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 **[**forty-seven**]** *forty-nine* passenger motor vehicles for replacement only, including not to exceed one ambulance and two buses, **[**$3,632,718,000**]** *$4,101,710,000*, to remain available until expended. *(Energy and Water Development Appropriations Act, 2006.)*

Explanation of Change

Changes are proposed to reflect the FY 2007 funding and vehicle request.

Science
Office of Science

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2005 Current Appropriation	FY 2006 Original Appropriation	FY 2006 Adjustments	FY 2006 Current Appropriation	FY 2007 Request
Science					
Basic Energy Sciences	1,083,616	1,146,017	-11,460[a]	1,134,557	1,420,980
Advanced Scientific Computing Research	226,180	237,055	-2,371[a]	234,684	318,654
Biological and Environmental Research	566,597	585,688	-5,857[a]	579,831	510,263
High Energy Physics	722,906	723,933	-7,239[a]	716,694	775,099
Nuclear Physics	394,549	370,741	-3,707[a]	367,034	454,060
Fusion Energy Sciences	266,947	290,550	-2,906[a]	287,644	318,950
Science Laboratories Infrastructure	37,498	42,105	-421[a]	41,684	50,888
Science Program Direction	154,031	160,725	-1,607[a]	159,118	170,877
Workforce Development for Teachers and Scientists	7,599	7,192	-72[a]	7,120	10,952
Safeguards and Security	72,773	74,317	-687[a]	73,630	76,592
Small Business Innovation Research/ Small Business Technology Transfer	113,621[b]	—	—	—	—
Subtotal, Science	3,646,317	3,638,323	-36,327	3,601,996	4,107,315
Less use of prior year balances	-5,062	—	—	—	—
Less security charge for reimbursable work	-5,605	-5,605	—	-5,605	-5,605
Total, Science	3,635,650	3,632,718	-36,327	3,596,391	4,101,710

Preface

As part of the President's American Competitiveness Initiative, the Office of Science (SC) request for Fiscal Year (FY) 2007 is $4,101,710,000; an increase of $505,319,000, or 14.1%, from the FY 2006 appropriation. The request funds investments in basic research that are critical to both the future economic competitiveness of the United States and to the success of Department of Energy (DOE) missions in national security and energy security; advancement of the frontiers of knowledge in the physical sciences and areas of biological, environmental, and computational sciences; and provision of world-class research facilities for the Nation's science enterprise.

SC provides the basic research that underpins the Department's technically complex missions. Part of this support is in the form of large-scale scientific user facilities that form the backbone of modern research. The suite of forefront facilities includes the world's highest energy proton accelerator—Fermi National Accelerator Laboratory's (Fermilab's) Tevatron—and the soon to be operational Spallation

[a] Reflects a rescission in accordance with P.L. 109–148, the Emergency Supplemental Appropriations Act to Address Hurricanes in the Gulf of Mexico and Pandemic Influenza, 2006.
[b] Includes $77,842,000 reprogrammed within SC and $35,779,000 transferred from other DOE programs.

Neutron Source (SNS). SC facilities represent a continuum of unique capabilities that meet the needs of a diverse set of nearly 20,000 researchers each year. For example, the National Synchrotron Light Source (NSLS) began ultraviolet operations in 1982 and, initially, primarily enabled physical science research. However, through the 1990's the numbers of researchers from the life sciences rapidly grew as the characteristics of this facility better suited the needs of researchers who study protein structure. Today, the NSLS is playing a major role in the Protein Structure Initiative, a national effort to find the three-dimensional shapes of a wide range of proteins, while also providing a suite of beamlines to the soon to be available Center for Functional Nanomaterials and a host of other research efforts.

Within the Science appropriation, SC has 10 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).

This Overview will describe Strategic Context, Mission, Benefits, Strategic Goals, and Funding by General Goal. These items together put the appropriation request in perspective. The Annual Performance Results and Targets, Means and Strategies, and Validation and Verification sections address how the goals will be achieved and how performance will be measured. Finally, this Overview will address the Research and Development (R&D) Investment Criteria, Program Assessment Rating Tool (PART), and Significant Program Shifts.

Strategic Context

Following publication of the Administration's National Energy Policy, the Department developed a Strategic Plan that defines its mission, four strategic goals for accomplishing that mission, and seven general goals to support the strategic goals. Each appropriation has developed quantifiable goals to support the general goals. Thus, the "goal cascade" is the following:

Department Mission ➡ Strategic Goal (25 yrs) ➡ General Goal (10–15 yrs) ➡ Program Goal (Government Performance and Results Act [GPRA] Unit) (10–15 yrs).

To provide a concrete link between budget, performance, and reporting, the Department developed a "GPRA Unit" concept. Within DOE, a GPRA Unit defines a major activity or group of activities that support the core mission and aligns resources with specific goals. Each GPRA Unit has completed or will complete a PART. A unique program goal was developed for each GPRA unit. A numbering scheme has been established for tracking performance and reporting.

The goal cascade accomplishes two things. First, it ties major activities for each program to successive goals and, ultimately, to DOE's mission. This helps ensure the Department focuses its resources on fulfilling its mission. Second, the cascade allows DOE to track progress against quantifiable goals and to tie resources to each goal at any level in the cascade. Thus, the cascade facilitates the integration of budget and performance information in support of the GPRA and the President's Management Agenda (PMA).

Another important component of our strategic planning—and the PMA—is use of the Administration's R&D investment criteria to plan and assess programs and projects. The criteria were developed in 2001 and further refined with input from agencies, Congressional staff, the National Academy of Sciences, and numerous private sector and nonprofit stakeholders.

The chief elements of the R&D investment criteria are quality, relevance, and performance. Programs must demonstrate fulfillment of these elements. For example, to demonstrate relevance, programs are expected to have complete plans with clear goals and priorities. To demonstrate quality, programs are expected to commission periodic independent expert reviews. There are several other requirements, many of which R&D programs have and continue to undertake.

