subject of a BES workshop on Basic Research Needs for Geosciences in February 2007, which focused on the research challenges posed by carbon dioxide storage in deep porous geological formations. The workshop report noted that the chemical and geological processes involved in the storage of carbon dioxide are highly complex and its prediction would need an interdisciplinary approach that strongly couples experiments with theory, modeling, and computation bridging multiple length and time scales. The BES effort supports fundamental research to understand the underlying chemical, geochemical, and geophysical processes involved in subsurface sequestration sites. The BER research effort focuses on understanding, modeling, and predicting the processes that control the fate of carbon dioxide injected into geologic formations, subsurface carbon storage, and the role of microbes and plants in carbon sequestration in both marine and terrestrial environments. These aspects of this focus area were also the subject of additional SC workshops that identified basic research areas in CO_2 capture and storage that could benefit the optimization of fossil fuel power generation and the development of carbon neutral fuels.

Characterization of Radioactive Waste: BES, BER, and NP support basic research in radioactive waste characterization. This R&D coordination focus area was the subject of six SC workshops, including three BES workshops. The workshop reports noted that the materials and chemical processes involved in radioactive waste storage are highly complex and their characterization would need an interdisciplinary approach that strongly couples experiments with theory, modeling, and computation bridging multiple length and time scales. The BES effort will focus on fundamental research to understand the underlying physical and chemical processes that occur under the conditions of radioactive waste storage, which include extremes of temperature, pressure, radiation flux, and multiple complex phases. The BER research effort addresses processes that control the mobility of radiological waste in the environment. The NP research effort is focused on characterization of radioactive waste through the advanced fuel cycle activities. The NP program areas are structured as scientific disciplines with goals to understand fundamental nuclear physics. A small portion of on-going research is relevant to the issues involved with radioactive waste and related advanced fuel cycles. The knowledge gained from this fundamental research will lead to breakthroughs in radioactive waste characterization necessary for permanent solutions to nuclear waste disposal, making nuclear power a major component in primary energy usage and lessening our dependence on oil.

Predicting High Level Waste System Performance over Extreme Time Horizons: BES supports basic research in predicting high level waste (HLW) system performance over extreme time horizons. This R&D coordination focus area was a subject of a BES workshop on Basic Research Needs for Geosciences in February 2007, which focuses on research challenges posed by geological repositories for HLW. The workshop report identified major research priorities in the areas of computational thermodynamics of complex fluids and solids, nanoparticulate and colloid physics and chemistry, biogeochemistry in extreme and perturbed environments, highly reactive subsurface materials and environments, and simulation of complex multi-scale systems for ultra-long times. The knowledge gained would in turn enable finding the permanent solutions to nuclear waste disposal, making nuclear power a major component in primary energy usage and lessening our dependence on oil. It would also further advance the goal of addressing environmental remediation needs.

High Energy Density Laboratory Plasmas: In May 2007, SC and NNSA jointly sponsored a workshop to update the HEDLP scientific research agenda. Three scientific themes emerged from the workshop: enabling the grand challenge of fusion energy by high energy density laboratory plasmas; creating, probing and controlling new states of high energy densities; and, catching reactions in the act by ultra-fast dynamics. In FY 2009, the FES request expands existing HEDLP research in response to the research opportunities identified in the workshop.

Scientific Workforce

Workforce development is an important element of the SC 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 2007	FY 2008	FY 2009
Estimated Number of University Grants			
BES	1,150	1,120	1,500
ASCR	150	170	180
BER	700	715	750
HEP	200	200	200
NP	188	188	188
FES	231	233	233
Total Estimated Number of University Grants	2,619	2,626	3,051

	FY 2007	FY 2008	FY 2009
Estimated Number of Ph.D.s Supported			
BES	4,840	4,770	5,840
ASCR	615	720	745
BER	1,511	1,654	1,720
HEP	1,750	1,660	1,765
NP	981	967	1,040
FES	815	817	807
Total Estimated Number of Ph.D.s Supported	10,512	10,588	11,917
Estimated Number of Graduate Students Supported			
BES	1,580	1,550	2,000
ASCR	335	415	435
BER	400	435	460
HEP	585	585	605
NP	472	460	490
FES	350	354	344
Total Estimated Number of Graduate Students Supported	3,722	3,799	4,334

Indirect Costs and Other Items of Interest

Institutional General Plant Projects (IGPP)

Institutional General Plant Projects are miscellaneous construction projects that are each less than $5,000,000 in TEC and are of a general nature (cannot be allocated to a specific program). IGPPs support multi-programmatic and/or inter-disciplinary programs and are funded through site overhead. Examples of acceptable IGPPs include site-wide maintenance facilities and utilities, such as roads and grounds outside the plant fences or a telephone switch that serves the entire facility.

Examples of current year projects are:

- 5000 Area 13.8kV distribution system upgrade—This project provides new 13.8 kV pad-mounted disconnect switches, underground duct bank and 13.8 kV cabling will be installed to integrate with the existing 13.8 kV system and to improve capacity and system reliability. TEC: $3,250,000.
- 4000 Substation Capacity Expansion—The existing 4000 substation will be reconfigured to increase its reliability and capacity. TEC: $2,300,000.
- West Campus 1500 Series Facility Renovations—The Biological and Environmental Sciences Directorate will consolidate its research activities into West Campus facilities and vacate 40,000 square feet of offices and laboratories, the majority located in 4500S. This project renovates building systems and laboratory space in the West Campus to accommodate the consolidation. TEC: $4,000,000.

The following displays IGPP funding by site:

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Argonne National Laboratory	—	1,500	6,000
Brookhaven National Laboratory	—	400	6,820
Lawrence Berkeley National Laboratory	336	500	4,100
Oak Ridge National Laboratory	6,932	14,200	14,000
Pacific Northwest National Laboratory	13	2,000	1,500
Stanford Linear Accelerator	—	—	3,000
Total, IGPP	7,281	18,600	35,420

The IGPP funding increases significantly in FY 2009 reflecting the elimination of direct funded GPP for multi-program sites, as that funding is transferred to the SLI program to support increased line item construction under the SC Infrastructure Initiative.

Facilities Maintenance and Repair

The Department's facilities maintenance and repair activities are tied to its programmatic missions, goals, and objectives. Facilities Maintenance and Repair activities funded at SC laboratories are displayed in the following tables. SC has set maintenance targets for each of its laboratories to achieve overall facilities maintenance and repair levels consistent with the National Academy of Science recommendation of 2–4% of replacement plant value for the SC laboratory complex.

Indirect-Funded Maintenance and Repair

Facilities maintenance and repair activities funded indirectly through overhead charges at SC laboratories are displayed below. Since this funding is allocated to all work done at each laboratory, these activities are paid for using funds from SC and other DOE organizations, as well other Federal agencies and other entities doing work at SC laboratories. Maintenance reported to SC for non-SC laboratories is also shown.