An additional set of criteria were established for R&D programs developing technologies that address industry issues. Some key elements of the criteria include: the ability of the programs to articulate the appropriateness and need for Federal assistance; relevance to the industry and the marketplace; identification of a transition point to industry commercialization (or of an off-ramp if progress does not meet expectations); and the potential public benefits, compared to alternative investments, that may accrue if the technology is successfully deployed.

The Office of Management and Budget (OMB)-Office of Science and Technology Policy (OSTP) guidance memorandum to agencies (http://www.ostp.gov/html/budget/2007/ostp_omb_guidancememo_FY07.pdf) describes the R&D investment criteria and identifies steps agencies should take to fulfill them. Where appropriate, throughout these justification materials, specific R&D investment criteria and requirements are cited to explain the Department's allocation of resources.

Mission

SC's mission is to deliver the discoveries and scientific tools that transform our understanding of energy and matter and advance the national, economic, and energy security of the United States.

Benefits

Developments at the nanoscale are expected to make major contributions to meeting DOE's applied mission needs such as strong, tough, ductile, lightweight materials with low failure rates that will improve the fuel efficiency and safety of ground and air transportation; smart materials that will range from paints that change color with temperature to windows that respond to thermal inputs and improve energy efficiency; nanostructured catalysts that will lead to cleaner, less expensive, more environmentally friendly petroleum refining; better batteries and fuel cells; improved chemical and product manufacturing; and innovative systems for harvesting light and storing energy that will dramatically improve solar energy conversion.

The knowledge developed from the Genomics: GTL program on understanding microbial genes and protein complexes, their regulation, and their functional roles in an ecosystem can lead both to greater energy security and a stabilization of net atmospheric CO_2 emissions. Currently, petroleum refineries "crack" raw oil through heat and catalysis to create gasoline and other petroleum products. In the future, we envision biorefineries that, in a one-step process, use microbial cellulase enzymes to crack the complex cellulose and hemicellulose in plant walls into simple sugars and microbially ferment those sugars into ethanol and other biobased products. Genomics: GTL research findings can accelerate this vision by improving the understanding of both plant cell-wall construction and the microbial enzymes necessary to deconstruct those walls. Microbes could also enable the inexpensive production of hydrogen by consuming a hydrogenated feedstock and releasing hydrogen. In addition, plants use the sun's energy to convert atmospheric carbon dioxide to biomass (e.g., leaves, roots, stems, and seeds) composed mainly of cellulose and lignin. Some biomass ultimately becomes incorporated into the soil where its carbon may be sequestered for hundreds of years. Understanding plant genes, their regulation and the role of microbes in the plant's root zone ultimately will enable manipulation of their carbon storage processes. Specialized, large-scale user facilities are needed to achieve the necessary economies of scale and output of molecular data associated with the Genomes: GTL effort.

Through investments in HEP and NP, 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. This knowledge rapidly travels from scientific journals to textbooks where it informs the creative vision of scientists, engineers, and entrepreneurs. This final path is neither linear nor overt, but we know that understanding the laws of nature is the key to technological progress. With this request, SC will focus efforts in these areas to places of world leadership and experiments with the greatest potential for radical discovery. The Relativistic Heavy Ion Collider (RHIC) will continue to explore new states of matter recently discovered there, providing a direct probe of the conditions found in exotic locations of the universe and at the first moments of the birth of the universe. Significant advances will be made in nuclear structure and nuclear astrophysics with the study of energy production in stars, the formation of heavy elements, and explosive stellar events. The Continuous Electron Beam Accelerator Facility (CEBAF) at the Thomas Jefferson National Accelerator Facility (TJNAF) provides unique world-wide capabilities in polarized electron beam studies of the quark structure of the nucleon—it is the world's most powerful electron "microscope" for studying the nucleus with unprecedented resolving power. The Fermilab Tevatron, the world's highest energy accelerator, is turning its powerful beams to solve the mystery of the existence of mass, to find the first evidence of a supersymmetric universe, and to explore the distinct possibility of finding extra dimensions of space and time in which we live. The B-factory at the Stanford Linear Accelerator Center (SLAC) is providing precision measurements of how matter and antimatter behave differently in the decays of short-lived exotic particles known as B-mesons, considered by physicists to be vital to understanding why the whole universe appears to be predominantly matter, rather than an equal quantity of matter and antimatter. There is also a broad program of experiments that studies those aspects of the fundamental nature of particles, forces, and the universe that cannot be determined solely through the use of accelerators, including the search for or measurement of dark matter and dark energy. A recent example is the unexpected and significant finding that neutrinos have mass, discovered by studying solar and cosmic ray neutrinos.

Strategic, General, and Program Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Science appropriation supports the following goal:

Science Strategic Goal: To protect our national and economic security by providing world-class scientific research capacity and advancing scientific knowledge.

General Goal 5, World-Class Scientific Research Capacity: Provide world-class scientific research capacity needed to: ensure the success of Department missions in national and energy security; advance the frontiers of knowledge in physical sciences and areas of biological, medical, environmental, and computational sciences; or provide world-class research facilities for the Nation's science enterprise.

The programs funded by the Science appropriation have the following six Program Goals which contribute to General Goal 5 in the "goal cascade":

Program Goal 05.22.00.00: 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.

Program Goal 05.23.00.00: 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.

Program Goal 05.21.00.00: 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.

Program Goal 05.19.00.00: 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.

Program Goal 05.20.00.00: 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.

Program Goal 05.24.00.00: 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 General Goals

Six of the programs within the Science appropriation directly contribute to General Goal 5 as follows:

BES contributes to General Goal 5 by advancing science through atomic- and molecular-level studies in materials sciences and engineering, chemistry, geosciences, and energy biosciences. BES also provides the Nation's researchers with world-class research facilities, including reactor and accelerator-based neutron sources, light sources including the X-ray free electron laser currently under construction, and micro-characterization centers. These facilities provide outstanding capabilities for imaging and characterizing materials of all kinds from metals, alloys, and ceramics to fragile biological samples. Construction of the Spallation Neutron Source will be completed during the 3rd quarter of FY 2006 and will join the suite of BES scientific user facilities. Four Nanoscale Science Research Centers will begin their first full year of operation in FY 2007—the Center for Nanophase Materials Sciences at Oak Ridge National Laboratory, the Molecular Foundry at Lawrence Berkeley National Laboratory, the Center for Nanoscale Materials at Argonne National Laboratory, and the Center for Integrated Nanotechnologies at Sandia National Laboratories and Los Alamos National Laboratory. A fifth Center, the Center for Functional Nanomaterials at Brookhaven National Laboratory, will be in its final year of construction. The Linac Coherent Light Source (LCLS) at Stanford Linear Accelerator Center is fully funded in FY 2007, including partial support for the SLAC linac. The Transmission Electron Aberration Corrected Microscope project continues as a Major Item of Equipment (MIE). Support is provided for R&D and project engineering and design (PED) activities for the National Synchrotron Light Source–II (NSLS–II) to enable the study of material properties and functions, particularly materials at the nanoscale, at a level of detail and precision never before possible. BES will increase support for basic research for the President's Hydrogen Fuel Initiative and will continue ongoing Scientific Discovery through Advanced Computing (SciDAC) efforts.

The ASCR program contributes to General Goal 5 by advancing mathematics and computer science, and developing the specialized algorithms, the scientific software tools, and the software libraries needed by DOE researchers to effectively use high-performance computing and networking hardware for scientific discovery. The ASCR program has been a leader in the computational sciences for several decades and has been acknowledged for pioneering accomplishments. The Leadership Computing activity will be expanded to Argonne National Laboratory to provide up to 100 teraflops of high performance computing capability with low electrical power needs to advance scientific understanding in areas that include materials science, biology, and advanced designs of nuclear reactors. The Leadership Computing

Facility at Oak Ridge National Laboratory will be upgraded to deliver 250 teraflops of peak capability in FY 2007. In FY 2007, the Energy Science Network (ESnet) will deliver a backbone network with two to four times the capability of today's network, to support the science mission of the Department. A procurement is planned in FY 2006 for the next generation of high performance resources at the National Energy Research Scientific Computing Center (NERSC) to be delivered in early FY 2007. This NERSC-5 system is expected to provide 100–150 teraflops of peak computing capacity. Corresponding investments in research and evaluation prototypes will help prepare scientists for petascale computing. ASCR will also continue core research efforts in applied mathematics and computer science and expand efforts in the SciDAC program and institutes.

BER contributes to General Goal 5 by advancing energy-related biological and environmental research in genomics and our understanding of complete biological systems, such as microbes that produce ethanol from cellulose or make hydrogen; by developing models to predict climate over decades to centuries; by developing science-based methods for cleaning up environmental contaminants; by providing regulators with a stronger scientific basis for developing future radiation protection standards; and by conducting limited research in medical imaging, radiopharmaceuticals, and development of an artificial retina. In FY 2007, BER will continue the Genomics: GTL program as a top priority, employing a systems approach to biology at the interface of the biological, physical, and computational sciences for DOE's energy security and environmental mission needs. Structural Biology infrastructure and innovative research on the biological effects of low dose radiation needed for future radiation protection standards will be sustained. BER continues as a pivotal partner in the interagency Climate Change Science Program focusing on the principal uncertainties of the causes and effects of climate change, the global carbon cycle, developing of predictive models for climate change over decades to centuries, and basic research for biological sequestration of carbon. Basic research in Environmental Remediation continues, at a reduced level, supporting fundamental research at the interfaces of biology, chemistry, geology, hydrology, and physics for solutions to environmental contamination challenges and terminating high level waste research. The Medical Sciences research program continues its principal focus on the artificial retina and medical imaging, including radiopharmaceuticals for imaging, at FY 2006 levels. Support for user facilities increases to meet growing scientific and technical demands for users of the Environmental Molecular Sciences Laboratory (EMSL), Production Genomics Facility (PGF), Atmospheric Radiation Measurement (ARM) sites, and Free Air Carbon Dioxide Enrichment (FACE) sites.

HEP contributes to General Goal 5 by advancing understanding of the basic constituents of matter, dark energy and dark matter, the lack of symmetry between matter and antimatter in the current universe, and the possible existence of other dimensions, collectively revealing key secrets of the universe. The FY 2007 budget request also contributes to this program goal by placing high priority on operations, upgrades, and infrastructure for the three major HEP user facilities (the Tevatron Collider and Neutrinos at the Main Injector [NuMI] at Fermilab and the B-factory at SLAC), to produce maximum scientific data. HEP and BES will jointly support accelerator operations at SLAC through the construction of the LCLS. The U.S. HEP program in FY 2007 will continue to lead the world with these forefront user facilities at Fermilab and SLAC, but these facilities will complete their scientific missions by the end of the decade. Thus the longer-term HEP program supported by this request begins to develop new cutting-edge facilities in targeted areas (for example, neutrino physics) that will establish U.S. leadership in these areas (see Significant Shifts) in the next decade, when the centerpiece of the world HEP program will reside at CERN. The FY 2007 budget also provides support for final installation, commissioning, and initial operations of the U.S.-supplied components of the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN) Laboratory.