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Ames Laboratory	1,011	997	1,031
Argonne National Laboratory	29,589	29,613	31,064
Brookhaven National Laboratory	23,767	27,511	28,289
Fermi National Accelerator Laboratory	8,514	8,557	9,668
Lawrence Berkeley National Laboratory	14,006	13,138	16,099
Lawrence Livermore National Laboratory	2,850	2,887	2,953
Los Alamos National Laboratory	100	100	100
Oak Ridge Institute for Science and Education	505	317	325
Oak Ridge National Laboratory	35,711	32,655	33,341
Oak Ridge National Laboratory facilities at Y-12	620	818	818
Office of Scientific and Technical Information	301	307	314

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Pacific Northwest National Laboratory	1,971	1,917	1,340
Princeton Plasma Physics Laboratory	5,226	5,499	5,636
Sandia National Laboratories	1,999	2,045	2,096
Stanford Linear Accelerator Center	5,533	4,353	5,631
Thomas Jefferson National Accelerator Facility	3,231	2,674	2,727
Total, Indirect-Funded Maintenance and Repair	134,934	133,388	141,432

Direct-Funded Maintenance and Repair

Generally, facilities maintenance and repair expenses are funded through an indirect overhead charge. In some cases, however, a laboratory may charge maintenance directly to a specific program. An example of this might be if the maintenance were performed in a building used only by a single program. These direct-funded charges are nonetheless in the nature of indirect charges, and therefore are not directly budgeted. The maintenance work for the Oak Ridge Office is direct funded and direct budgeted by the Science Laboratories Infrastructure program. A portion of the direct-funded maintenance and repair expenses reflects charges to non-SC programs performing work at SC laboratories.

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Brookhaven National Laboratory	3,284	1,711	1,771
Fermilab National Accelerator Facility	3,260	3,411	3,854
Notre Dame Radiation Laboratory	151	161	169
Oak Ridge National Laboratory	16,859	14,897	15,210
Oak Ridge Office	503	550	600
Stanford Linear Accelerator Center	6,097	6,737	6,283
Thomas Jefferson National Accelerator Facility	80	52	53
Total, Direct-Funded Maintenance and Repair	30,234	27,519	27,940

Deferred Maintenance Backlog Reduction

SC is working to reduce the backlog of deferred maintenance at its laboratories as part of the Federal Real Property Initiative within the President's Management Agenda. The total deferred maintenance backlog at the end of FY 2007 is estimated to be $518,000,000[a]. This backlog includes the Argonne, Brookhaven, Lawrence Berkley, Oak Ridge, and Pacific Northwest national laboratories; the Ames Laboratory, Fermilab National Accelerator Facility, Princeton Plasma Physics Laboratory, Stanford Linear Accelerator Center, and Thomas Jefferson National Accelerator Facility; and other SC facilities in Oak Ridge and Notre Dame. The Department's goals for asset condition are based on the mission dependency of the asset. For example, the asset condition index long-term (FY 2015) target for mission

[a] The FY 2008 budget reported an estimated deferred maintenance backlog of $225,000,000 at the end of the FY 2006. This reflected deferred maintenance in excess of the DOE Asset Condition Index targets. The $518,000,000 estimate reflects the total deferred maintenance backlog.

critical facilities is 0.98 or above, where the index is computed as 1 less the ratio of deferred maintenance to replacement plant value. A higher index indicates lower deferred maintenance.

SC's $518,000,000 deferred maintenance back log at the end of FY 2007 exceeded the DOE Asset Condition Index goal by $232,000,000. To reduce the deferred maintenance backlog such that SC achieves the goals, SC sets targets for each of its laboratories for reduction of the deferred maintenance backlog based on the variance from departmental goals (e.g., the 0.98 goal for mission critical facilities). The FY 2007 target for deferred maintenance reduction funding was not met due to delayed appropriations, which postponed the start of planned projects.

Deferred maintenance activities are primarily funded by the laboratories as overhead, charged to all users of the laboratory facilities. The deferred maintenance estimates in the table below are in addition to funding of day-to-day maintenance and repair amounts shown in the tables above. In order to ensure that new maintenance requirements are not added to the backlog, SC has set targets for our laboratories that, overall, exceed 2% of the SC laboratory complex replacement plant value, commensurate with the industry standard funding level recommended by the National Academy of Sciences of 2–4% of the replacement plant value. The table below shows the targets planned for funding of deferred maintenance backlog reduction.

A key additional strategy in reducing deferred maintenance is SC's proposed Infrastructure Modernization Initiative, which will modernize the general purpose infrastructure at SC laboratories. The initiative focuses on increased funding for line item construction projects which will result in significant additional reductions to the deferred maintenance backlog, but are not included within the indirect funding in the following table. SLI is developing measures for tracking the progress of the initiative in reducing deferred maintenance, as well as improving mission readiness, improving operational reliability and safety, and reducing the footprint and average age of facilities.

(dollars in thousands)

	FY 2007	FY 2008	FY 2009
Argonne National Laboratory	2,721	1,983	4,581
Brookhaven National Laboratory	3,799	5,374	8,147
Fermi National Accelerator Laboratory	1,621	1,900	2,800
Lawrence Berkeley National Laboratory	2,200	4,038	2,500
Oak Ridge National Laboratory	5,320	6,000	6,500
Princeton Physics Plasma Laboratory	173	177	258
Stanford Linear Accelerator Center	792	686	1,001
Thomas Jefferson National Accelerator Facility	114	646	500
Total, Deferred Maintenance Backlog Reduction	16,740	20,804[a]	26,287[a]

[a] Funding estimates may need to be updated as a result of annual reviews of asset condition and the extent of the deferred maintenance backlog. The SC infrastructure initiative and the conversion from GPP to IGPP may also further impact the FY 2009 estimate. The impact of the FY 2008 appropriation may result in adjustments to the FY 2008 deferred maintenance funding goal.