NP contributes to General Goal 5 by supporting innovative, 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. The program builds and supports world-leading scientific facilities and state-of-the-art instruments necessary to carry out its basic research agenda. NP also supports an effort in nuclear data that collects, evaluates, and disseminates nuclear physics data for basic nuclear research and for applied nuclear technologies, such as the design of reactors and national and homeland security. 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, including implementation of required instrumentation to realize scientific goals. A new Electron Beam Ion Source (EBIS) begins construction together with the National Aeronautics and Space Administration (NASA) to provide RHIC with more cost-effective, reliable operations. In addition to RHIC efforts, the High Energy Density Physics activities include NP contributions to enhance heavy ion capabilities of existing LHC experiments and the accompanying research program at universities and laboratories. Operations of the Continuous Electron Beam Accelerator Facility (CEBAF) are supported to provide high-energy electron beams to investigate a unique property called "confinement" that binds together the fundamental constituents of protons and neutrons, particles called quarks and gluons. At the FY 2007 level of funding, the accelerator provides beams simultaneously to all three experimental halls to better understand the structure of the nucleon. PED begins on a significant upgrade of the facility, the 12 GeV CEBAF Upgrade project. NP also continues efforts in nuclear structure/astrophysics, fundamental interactions, and neutrinos. Efforts at the Argonne Tandem Linear Accelerator System (ATLAS) and the Holifield Radioactive Ion Beam Facility (HRIBF) will be supported to focus on investigating new regions of nuclear structure, studying interactions in nuclear matter like those occurring in neutron stars, and determining the reactions that created the nuclei of the chemical elements inside stars and supernovae. Generic R&D in radioactive ion beam development, relevant for next-generation facilities in nuclear structure and astrophysics, is supported in FY 2007. The GRETINA gamma-ray tracking array, currently under fabrication, revolutionizes gamma ray detection technology and offers dramatically improved capabilities to study the structure of nuclei at ATLAS and HRIBF. The Fundamental Neutron Physics Beamline (FNPB) under fabrication at SNS will provide a world-class capability to study the neutron decay properties, leading to a refined characterization of the weak force. Investments are made to initiate the fabrication of a neutron Electric Dipole Moment experiment in the search for new physics beyond the Standard Model, for fabrication of instrumentation that will provide opportunities for U.S. involvement in the heavy-ion program at the CERN Large Hadron Collider, and for design and R&D associated with a Double Beta Decay experiment that will measure the absolute mass of the neutrino.

FES contributes to General Goal 5 by advancing the theoretical and experimental understanding of plasma and fusion science through our domestic activities and a close collaboration with international partners on specialized facilities abroad. FES also contributes to General Goal 5 through participation in ITER, an experiment to study and demonstrate the scientific and technical feasibility of fusion power. ITER is a multi-billion dollar international research project that will, if successful, advance progress towards developing fusion's potential as a commercially viable and clean source of energy near the middle of the century. The FY 2006 Appropriation provided for a slower start for the U.S. Contributions to the ITER project. The FY 2007 request provides for the continuation of the U.S. Contributions to the ITER MIE project. In FY 2007, the overall Total Project Cost remains unchanged from FY 2006, but the funding requested in FY 2007 is lower than shown in the profile in the FY 2006 budget, and slightly adjusted between the Total Estimated Cost (TEC) and Other Project Cost (OPC) categories to address domestic and international project priorities. The U.S. contributions to the ITER project provides for the

U.S. "in-kind" equipment contributions, U.S. personnel to work at the ITER site, and cash for the U.S. share of common expenses such as infrastructure, hardware assembly, and installation.

Experimental research on tokamaks is continued in FY 2007, with increasing emphasis on physics issues of interest to the ITER project. Operations at the largest facility, the DIII-D tokamak at General Atomics (a private company), will increase from 7 weeks in FY 2006 to 12 weeks in FY 2007, while operations at C-Mod at MIT will increase from 14 to 15 weeks, and operations at the National Spherical Torus Experiment (NSTX) at PPPL will increase from 11 to 12 weeks. Fabrication of the National Compact Stellarator Experiment (NCSX) will continue along the new baseline established in July 2005 with completion expected in July 2009. The General Plasma Science program continues at approximately FY 2006 levels.

Funding by General and Program Goal

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
General Goal 5, World-Class Scientific Research Capacity			
Program Goal 05.22.00.00, Basic Energy Sciences	1,083,616	1,134,557	1,420,980
Program Goal 05.23.00.00, Advanced Scientific Computing Research	226,180	234,684	318,654
Program Goal 05.21.00.00, Biological and Environmental Research	566,597	579,831	510,263
Program Goal 05.19.00.00, High Energy Physics	722,906	716,694	775,099
Program Goal 05.20.00.00, Nuclear Physics	394,549	367,034	454,060
Program Goal 05.24.00.00, Fusion Energy Sciences	266,947	287,644	318,950
Subtotal, General Goal 5, World-Class Scientific Research Capacity	3,260,795	3,320,444	3,798,006
All Other			
Science Laboratories Infrastructure	37,498	41,684	50,888
Program Direction	154,031	159,118	170,877
Workforce Development for Teachers and Scientists	7,599	7,120	10,952
Safeguards and Security	72,773	73,630	76,592
Small Business Innovation Research/Small Business Technology Transfer	113,621	—	—
Total, All Other	385,622	281,552	309,309
Total, General Goal 5 (Science)	3,646,317	3,601,996	4,107,315

Major FY 2005 Accomplishments

An incident solar photon striking a semiconductor solar cell normally produces a single electron-hole pair (exciton) and some excess heat. Experimentalists have recently demonstrated that two or more excitons can be created by absorption of a single photon in an array of lead-selenide nanocrystals. This process is called "impact ionization" and is observed when the photon energy is greater than three times the band gap of the nanocrystal. Multiple excitons from a single photon are formed on the picosecond time scale, and the process occurs with up to 100% efficiency depending on the excess energy of the absorbed photon. If this process could be translated into an operational solar cell, the gain in efficiency for converting light to electrical current would be greater than 35%.