Science
Office of Science

Funding by Site by Program

(dollars in thousands)

	FY 2007	FY 2008	FY 2009
Ames Laboratory			
Basic Energy Sciences	20,268	18,906	20,882
Advanced Scientific Computing Research	1,303	1,326	1,125
Workforce Development for Teachers and Scientists	237	100	446
Safeguards and Security	946	944	974
Total, Ames Laboratory	22,754	21,276	23,427
Ames Site Office			
Science Program Direction	519	555	576
Argonne National Laboratory			
Basic Energy Sciences	184,088	173,295	181,649
Advanced Scientific Computing Research	31,904	36,411	42,591
Biological and Environmental Research	26,903	26,034	26,309
High Energy Physics	12,953	10,448	11,368
Nuclear Physics	24,851	25,339	27,253
Fusion Energy Sciences	1,019	543	40
Science Laboratories Infrastructure	3,500	389	—
Workforce Development for Teachers and Scientists	1,353	395	2,006
Safeguards and Security	8,375	8,527	8,562
Total, Argonne National Laboratory	294,946	281,381	299,778
Argonne Site Office			
Science Program Direction	3,689	4,125	4,289
Berkeley Site Office			
Science Program Direction	4,194	4,394	4,680

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Brookhaven National Laboratory			
Basic Energy Sciences	113,270	133,343	193,883
Advanced Scientific Computing Research	1,009	1,009	730
Biological and Environmental Research	21,233	17,753	16,427
High Energy Physics	40,578	40,029	45,305
Nuclear Physics	170,537	167,838	180,794
Science Laboratories Infrastructure	3,855	8,200	14,882
Workforce Development for Teachers and Scientists	636	410	533
Safeguards and Security	10,710	10,834	11,451
Total, Brookhaven National Laboratory	361,828	379,416	464,005
Brookhaven Site Office			
Science Program Direction	3,747	4,234	4,529
Chicago Office			
Basic Energy Sciences	178,733	149,786	134,601
Advanced Scientific Computing Research	39,368	34,030	47,516
Biological and Environmental Research	140,925	128,319	107,807
High Energy Physics	128,669	123,556	146,149
Nuclear Physics	66,361	67,231	63,854
Fusion Energy Sciences	133,651	143,265	139,741
Science Laboratories Infrastructure	1,282	—	1,385
Science Program Direction	28,187	26,060	31,363
Safeguards and Security	488	1,607	2,150
SBIR/STTR	126,255	—	—
Total, Chicago Office	843,919	673,854	674,566
Fermi National Accelerator Laboratory			
Advanced Scientific Computing Research	120	120	120
High Energy Physics	344,256	319,241	376,799
Nuclear Physics	288	270	—
Workforce Development for Teachers and Scientists	162	80	436
Safeguards and Security	2,908	1,686	1,742
Total, Fermi National Accelerator Laboratory	347,734	321,397	379,097

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Fermi Site Office			
Science Program Direction	2,262	2,496	2,570
Golden Field Office			
Basic Energy Sciences	—	—	4
Workforce Development for Teachers and Scientists	774	250	869
Total, Golden Field Office	774	250	873
Idaho National Laboratory			
Basic Energy Sciences	395	375	375
Biological and Environmental Research	1,364	1,575	647
Fusion Energy Sciences	2,323	2,321	2,321
Workforce Development for Teachers and Scientists	100	86	255
Total, Idaho National Laboratory	4,182	4,357	3,598
Lawrence Berkeley National Laboratory			
Basic Energy Sciences	124,169	123,451	132,528
Advanced Scientific Computing Research	75,663	86,233	94,836
Biological and Environmental Research	90,177	99,091	87,084
High Energy Physics	52,745	49,240	56,007
Nuclear Physics	22,352	22,997	24,965
Fusion Energy Sciences	4,660	4,846	4,846
Science Laboratories Infrastructure	8,961	17,417	29,956
Workforce Development for Teachers and Scientists	713	409	1,087
Safeguards and Security	4,894	4,985	5,006
Total, Lawrence Berkeley National Laboratory	384,334	408,669	436,315

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Lawrence Livermore National Laboratory			
Basic Energy Sciences	4,375	3,912	4,061
Advanced Scientific Computing Research	12,256	9,640	13,093
Biological and Environmental Research	23,805	22,318	22,492
High Energy Physics	1,570	347	300
Nuclear Physics	1,423	1,369	1,010
Fusion Energy Sciences	12,580	12,639	12,393
Workforce Development for Teachers and Scientists	111	50	289
Total, Lawrence Livermore National Laboratory	56,120	50,275	53,638
Los Alamos National Laboratory			
Basic Energy Sciences	29,372	21,576	22,936
Advanced Scientific Computing Research	4,442	4,342	4,424
Biological and Environmental Research	16,298	15,768	14,840
High Energy Physics	1,172	248	350
Nuclear Physics	10,431	11,479	14,935
Fusion Energy Sciences	3,145	2,932	2,786
Workforce Development for Teachers and Scientists	50	50	364
Total, Los Alamos National Laboratory	64,910	56,395	60,635
National Energy Technology Laboratory			
Basic Energy Sciences	—	300	—
Science Laboratories Infrastructure	115	—	—
Workforce Development for Teachers and Scientists	475	570	633
Total, National Energy Technology Laboratory	590	870	633
National Renewable Energy Laboratory			
Basic Energy Sciences	8,261	6,700	7,630
Advanced Scientific Computing Research	674	696	631
Biological and Environmental Research	1,620	1,338	1,227
Workforce Development for Teachers and Scientists	30	—	—
Total, National Renewable Energy Laboratory	10,585	8,734	9,488

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
New Brunswick Laboratory			
Science Program Direction	—	6,644	6,782
Oak Ridge Institute for Science and Education			
Basic Energy Sciences	4,100	91	660
Advanced Scientific Computing Research	2,138	2,054	2,000
Biological and Environmental Research	5,721	3,895	4,101
High Energy Physics	171	156	150
Nuclear Physics	1,133	988	695
Fusion Energy Sciences	1,158	1,287	1,400
Science Laboratories Infrastructure	117	—	—
Science Program Direction	26	—	—
Workforce Development for Teachers and Scientists	1,600	1,592	2,952
Safeguards and Security	1,585	1,579	1,617
Total, Oak Ridge Institute for Science and Education	17,749	11,642	13,575
Oak Ridge National Laboratory			
Basic Energy Sciences	303,179	304,413	316,338
Advanced Scientific Computing Research	92,353	87,119	94,721
Biological and Environmental Research	50,234	62,720	63,643
High Energy Physics	170	30	85
Nuclear Physics	23,656	24,162	33,480
Fusion Energy Sciences	80,427	28,962	231,596
Science Laboratories Infrastructure	3,069	9,535	14,103
Safeguards and Security	7,473	7,897	8,895
Total, Oak Ridge National Laboratory	560,561	524,838	762,861
Oak Ridge Office			
Biological and Environmental Research	85	50	50
Science Laboratories Infrastructure	5,079	5,033	5,079
Science Program Direction	43,584	43,450	45,341
Safeguards and Security	18,476	17,849	18,819
Total, Oak Ridge Office	67,198	66,382	69,289

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Office of Scientific and Technical Information			
Basic Energy Sciences	80	100	80
Advanced Scientific Computing Research	80	80	80
Biological and Environmental Research	353	367	373
High Energy Physics	80	100	100
Nuclear Physics	80	100	—
Fusion Energy Sciences	80	100	100
Science Program Direction	8,600	8,684	8,916
Workforce Development for Teachers and Scientists	135	120	120
Safeguards and Security	483	470	490
Total, Office of Scientific and Technical Information	9,971	10,121	10,259
Pacific Northwest National Laboratory			
Basic Energy Sciences	18,103	16,716	17,744
Advanced Scientific Computing Research	5,155	3,928	4,362
Biological and Environmental Research	91,491	90,923	92,586
Nuclear Physics	90	—	—
Fusion Energy Sciences	873	900	900
Science Laboratories Infrastructure	10,000	24,773	41,155
Workforce Development for Teachers and Scientists	760	545	1,071
Safeguards and Security	11,318	11,143	11,163
Total, Pacific Northwest National Laboratory	137,790	148,928	168,981
Pacific Northwest Site Office			
Science Program Direction	4,836	5,053	5,618
Princeton Plasma Physics Laboratory			
Advanced Scientific Computing Research	1,227	1,154	954
High Energy Physics	236	—	252
Fusion Energy Sciences	69,084	72,027	73,603
Workforce Development for Teachers and Scientists	155	155	565
Safeguards and Security	2,128	2,128	2,149
Total, Princeton Plasma Physics Laboratory	72,830	75,464	77,523

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Princeton Site Office			
Science Program Direction	1,653	1,759	1,813
Sandia National Laboratories			
Basic Energy Sciences	36,064	40,369	44,213
Advanced Scientific Computing Research	6,524	5,966	6,598
Biological and Environmental Research	2,564	2,000	1,700
Nuclear Physics	294	275	—
Fusion Energy Sciences	2,111	2,270	2,220
Workforce Development for Teachers and Scientists	152	—	676
Total, Sandia National Laboratories	47,709	50,880	55,407
Savannah River National Laboratory			
Basic Energy Sciences	300	200	300
Biological and Environmental Research	951	520	483
Fusion Energy Sciences	40	—	—
Workforce Development for Teachers and Scientists	—	—	314
Total, Savannah River National Laboratory	1,291	720	1,097
Stanford Linear Accelerator Center			
Basic Energy Sciences	194,703	181,887	215,053
Advanced Scientific Computing Research	138	338	338
Biological and Environmental Research	4,741	4,843	3,986
High Energy Physics	145,786	95,491	91,532
Science Laboratories Infrastructure	5,770	—	—
Workforce Development for Teachers and Scientists	150	150	519
Safeguards and Security	2,566	2,566	2,586
Total, Stanford Linear Accelerator Center	353,854	285,275	314,014
Stanford Site Office			
Science Program Direction	2,123	2,551	2,625

	(dollars in thousands)		
	FY 2007	FY 2008	FY 2009
Thomas Jefferson National Accelerator Facility			
Advanced Scientific Computing Research	29	100	100
Biological and Environmental Research	550	600	600
High Energy Physics	1,879	1,148	2,411
Nuclear Physics	89,920	94,332	117,132
Science Laboratories Infrastructure	—	—	3,700
Workforce Development for Teachers and Scientists	359	100	448
Safeguards and Security	1,376	1,376	1,411
Total, Thomas Jefferson National Accelerator Facility	94,113	97,656	125,802
Thomas Jefferson Site Office			
Science Program Direction	1,550	1,872	1,965
Washington Headquarters			
Basic Energy Sciences	1,920	94,482	275,223
Advanced Scientific Computing Research	1,351	76,627	54,601
Biological and Environmental Research	1,089	66,283	124,185
High Energy Physics	2,169	49,297	74,152
Nuclear Physics	914	16,346	45,962
Fusion Energy Sciences	513	14,456	21,104
Science Laboratories Infrastructure	238	1,514	—
Science Program Direction	61,499	65,902	82,846
Workforce Development for Teachers and Scientists	—	2,982	—
Safeguards and Security	2,104	2,355	3,588
Congressionally Directed Projects	—	123,623	—
Total, Washington Headquarters	71,823	513,867	681,661
Total, Science	3,852,138	4,026,330	4,721,969

Major Changes or Shifts by Site

Argonne National Laboratory

Basic Energy Sciences

- The Intense Pulsed Neutron Source, a short-pulsed spallation neutron source that operated as a user facility since 1981, is shut down during FY 2008, and funds are provided in FY 2009 to place the facility in a safe storage condition.

Advanced Scientific Computing Research

- The Leadership Computing Facility will be fully operational at 250-500 teraflops and will provide open high-performance computing capability with low electrical power consumption to enable scientific advances.

Science Laboratories Infrastructure

- The Building Electrical Services Upgrade, Phase II, project will be cancelled.

Brookhaven National Laboratory

Basic Energy Sciences

- The Center for Functional Nanomaterials, one of five DOE Nanoscale Science Research Centers, will be fully operational in FY 2009.
- The National Synchrotron Light Source-II (NSLS-II) will begin construction in FY 2009. NSLS-II will provide the world's finest capabilities for x ray imaging.

Nuclear Physics

- Radioisotope related activities at the Brookhaven Linear Isotope Producer (BLIP) Building 931 and Hot Cell Building 801 are transferred from the Office of Nuclear Energy to SC in FY 2009.

Science Laboratories Infrastructure

- The Interdisciplinary Science Building, Phase I, project at BNL is initiated to replace 100,000 to 120,000 square feet of old, wood and masonry buildings with a new, 87,000 to 93,000 square foot building, with state-of-the-art laboratories, associated offices and support space.

Lawrence Berkeley National Laboratory

Biological and Environmental Research

- The Joint BioEnergy Institute at Lawrence Berkeley National Laboratory will be fully operational in FY 2009.

Science Laboratories Infrastructure

- The Seismic Life-Safety, Modernization, and Replacement of General Purpose Buildings, Phase II, project is initiated to remedy high seismic life-safety risks by replacing three seismically "very poor" and "poor" (University of California classification) buildings and five failing trailers with one new approximately 43,000 square feet general-purpose laboratory/office building.

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 2009 by $203,874,000.

Nuclear Physics

- Radioisotope related activities at hot cells in Buildings 4501 and 7920, and chemical and materials laboratories in Buildings 9204-3 and 5500 are transferred from the Office of Nuclear Energy to SC in FY 2009.

Oak Ridge Office

Science Program Direction

- Funding responsibility of the Department's nation-wide Payments Processing Center (PPC) at the Oak Ridge Financial Service Center (ORFSC) will be transferred from SC to the Department's Working Capital Fund. Each Departmental organization will be assessed an equitable share of the PPC contractor support requirements. As the responsible program for Oak Ridge, SC will continue to fund the salaries, benefits, and related expenses of the federal staff providing oversight to the ORFSC and PPC.