Diatoms are simple single-celled algae, covered with elegant and often very beautiful casings sculpted from silica. They share biochemical features of both plants and animals and are related to the organisms that make up the well known White Cliffs of Dover in England. Scientists have taken a big step toward resolving the paradoxical nature of these odd microbes by sequencing the genome of the marine diatom *Thalassiosira pseudonana*. Analyses of these genes and the proteins they encode confirm that diatoms, in their evolutionary history, apparently acquired new genes by engulfing microbial neighbors including, possibly, genes that provided the diatom with all the machinery necessary for photosynthesis. Diatoms occupy vast swaths of ocean and fresh water, where they play a key role in the global carbon cycle. Diatom photosynthesis yields 19 billion tons of organic carbon—about 40% of the marine carbon produced each year—and thus represent one of nature's key defenses against global warming. Progress in analyzing the diatom genome is also shedding light on how a diatom constructs its intricately patterned glass shell, progress that could benefit both materials and climate change scientists.

The universe may have begun as a "perfect" liquid, not a gas. In April 2005, nuclear physicists working on the four experiments at RHIC presented "White Papers" documenting details and summarizing the evidence for an extraordinary new state of matter obtained from the first three years of RHIC operations. These latest results show that a new state of hot, dense matter was created out of quarks and gluons, but quite different and even more remarkable than had been previously predicted. The matter created in heavy-ion collisions appears to behave like a near "perfect" liquid rather than a fiery gas of free quarks and gluons. The word "perfect" refers to the liquid's viscosity—a friction like property that impedes a fluid's ability to flow. A perfect liquid has no viscosity. The RHIC results are consistent with "ideal" hydrodynamic calculations suggesting that the lowest viscosity possible in a "Quark-Gluon Plasma (QGP) fluid" may be achieved— a stunning discovery that could revise physicists' conception of the earliest moments of the universe.

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.

The current focus is to establish outcome- and output-oriented goals, the successful completion of which will lead to benefits to the public, such as increased national security and energy security, and improved environmental conditions. DOE has incorporated feedback from OMB into the FY 2006 Budget Request, and the Department will take the necessary steps to continue to improve performance.

SC did not complete PARTs for the FY 2007 Budget. 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." The full PARTs are available on the OMB website at http://www.whitehouse.gov/omb/budget/fy2005/part.html. SC expects to stagger updated PART reviews in the future.

SC has taken steps to enhance public understanding of our revised performance measures. The PART website (http://www.science.doe.gov/measures/) has been improved to better explain what each scientific measure means, why it is important to the Department and/or the research community, and how progress will be measured. Roadmaps with more detailed information on tracking progress toward the long-term measures have been developed with the Scientific Advisory Committees and are posted to this PART website. The Advisory Committees will review progress toward those measures vis-à-vis the roadmaps every three to five years. The first reviews will be conducted in FY 2006. The results of these reviews will be published on the PART website as they become available.

For the FY 2007 budget, OMB has developed PARTWeb—a new interface for PART that facilitates collaboration between agencies and OMB. PARTWeb will link to the new http://ExpectMore.gov website and will improve public access to PART assessments and follow up actions. New actions for Science in 2006 include:

- Implementing the recommendations of past and new external assessment panels, as appropriate;
- Engaging the Advanced Scientific Computing Advisory Committee and other outside groups in regular, thorough scientific assessments of the quality, relevance, and performance of its research portfolio and computing/network facilities;
- A detailed corporate solution for managing and operating the High Flux Isotope Reactor;
- Engaging the National Academies in an independent assessment of the scientific basis and business case for microbial genomics research efforts;
- Developing strategic and implementation plans in response to multiple Congressional requirements for ITER and Fusion Energy Sciences;
- Re-engaging the Fusion Energy Sciences Advisory Committee in a study of the how the program could best evolve over the coming decade to take into account new and upgraded international facilities;
- Developing a strategy and implementation plan for particle accelerator research and development, including a potential international linear collider;
- Engaging the National Academies to help develop a realistic long term plan for High Energy Physics that is based on prioritized scientific opportunities and input from across the scientific community;
- Engaging the National Academies, including experts outside of nuclear physics, to study the scientific capabilities of a proposed rare isotope accelerator in an international context; and
- Maximizing operational efficiency of major Nuclear Physics experimental facilities in response to increasing power costs.

Significant Policy or Program Shifts

Basic Energy Sciences—Over the next two to three years, the Spallation Neutron Source (SNS) will fabricate and commission instruments and increase power to full levels. A new major item of equipment is funded that will allow the fabrication of four to five additional instruments for the SNS, thus nearly completing the initial suite of twenty four instruments that can be accommodated in the high-power target station. BES also supports energy security through basic research for effective solar energy utilization, basic research for the hydrogen economy, and basic research underpinning advanced nuclear energy power.

Advanced Scientific Computing Research— In FY 2007, ASCR supports increases in SciDAC activities, the initiation of new university based competition for SciDAC Institutes, and enhancements to SciDAC that develop leadership class computing simulations for petaflop-scale computers. Increases in funding for both production and leadership computing facilities will enable continued scientific leadership through high performance computing. The success of this effort is built on the enhancements to the research and evaluation prototype and computer science research activities. The Research and Evaluation Prototypes activity will prepare users for the next generations of scientific computers and reduce the risk of major procurements. Increases in funding would also enable ESnet to evolve to manage the increased data flows from petascale computers and the experimental facilities that are critical to the Nation's future.

Biological and Environmental Research—Development of a global biotechnology-based energy infrastructure requires a science base that enables scientists to redesign specific proteins, biochemical pathways, and even entire plants or microbes. Studies have suggested that, by 2100, biotechnology-based energy use could equal all global fossil energy use today. Two examples of biofuels are ethanol derived from the cellulose in plant cell walls (cellulosic ethanol) and hydrogen produced from water using energy from the sun (biophotolytic hydrogen). Within the Genomics: GTL program, BER will develop the understanding needed to advance biotechnology-based strategies for biofuel production. In addition, the FY 2007 budget includes funds for the continued expansion of the Genomics: GTL program—a program at the forefront of the biological revolution. Funding reductions are initiated in the Environmental Remediation Research and in the Climate Change Research Subprograms. High level waste, ocean sciences, and ocean carbon sequestration research are terminated within these two subprograms.

High Energy Physics—Our highest priority HEP R&D effort is the development of an International Linear Collider (ILC), and this request significantly advances the ILC R&D program. Pre-conceptual R&D for the ILC is doubled to enable a strong U.S. leadership role as a part of a comprehensive, coordinated international R&D program. In addition, R&D for other accelerator and detector technologies will continue at an increased level relative to FY 2006. Project engineering and design (PED) will begin on a new detector optimized to detect electron neutrinos, the Electron Neutrino Appearance (EνA) Detector, which will utilize the existing NuMI beam. Participation will begin in a reactor-based neutrino experiment, and R&D for a high-intensity neutrino super beam facility and a double beta decay experiment will continue. These efforts are part of a coordinated neutrino program developed from an American Physical Society study and a joint High Energy Physics Advisory Panel/Nuclear Science Advisory Committee review. In order to explore the nature of dark energy, conceptual R&D for the Super Nova/Acceleration Probe (SNAP) mission concept will continue in FY 2007. SNAP is expected to be a mission concept proposed for a potential interagency-sponsored experiment with NASA, the Joint Dark Energy Mission (JDEM). In addition, to fully determine the nature of dark energy, independent and complementary measurements are scientifically advisable. In FY 2007, additional R&D will be done for ground facilities and/or space-based facilities which could provide these measurements.

Nuclear Physics—The FY 2007 budget request increases support for operations and research by approximately 21% compared to FY 2006. At this level, operations of the four NP National User Facilities allow researchers to make effective progress towards the program's scientific goals and milestones. This budget request supports initiation of research efforts in the CERN LHC heavy ion program and starts PED activities for the 12 GeV CEBAF Upgrade project. NP also supports increases for research relevant to advanced nuclear fuel cycles. While we have a relatively good understanding of the origin of the chemical elements in the cosmos lighter than iron, the production of the elements from iron to uranium remains a puzzle. A next-generation exotic beam facility would allow the U.S. to play a leading role in nuclear structure and astrophysics studies in the next decade. Modest funding for generic R&D in exotic beam development is supported in FY 2007.

Fusion Energy Sciences—The FY 2007 budget continues the redirection of the fusion program to prepare for and participate in the international ITER project. The redirection will require modest reductions in several program elements not directly related to ITER. The FY 2007 request for the U.S. Contributions to ITER MIE project reflects a more modest first two years than was contained in the FY 2006 President's Budget, but maintains the overall Total Project Cost funding cap of $1,122,000,000. The reductions allow for the U.S. to be more consistent with the other ITER parties in the pace of starting the long lead procurements, in providing increased numbers of personnel to the ITER Organization, and in providing cash for common expenses. The profile is preliminary until the baseline scope, cost, and schedule for the MIE project are established, and the Director General Nominee and ITER Organization have achieved a standard mode of operation. SciDAC efforts will increase and will continue development of collaboratory tools to facilitate international fusion collaborations and initiate development of an integrated software environment that can accommodate the wide range of space and time scales and the multiple physical phenomena that are encountered in simulations of fusion systems. The Fusion Simulation Project is a major initiative involving plasma physicists, applied mathematicians, and computer scientists to create a comprehensive set of models of fusion systems, combined with the algorithms required to implement the models and the computational infrastructure to enable them to work together. High Energy Density Physics, Plasma Technology and Materials Research, Experimental Plasma Research, and Fusion Theory will be reduced.

Scientific Laboratory Infrastructure—In FY 2007, SLI will initiate funding for four construction projects: the Seismic Safety Upgrade of Buildings, Phase I, at the Lawrence Berkeley National Laboratory; the Modernization of Building 4500N, Wing 4, Phase I, at the Oak Ridge National Laboratory; the Building Electrical Services Upgrade, Phase II, at the Argonne National Laboratory; and Renovate Science Lab, Phase I, at the Brookhaven National Laboratory. Funding for the Pacific Northwest National Laboratory Physical Sciences Facility is requested in the National Nuclear Security Administration's (NNSA's) Nuclear Non-Proliferation R&D program for FY 2007. This project is co-funded by SC, NNSA, and the Department of Homeland Security. The SLI program will continue full funding for demolition of the Bevatron at Lawrence Berkeley National Laboratory. General plant project (GPP) funding is terminated in FY 2007 because it is supported in other SC programs' budgets in FY 2007.

Science Program Direction—Program direction funding increases by 7.4%, with most of the increase to support an additional 25 FTEs planned to be hired in support of the overall Science program, which is increased by 14.1% in the FY 2007 request. The increase also supports a 2.2% pay raise; an increased cap for SES basic pay; other pay related costs such as the government's contributions for employee health insurance and Federal Employees' Retirement System (FERS); escalation of non-pay categories, such as travel, training, and contracts; and increased e-Gov assessments and other fixed operating requirements across the SC complex. Finally, the increase will cover requirements not requested in previous SCPD budget requests, including travel expenses of SC Advisory Committee members and requirements related to Appendix A of OMB Circular A-123, Management's Responsibility for Internal Control.

Workforce Development for Teachers and Scientists—The Laboratory Science Teacher Professional Development (LSTPD) program increases to expand participation from 108 teachers in FY 2006 to 300 in FY 2007. The Faculty Sabbatical activity was initiated in FY 2005 for faculty from Minority Serving Institutions (MSI) and reduced in FY 2006 due to feedback from MSI faculty who expressed their inability to participate in sabbatical programs and a preference for shorter fellowship-type opportunities. FY 2007 participation will be reduced to two faculty members. The Science Undergraduate Laboratory Internship (SULI) programs will be increased to add approximately 55 students. The Albert Einstein Distinguished Educator Fellowship and the National and Middle School Science Bowls will all continue.