Princeton Plasma Physics Laboratory

Fusion Energy Sciences

- The National Compact Stellarator Experiment (NCSX) MIE project cost and schedule baseline is changing and is under discussion within the DOE. A decision as to the future of the project is expected to be made in the second quarter of FY 2008.

Stanford Linear Accelerator Center

Basic Energy Sciences

- FY 2009 marks the first full year of Basic Energy Sciences funding for SLAC linac operations as B-factory operations completed in FY 2008 and the Linac Coherent Light Source (LCLS) operations start in FY 2009. Support continues for construction and Other Project Costs of the LCLS.

High Energy Physics

- The B-factory an electron-positron collider optimized for the study of heavy quarks and operated as a user facility is shutdown after a successful run of over eight years. This marks the first time since its inception that SLAC has not had a HEP user facility operating or under construction. SLAC will begin decommissioning and decontamination of B-factory accelerator and detector components in FY 2009.

Thomas Jefferson National Accelerator Facility

Nuclear Physics

- Beginning in FY 2009, funding is provided to start construction activities for the 12 GeV Continuous Electron Beam Accelerator Facility (CEBAF) Upgrade project. When completed, the project will provide electron beams and an additional target hall (Hall D) opening a new energy regime and enhancing capabilities to study the quark structure of the nucleon and nuclei.

Science Laboratories Infrastructure

- The Technology and Engineering Development Facility project is initiated to address infrastructure inadequacies by renovating the 42-year-old Test Lab Building, constructing a new, approximately, 100,000 square foot building, and removing 22,000 square feet of obsolete building and trailer space.

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 39 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 coordinates planning, policy, implementation, and oversight in the areas of security systems, protective forces, personnel security, program management, material control and accountability, and cyber security. A protective force is maintained to provide protection of personnel, equipment, and property from acts of theft, vandalism, and sabotage through facility walk-through, monitoring of electronic alarm systems, and emergency communications.

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 99 buildings (4.4 million gross square feet of space) with an average building age of 36 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. ANL was selected by DOE, in partnership with ORNL and PNNL, to develop a Leadership Computing Facility (LCF) for science to revitalize the U.S. effort in high end computing. As part of the LCF activity, the ANL facility will operate 250-500 teraflops of open high-performance computing with low electrical power consumption to advance science and will continue to focus on testing and evaluating leading edge computers under development.

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) 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 at that site. ANL also 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 ORNL, PNNL, 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: HEP supports physics research in theoretical and experimental physics and accelerator technology R&D at ANL, using unique capabilities of the laboratory in the areas of engineering, detector technology, and advanced accelerator and computing techniques. The program had a significant presence at the recently concluded collider program at the Deutsches Elektronen-Synchrotron (DESY) laboratory in Hamburg, Germany and continues to participate in the Tevatron and neutrino research programs at Fermi National Accelerator Laboratory ("Fermilab"); 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 develop 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, e-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; left-handed meta-materials; high-power/high-brightness electron beams; and advanced beam diagnostics.

Nuclear Physics: The major ANL activity is the operation and R&D program at the Argonne Tandem Linac Accelerator System (ATLAS) National User 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), Fermi National Laboratory (Fermilab), Relativistic Heavy Ion Collider (RHIC), and Deutsches Elektronen-Synchrotron (DESY) in Germany investigating the structure of the nucleon; generic R&D in rare isotope beam development relevant for a next generation facility in nuclear structure and astrophysics; 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, 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% 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.

Fusion Energy Sciences: Argonne contributes a small effort in basic plasma science.

Science Laboratories Infrastructure: SLI enables Departmental research missions at Argonne 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 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. Program activities include security systems, material control and accountability, information and cyber security, program management, and personnel security. In addition, a protective force is maintained. These activities ensure that the facility, personnel, and assets remain safe from potential threats.

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 336 SC buildings (3.8 million gross square feet of space) with an average building age of 37 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 to efforts in geosciences and biosciences. It is also the site of one BES supported user facilities—the National Synchrotron Light Source (NSLS).

- 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 solve 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 the Genomics: GTL program 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. The 2005 BER Distinguished Scientist for Medical Sciences is at BNL. BNL scientists support the environmental remediation sciences research program in the area of subsurface contaminant fate and transport.

- Climate change research includes the operation of the **Atmospheric Radiation Measurement (ARM)** External Data resource that provides ARM investigators with data from non-ARM sources, including satellite and ground-based systems. BNL scientists form an important part of the science team in the Atmospheric Sciences program (ASP), including providing special expertise in conducting atmospheric field campaigns and aerosol research. The ASP chief scientist is at BNL.
- 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: HEP supports physics research in theoretical and experimental physics and accelerator technology research and development (R&D) at BNL, using unique resources of the laboratory, including engineering and technology for future accelerators and detectors, advanced computational resources, and the Accelerator Test Facility. BNL serves as the host lab 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. ILC 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 NuMI facility with the 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; a small exploratory research activity directed towards the heavy ion program at the Large Hadron Collider (LHC); analysis of data from the Sudbury Neutrino Observatory (SNO) and reporting results obtained from SNO on the properties of neutrinos; and conducting R&D directed towards the reactor neutrino oscillation experiment at Daya Bay; 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, completed in 1999, is a major unique international facility currently used by about 1,200 scientists from 19 countries. RHIC uses 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. Four detectors were fabricated to provide complementary measurements, with some overlap in order to cross-calibrate the measurements; the first two are still operating. The core of the Solenoidal Tracker at RHIC (STAR) detector is a large Time Projection Chamber (TPC) located inside a solenoidal magnet that tracks thousands of charged particles emanating from a single head-on gold-gold collision. A large modular barrel Electro-Magnetic Calorimeter (EMCal) and end-cap calorimeter measure deposited energy for high-energy charged and neutral particles and contain particle-photon discrimination capability. Other ancillary detector systems include a Silicon Vertex Tracker and forward particle tracking capabilities. A barrel Time of Flight detector upgrade (STAR TOF) is being added to significantly extend the particle identification capability of STAR detector. The Pioneering High-Energy Nuclear Interacting Experiment (PHENIX) detector has a particular focus on the measurement of rare probes at high event detection rate. It consists of two transverse spectrometer arms that can track charged particles within a magnetic field, especially to higher momentum: it provides excellent discrimination among photons, electrons, and hadrons. There are also two large muon tracking and identification systems in the forward and backward directions as well as ancillary tracker systems. Additional detector subsystems are being added to PHENIX to enhance its capabilities. Scientists that used the other two smaller detectors, Phobos and Broad Range Hadron Magnetic Spectrometer (BRAHMS), have completed their data acquisition programs and are focused on data analysis. International participation was essential in the implementation of all four detector systems.
- 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 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, among a variety of uses, with the support for these activities being provided by the relevant agencies.
- The **Booster Synchrotron**, part of the RHIC injector, is providing 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.
- 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 protons into the 33 giga-electron-volt Alternating Gradient Synchrotron. Produced isotopes, such as strontium-82, germanium-68, copper-67, and others, are used in medical diagnostic and therapeutic applications and other scientific research. The Radioisotopes Program is transferred from the Office of Nuclear Energy to the Office of Science in FY 2009.

Science Laboratories Infrastructure: SLI enables Departmental research missions at Brookhaven 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. BNL operates a transportation division to move special nuclear materials around the site. Material control and accountability efforts focus on accurately accounting for and protecting the site's special nuclear materials.

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 colleges/universities 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. The strength and effectiveness of the university-based program is critically important to the success of the program as a whole.

Nuclear Physics: NP funds 190 research grants at 85 colleges/universities located in 34 states and the District of Columbia. Among these are grants with the Triangle Universities Nuclear Laboratory (TUNL) which includes the High Intensity Gamma Source (HIGS) at the Duke Free Electron Laser Laboratory; the Texas A&M (TAMU) Cyclotron Institute; the Yale Wright Nuclear Science Laboratory; the University of Washington Center for Experimental Nuclear and Particle Astrophysics (CENPA) and the Institute for Nuclear Theory (INT); and the Research and Engineering (R&E) Center at the Massachusetts Institute for Technology. The first three of these include accelerator facilities which offer niche capabilities and opportunities not available at the National User Facilities, or many foreign low-energy laboratories, such as specialized sources and targets, opportunities for extended experiments, and specialized instrumentation. The CENPA and R&E Center have unique infrastructure ideal for pursuing instrumentation projects important to the NP mission. The Institute for Nuclear Theory (INT) is a premier international center for new initiatives and collaborations in nuclear theory research.

Fusion Energy Sciences: The Chicago Office supports FES by implementing grants and cooperative agreements for research at more than 50 colleges and universities located in approximately 30 states. It also supports the FES program by implementing a cooperative agreement and grants for the DIII-D tokamak experiment and related programs at General Atomics, an industrial firm located in San Diego, California.

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 346 buildings (2.3 million gross square feet of space) with an average building age of 40 years. Fermilab is the largest U.S. laboratory for research in high-energy physics and is second only to CERN, the European Laboratory for Particle Physics. About 2,200 scientific users, scientists from universities and laboratories throughout the U.S. and around the world, use Fermilab for their research. Fermilab's mission is the goal of high-energy physics: 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 2008. 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 that will make further use of the NuMI beam are planned to begin fabrication in FY 2008.
- Fermilab is host laboratory for the U.S. 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.
- The laboratory is involved in R&D associated with global systems, accelerator physics, and value engineering for the ILC. 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: S&S program efforts are directed at maintaining protective force staffing and operations to protect personnel and the facility, and toward continuing the cyber security, program management, security systems, and material control and accountability programs to accurately account for and protect 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 science relating to clean up of the nuclear weapons complex with an emphasis on understanding coupled processes affecting contaminant transport.

Fusion Energy Sciences: Since 1978, INL has been the lead laboratory for fusion safety. As such, it has helped to develop the fusion safety database that will demonstrate the environmental and safety characteristics of both nearer term fusion devices and future fusion power plants. 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 our domestic 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. INL has initiated operation of the Safety and Tritium Applied Research (STAR) Facility; a small tritium laboratory where the fusion program can conduct tritium material science, chemistry, and safety experiments. The STAR Facility has been declared a National User Facility. INL also coordinates safety codes and standards within the ITER program.

Lawrence Berkeley National Laboratory

The Lawrence Berkeley National Laboratory 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 107 buildings (1.5 million gross square feet of space) with an average building age of 38 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 Molecular Foundry, and the National Center for Electron Microscopy (NCEM).

- 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 is a growing facility with a lengthening portfolio of beamlines that has already been applied to make important discoveries in a wide variety of scientific disciplines. An ALS User Support Building (USB) will finish construction in FY 2012. The 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. 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 will be completed in FY 2009.
- 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 one of the major national laboratory partners forming 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 Genomics: GTL program. The Chief Scientist for the Low Dose Radiation Research program and the 2005 BER Distinguished Scientists for Environmental Remediation and for Life Sciences are at LBNL. 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 environmental remediation sciences research and provides geophysical, biophysical, and biochemical research capabilities for field sites in that program 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 Genomics:GTL Bioenergy Research Centers, will focus attention 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 will experiment with *E. Coli* and yeast, two workhorse microbes for conversion, as well as *Sulfolobus solfataricus*, an organism that has undergone much less historical research. JBEI will also consider biological production of alternatives to ethanol, such as butanol.

High Energy Physics: HEP supports physics research in experimental and theoretical physics and technology R&D at LBNL, using unique capabilities of the laboratory in the areas of superconducting magnet R&D, engineering and detector technology, world-forefront expertise in laser driven particle acceleration, expertise in design of advanced electronic devices, computational resources, and 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 detectors and in the application of high energy physics analysis methods to astronomical observations. LBNL physicists lead ongoing studies of dark energy using supernovae, including providing a catalog of data on supernova as distance indicators. The SuperNova Acceleration Probe (SNAP) 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, as well as devices to study dark energy and the cosmic microwave background. LBNL also is host to the 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 and are updated annually.

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 Brookhaven'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) at the European Organization for Nuclear Research (CERN); analysis of data from the Sudbury Neutrino Observatory (SNO) detector in Canada and reporting results on the properties of neutrinos; research at the KamLAND detector in Japan that is performing neutrino studies; development of next generation neutrino detectors, including 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 a technical effort in generic R&D of rare isotope beam development with the development of electron-cyclotron resonance (ECR) ion sources. The 88-Inch Cyclotron at the LBNL is a facility for testing electronic circuit components for radiation "hardness" to cosmic rays, supported by the National Reconnaissance Office (NRO) and the U.S. Air Force (USAF), 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 Departmental 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. This is accomplished with protective forces, security systems, cyber security, program management, personnel security, and material control and accountability of 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 comprise the Joint Genome Institute (JGI), the principal goal of which is high-throughput DNA sequencing. LLNL is developing new biocompatible materials and microelectronics for the artificial retina project. It also 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 the performance of climate models and to improve them. 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. The 2005 BER Distinguished Scientist for Climate Change Research is at LLNL.

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 CERN LHC, in nuclear data and compilation activities, in R&D of neutrinoless double beta decay experiments, on theoretical nuclear structure studies, and a technical effort involved in generic R&D of rare isotope beam development.