Safeguards and Security—The FY 2007 budget will ensure adequate security posture for SC facilities by protecting fundamental science, national security, and the health and safety of DOE and contractor employees, the public and the environment. FY 2007 funding will cover the implementation of the 2003 Design Basis Threat (DBT). In FY 2007, an increase in funding for the Cyber Security program element is being requested to begin to address the promulgation of new National Institute of Standards and Technology (NIST) requirements which are statutorily required by the Federal Information Security Management Act (FISMA) to improve the Federal and SC laboratory cyber security posture.

Indirect Costs and Other Items of Interest

Institutional General Plant Projects

Institutional General Plant Projects (IGPPs) 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:

- Quadrangle Common Area design and construction at Oak Ridge National Laboratory. This FY 2004 and FY 2005 effort includes lawn, landscaping, sidewalks, lighting, and street improvements to an area of approximately 71,000 square feet. TEC: $2,697,000.
- East Campus Storm Water Upgrades at Oak Ridge National Laboratory. This FY 2005 project will upgrade the East Campus storm water drainage system to prevent flooding of new East Campus facilities. Recent storm modeling of the East Campus watershed has determined that a 500-year storm could produce substantial flooding in the Oak Ridge East Campus. TEC: $750,000
- East Campus Parking Expansion design and construction at Oak Ridge National Laboratory. This project, scheduled for completion in FY 2006, will provide expanded parking capacity for the recently completed Third Party Buildings, Joint Institute for Computational Science/Oak Ridge Center for Advanced Studies, and Research Support Center, as well as the Multiprogram Research Facility. TEC: $3,500,000.

The following displays IGPP funding by site:

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Oak Ridge National Laboratory	9,000	10,000	8,000
Pacific Northwest National Laboratory	2,000	2,000	5,000
Argonne National Laboratory	—	—	2,000
Total, IGPP	11,000	12,000	15,000

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 by the Office of Science or 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 2005	FY 2006	FY 2007
Ames Laboratory	1,023	915	858
Argonne National Laboratory	26,413	26,327	28,332
Brookhaven National Laboratory	21,511	22,925	23,098
Fermi National Accelerator Laboratory	6,033	8,893	6,738
Lawrence Berkeley National Laboratory	11,175	13,000	15,440
Lawrence Livermore National Laboratory	2,735	2,767	2,822
Massachusetts Institute of Technology	569	—	—
Oak Ridge Institute for Science and Education	546	475	380
Oak Ridge National Laboratory	23,372	23,080	23,075
Oak Ridge National Laboratory facilities at Y-12	738	500	500
Pacific Northwest National Laboratory	1,868	1,895	1,476
Princeton Physics Plasma Laboratory	4,387	5,045	5,300
Sandia National Laboratory	1,905	1,960	1,999
Stanford Linear Accelerator Center	5,837	5,278	5,140
Thomas Jefferson National Accelerator Facility	2,676	3,440	2,518
Total, Indirect-Funded Maintenance and Repair	110,788	116,500	117,676

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 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 2005	FY 2006	FY 2007
Brookhaven National Laboratory	2,290	2,974	2,974
Fermilab National Accelerator Facility	3,028	3,628	3,628
Notre Dame Radiation Laboratory	172	145	150
Oak Ridge National Laboratory	15,842	13,748	13,929
Oak Ridge National Laboratory facilities at Y-12	79	—	—
Oak Ridge Office	1,771	1,891	2,019
Stanford Linear Accelerator Center	1,079	2,520	3,480
Thomas Jefferson National Accelerator Facility	44	50	52
Total, Direct-Funded Maintenance and Repair	24,305	24,956	26,232

Deferred Maintenance Backlog Reduction

SC is planning an increased focus on reducing the backlog of deferred maintenance activities. SC will set targets for each of its laboratories for activities specifically focused on reduction of the backlog of these activities. The current deferred maintenance backlog at SC laboratories is estimated to be $660,000,000 and this amount will be our deferred maintenance baseline from which we will measure improvement. Deferred maintenance activities are primarily funded by the laboratories as overhead, charged to all uses of the laboratory facilities. The overall target for deferred maintenance at SC laboratories will be $19,800,000 in FY 2007. These deferred maintenance estimates are in addition to funding of day-to-day maintenance and repair amounts shown in the tables above. In order to assure 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 tables below show the targets planned for funding of deferred maintenance backlog reduction.

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Argonne National Laboratory	—	—	2,574
Brookhaven National Laboratory	—	—	5,940
Fermi National Accelerator Laboratory	—	—	1,980
Lawrence Berkeley National Laboratory	—	—	2,178
Oak Ridge National Laboratory	—	—	5,544
Princeton Physics Plasma Laboratory	—	—	396
Stanford Linear Accelerator Center	—	—	792
Thomas Jefferson National Accelerator Facility	—	—	396
Total, Deferred Maintenance Backlog Reduction	—	—	19,800

Selected Administration Priorities

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Hydrogen Fuel Initiative	29,183	32,500	50,000
Climate Change Science Program	126,985	130,646	126,187
Networking and Information Technology Research and Development	246,846	255,830	344,672
National Nanotechnology Initiative	207,837	206,404	256,914
ITER (TPC)	——	19,315	60,000

Science
Office of Science
Funding by Site by Program

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Ames Laboratory			
Basic Energy Sciences	23,538	20,410	20,857
Advanced Scientific Computing Research	1,681	1,450	562
Biological and Environmental Research	800	——	——
Science Laboratories Infrastructure	210	150	——
Workforce Development for Teachers and Scientists	65	65	227
Safeguards and Security	505	507	570
Total, Ames Laboratory	26,799	22,582	22,216
Ames Site Office			
Science Program Direction	470	453	520
Argonne National Laboratory			
Basic Energy Sciences	180,613	171,629	190,810
Advanced Scientific Computing Research	13,145	9,918	28,174
Biological and Environmental Research	26,291	27,297	27,713
High Energy Physics	10,829	8,939	9,748
Nuclear Physics	23,158	18,762	23,682
Fusion Energy Sciences	971	990	960
Science Laboratories Infrastructure	2,457	1,246	3,697
Workforce Development for Teachers and Scientists	1,833	298	2,056
Safeguards and Security	8,671	8,570	8,462
Total, Argonne National Laboratory	267,968	247,649	295,302
Argonne Site Office			
Science Program Direction	3,413	3,677	3,813
Berkeley Site Office			
Science Program Direction	3,361	3,675	4,241