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 a few efforts in materials sciences, chemical sciences, geosciences, and engineering. LANL supports research on strongly correlated electronic materials, high-magnetic fields, microstructures, deformation, alloys, bulk ferromagnetic glasses, mechanical properties, ion enhanced synthesis of materials, metastable phases and microstructures, and mixtures of particles in liquids.

Research is also supported to understand the electronic structure and reactivity of actinides through the study of organometallic compounds. Also supported is work to understand the chemistry of plutonium and other light actinides in both near-neutral pH conditions and under strongly alkaline conditions relevant to radioactive wastes and research in 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 a long history and 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** provides tools and expertise to explore the continuum from scientific discovery to the integration of nanostructures into the microworld and the macroworld. CINT 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 comprise 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 research to understand 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 the 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 ARM site. In addition, LANL manages the deployment and operation of the ARM 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 also conducts research under environmental remediation sciences with an emphasis on biological processes associated with plutonium mobility in the environment. LANL is participating in the NSF/DOE Environmental Molecular Sciences Institute at Pennsylvania State University.

High Energy Physics: HEP supports theoretical physics research and technology R&D at LANL.

Nuclear Physics: NP supports a broad program of research including: a program of neutron beam research that utilized 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 the 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; analysis of data from the Sudbury Neutrino Observatory (SNO) and Mini Booster Neutrino Experiment (MiniBooNE) experiments and reporting results on the properties of neutrinos, and research and development directed at future studies of the properties of neutrinos; a broad program of theoretical research; nuclear data and compilation activities as part of the U.S. Nuclear Data program; and a technical effort involved in rare isotope beam development.

- At LANL, the 100 MeV Isotope Production Facility (IPF) produces major 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. The Radioisotopes Program is transferred from the Office of Nuclear Energy to the Office of Science in FY 2009.

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 (Solar) located on 632 acres in Golden, Colorado. NREL was built to emphasize 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 sole mission has been to develop renewable energy and energy efficiency technologies and transfer these technologies to the private sector.

Basic Energy Sciences: NREL supports basic research efforts that underpin this technological emphasis at the laboratory, e.g., 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.

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 150-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 supports a consortium of university and industry scientists to share the ORNL research station at NSLS to study the atomic and molecular structure of matter (known as ORSOAR, the Oak Ridge Synchrotron Organization for Advanced Research). 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. ORISE manages the **Shared Research Equipment (SHaRE)** program at ORNL. The SHaRE program makes available state-of-the-art electron beam microcharacterization facilities for collaboration with researchers from universities, industry, and other government laboratories.

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 manages the DOE-NSF program supporting graduate students to attend the Lindau Meeting of Nobel Laureates. It also coordinates activities associated with the peer review of the research proposals and applications submitted to BER.

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 in conjunction with FES, Oak Ridge Office, participating universities, DOE laboratories, and industries.

Science Laboratories Infrastructure: SLI enables the cleanup and removal of excess facilities at ORISE.

Safeguards and Security: S&S at ORISE provides physical protection/protective force services by employing unarmed security officers. The facilities are designated as property protection areas for the purpose of protecting government-owned assets. In addition to the government-owned facilities and personal property, ORISE possesses small quantities of nuclear materials that must be protected. The program includes information security, program management, personnel security, protective forces, security systems, and cyber security.

Oak Ridge National Laboratory

The Oak Ridge National Laboratory is a multiprogram laboratory located on the 24,000 acre reservation at Oak Ridge, Tennessee. The laboratory's 1,100 acre main site on Bethel Valley Road contains 248 buildings (3.4 million gross square feet of space) with an average building age of 37 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. The laboratory supports almost every major Departmental mission in science, defense, energy resources, and environmental quality. It 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, Oak Ridge supports the development and coordination of the implementation of domestic and international policy aimed at reducing threats, both internal and external, to the U.S. from weapons of mass destruction. The Laboratory 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 three BES supported user facilities—the Spallation Neutron Source (SNS); the High Flux Isotope Reactor (HFIR); 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 so 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 later.
- 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 very 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 **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 Center for Computational Sciences (CCS), located at ORNL, provides high-end capability computing services to SciDAC teams and other DOE users. ORNL was selected by DOE to develop Leadership Computing Facility (LCF) for science to revitalize the U.S. effort in high end computing. As part of the LCF activity, the ORNL facility will be operate one petaflops of open high-performance computing to advance science.

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, through laboratory experiments involving model ecosystems exposed to global change factors, and through 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 FACE experiment which facilitates research on terrestrial carbon processes and the development of terrestrial carbon cycle models. It also houses the ARM archive, providing data to ARM 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 environmental remediation sciences research programs, 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 comprise 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 Genomics: GTL. The laboratory also operates the Laboratory for Comparative and Functional Genomics, or "Mouse House."

- The **BioEnergy Science Center (BESC)** at ORNL, one of three Genomics: GTL Bioenergy Research Centers, will focus attention on two prime candidate feedstock plants, the poplar tree and switchgrass.

High Energy Physics: HEP supports a small research effort using unique capabilities of ORNL in the area of advanced accelerator R&D.

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 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. The FNPB will provide cold and ultra-cold neutron beams for a user research program in fundamental interactions and symmetries.

- 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 235 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.
- Enriched stable isotopes are processed at materials and chemical laboratories (Building 5500 and Building 9204-3). The materials laboratory performs a wide variety of metallurgical, ceramic, and high vacuum processing techniques; the chemical laboratory performs scraping, leaching, dissolving, oxidizing processes to remove unwanted materials and place the isotope into a "chemically stable" form. Radioactive isotopes are chemically processed and packaged in hot cells in Buildings 4501 and 7920. The Radioisotopes Program is transferred from the Office of Nuclear Energy to the Office of Science in FY 2009.

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 and design and is a major partner with PPPL on the NCSX MIE project being built at PPPL. ORNL hosts the U.S. ITER Project Office and is the lead laboratory managing the U.S. Contributions to ITER MIE project.

Science Laboratories Infrastructure: SLI enables Departmental research missions at Oak Ridge 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 Oak Ridge 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. Additionally, ORNL is responsible for providing overall laboratory policy direction and oversight in the security arena; for conducting recurring programmatic self-assessments; for assuring a viable ORNL Foreign Ownership, Control or Influence (FOCI) program is in place; and for identifying, tracking, and obtaining closure on findings or deficiencies noted during inspections, surveys, or assessments of S&S programs.

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 three major management and operating laboratories: Pacific Northwest National Laboratory, Stanford Linear Accelerator Center, 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 32 buildings (184,317 square feet) with an average age of 46 years and a total replacement plant value (RPV) of $29.0 million. The RPV of the roads and other structures on the Reservation is $47.5 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 ORNL and the Oak Ridge Institute for Science and Education (ORISE). The Manager provides on-site presence for ORNL and 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, PILT, and other needs related to landlord responsibilities.

Safeguards and Security: S&S provides for contractor protective forces for the Federal office building and ORNL. This includes protection of a category 1 Special Nuclear Material Facility, Building 3019. Other small activities include security systems, information security, and personnel security.

Office of Scientific and Technical Information

The Office of Scientific and Technical Information (OSTI) collects, preserves, and disseminates R&D information produced by DOE-sponsored research for use by DOE, the scientific community, academia, U.S. industry, and the public to expand the knowledge base of science and technology. OSTI's mission is to advance science and sustain technological creativity by making R&D findings available and useful to DOE researchers and the American people. OSTI is responsible for the development and operation of DOE's leading e-Gov systems such as the Information Bridge, Energy Citations Database, and the E-Print Network. OSTI also developed and hosts the interagency e-Gov system Science.gov, which uses breakthrough technology for simultaneously searching across more than 50 million pages in 30 federal databases involving 13 different federal agencies. Internationally, DOE (representing the United States), through OSTI's partnership with the British Library, used the same federated searching technology to open a web-based global gateway, WorldWideScience.org, to science information, covering 24 portals and databases from 17 countries. Although the majority of DOE's R&D output is open to the scientific community, a sizable share is classified or sensitive, and OSTI's responsibilities are to ensure protection and limited, appropriate access.

Pacific Northwest National Laboratory

Pacific Northwest National Laboratory 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 208,775 square feet national scientific user facility constructed by DOE that houses 375 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. PNNL, in partnership with ANL and ORNL, was selected by DOE to develop Leadership Computing for science to revitalize the U.S. effort in high end computing.

Biological and Environmental Research: PNNL is home to the William R. Wiley **Environmental Molecular Sciences Laboratory (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 wide variety of other cutting edge analytical capabilities for use by the national research community.

PNNL conducts a wide variety of research in subsurface environmental remediation science, with emphases on biogeochemistry and fate and transport of radionuclides. PNNL is participating in the National Science Foundation (NSF)/DOE Environmental Molecular Sciences Institutes at Pennsylvania

State University and Stanford 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) program office is located at PNNL, as is the project manager for the ARM engineering activity; this provides invaluable logistical, technical, and scientific expertise for the program. PNNL manages the ARM Aerial Vehicles Program (AAVP) as well. PNNL also conducts research on improving 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 comprise 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 Genomics: GTL. The Chief Scientist for the Genomics: GTL program is at PNNL.

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 vanadium, copper, and ferrite steels as part of the U.S. fusion materials team.

Science Laboratories Infrastructure: SLI enables Departmental 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 (Fusion Energy Sciences) located on 88 acres in Plainsboro, New Jersey. The laboratory consists of 36 buildings (721,000 gross square feet of space) with an average building age of 33 years. DOE does not own the land.

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, and is fabricating the National Compact Stellarator Experiment (NCSX), another innovative confinement device. 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 in the U.S., as well as several large tokamak facilities abroad, including Joint European Torus in the United Kingdom, JT-60U in Japan, and 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 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 nuclear materials, government property, and other vital assets from unauthorized access, theft, diversion, sabotage, or other hostile acts. These activities result in reduced risk to national security and the health and safety of DOE and contractor employees, the public, and the environment. The program consists of protective forces, 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 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** provides tools and expertise to explore the continuum from scientific discovery to the integration of nanostructures into the microworld and the macroworld. CINT 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 ARM 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: Sandia 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 Sandia'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. Sandia 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.

Stanford Linear Accelerator Center

The Stanford Linear Accelerator Center (SLAC) 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 2 mile long Stanford Linear Accelerator (linac) since 1966. SLAC consists of 115 buildings (1.7 million gross square feet of space) with the average age of 30 years. In addition, SLAC will become the site of the world's first x-ray laser, the Linac Coherent Light Source (LCLS) in 2009. Funding for operations of the SLAC linac is transitioning from High Energy Physics to Basic Energy Sciences, with full funding by Basic Energy Sciences starting in FY 2009.

SLAC houses the Kavli Institute for Particle Astrophysics and Cosmology (KIPAC), which is an independent laboratory of Stanford University.

Basic Energy Sciences: SLAC is the home of the **Stanford Synchrotron Radiation Laboratory** and peer-reviewed research projects associated with SSRL. The facility is used by 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.

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: SLAC operates the **B-factory,** which consists of PEP-II, a high energy asymmetric electron-positron collider, and a multi-purpose detector, BaBar. The B-factory was constructed to support a search for and high-precision study of CP symmetry violation in the B meson system, and began operations in 1999. The last year of B-factory operations for HEP will be FY 2008. The BaBar detector collaboration includes about 600 physicists from SLAC and other national laboratories, U.S. universities, and foreign universities and research institutes. A small group at SLAC also participates in the research program of the ATLAS detector at the Large Hadron Collider.

SLAC researchers are also working at the frontier of particle astrophysics. In 2006, SLAC completed construction of the detector for the Gamma Ray Large Array Telescope (GLAST) which will be launched into earth orbit in 2007. SLAC physicists and a user community will analyze the GLAST data through 2012. 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.

SLAC is a major contributor to the leadership and development of the proposed International Linear Collider, applying their expertise to nearly all aspects of the project. The laboratory is at the forefront of damping ring and beam delivery designs, required to ensure the beam brightness and precision control needed for the experimental program. 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 Departmental 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 protective forces, 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 is an Office of Science laboratory (Nuclear Physics) located on 206 acres (DOE-owned) in Newport News, Virginia focused on the exploration of nuclear and nucleon structure. The laboratory consists of 64 buildings (477,000 gross square feet of space) with an average building age of 15 years, 2 state-leased buildings, 23 real property trailers, and 10 other structures and facilities. The laboratory was constructed over the period FY 1987–1995.

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 1,200 researchers. Polarized electron beams up to 5.7 GeV can be provided by CEBAF simultaneously to 3 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 developed 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 (SRF) accelerator technology; their expertise is being used in the development of the 12 GeV Upgrade for CEBAF and the proposed International Linear Collider, and was utilized for the completed the Spallation Neutron Source. The 12 GeV CEBAF Upgrade initiates 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 Departmental research missions at TJNAF by funding line item construction to maintain the general purpose infrastructure, and the cleanup and removal of excess facilities.

The Technology and Engineering Development Facility project is initiated to renovate about 89,000 square feet in the Test Lab Building and remove over 10,000 square feet of inadequate and obsolete work space. The project will also construct a new building which will provide approximately 100,000 square feet of space to eliminate severe overcrowding and improve workflow and productivity by co-locating the engineering and technical functions currently spread across the Laboratory.

Safeguards and Security: TJNAF has a guard force (protective force) that provides 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 disciplines 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.