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Brookhaven National Laboratory			
Basic Energy Sciences	89,876	101,633	133,783
Advanced Scientific Computing Research	1,000	673	——
Biological and Environmental Research	23,620	20,172	18,074
High Energy Physics	30,648	26,542	30,193
Nuclear Physics	158,441	146,832	183,255
Science Laboratories Infrastructure	7,706	4,996	5,100
Workforce Development for Teachers and Scientists	734	436	1,013
Safeguards and Security	11,335	11,229	10,967
Total, Brookhaven National Laboratory	323,360	312,513	382,385
Brookhaven Site Office			
Science Program Direction	3,267	3,537	3,643
Chicago Office			
Basic Energy Sciences	180,295	130,276	130,351
Advanced Scientific Computing Research	41,556	24,853	18,164
Biological and Environmental Research	220,252	109,654	75,868
High Energy Physics	127,944	117,772	120,152
Nuclear Physics	73,339	59,258	61,664
Fusion Energy Sciences	135,356	134,241	129,817
Science Laboratories Infrastructure	1,848	——	1,520
Science Program Direction	25,306	24,719	26,162
Workforce Development for Teachers and Scientists	36	——	——
Safeguards and Security	185	825	3,400
SBIR/STTR	113,621	——	——
Total, Chicago Office	919,738	601,598	567,098
Fermi National Accelerator Laboratory			
Advanced Scientific Computing Research	646	1,215	——
High Energy Physics	318,316	298,533	320,367
Nuclear Physics	33	——	——
Fusion Energy Sciences	——	3	——
Science Laboratories Infrastructure	662	491	——
Workforce Development for Teachers and Scientists	62	50	308
Safeguards and Security	3,015	2,893	3,221
Total, Fermi National Accelerator Laboratory	322,734	303,185	323,896

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Fermi Site Office			
Science Program Direction	2,185	2,235	2,346
Golden Field Office			
Basic Energy Sciences	——	4	4
Advanced Scientific Computing Research	——	3	——
Biological and Environmental Research	——	3	——
High Energy Physics	——	4	——
Nuclear Physics	——	3	——
Workforce Development for Teachers and Scientists	622	250	835
Total, Golden Field Office	622	267	839
Idaho National Laboratory			
Basic Energy Sciences	353	225	225
Biological and Environmental Research	3,670	1,566	1,190
Fusion Energy Sciences	2,499	2,380	2,334
Workforce Development for Teachers and Scientists	75	70	340
Total, Idaho National Laboratory	6,597	4,241	4,089
Idaho Operations Office			
Biological and Environmental Research	1,113	——	——
Lawrence Berkeley National Laboratory			
Basic Energy Sciences	135,564	110,437	125,497
Advanced Scientific Computing Research	71,546	65,408	77,559
Biological and Environmental Research	71,818	71,517	72,671
High Energy Physics	43,101	40,834	44,812
Nuclear Physics	18,784	18,399	20,706
Fusion Energy Sciences	6,048	5,653	4,911
Science Laboratories Infrastructure	8,199	15,009	21,500
Workforce Development for Teachers and Scientists	799	379	885
Safeguards and Security	5,733	4,723	4,981
Total, Lawrence Berkeley National Laboratory	361,592	332,359	373,522

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Lawrence Livermore National Laboratory			
Basic Energy Sciences	3,405	2,819	2,854
Advanced Scientific Computing Research	6,734	4,743	1,800
Biological and Environmental Research	26,149	24,224	25,209
High Energy Physics	2,140	1,951	2,196
Nuclear Physics	1,084	643	905
Fusion Energy Sciences	13,751	13,282	12,025
Science Laboratories Infrastructure	150	150	——
Workforce Development for Teachers and Scientists	50	——	78
Total, Lawrence Livermore National Laboratory	53,463	47,812	45,067
Los Alamos National Laboratory			
Basic Energy Sciences	27,624	22,753	21,993
Advanced Scientific Computing Research	3,879	2,832	2,075
Biological and Environmental Research	20,825	17,675	15,479
High Energy Physics	809	540	590
Nuclear Physics	9,647	8,008	10,515
Fusion Energy Sciences	3,831	3,946	3,356
Workforce Development for Teachers and Scientists	50	50	361
Total, Los Alamos National Laboratory	66,665	55,804	54,369
National Energy Technology Laboratory			
Basic Energy Sciences	82	100	——
Biological and Environmental Research	31	——	——
High Energy Physics	81	——	——
Nuclear Physics	16	100	——
Fusion Energy Sciences	81	3	——
Science Laboratories Infrastructure	——	275	——
Workforce Development for Teachers and Scientists	127	263	500
Total, National Energy Technology Laboratory	418	741	500
National Renewable Energy Laboratory			
Basic Energy Sciences	8,043	7,197	7,403
Advanced Scientific Computing Research	150	150	150
Biological and Environmental Research	400	569	875
Workforce Development for Teachers and Scientists	52	——	——
Total, National Renewable Energy Laboratory	8,645	7,916	8,428
NNSA Service Center/Albuquerque			
Biological and Environmental Research	850	800	——

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Oak Ridge Institute for Science and Education			
Basic Energy Sciences	3,455	810	810
Advanced Scientific Computing Research	315	600	——
Biological and Environmental Research	5,557	4,088	4,159
High Energy Physics	278	50	——
Nuclear Physics	1,067	590	703
Fusion Energy Sciences	1,186	1,215	788
Science Laboratories Infrastructure	565	768	——
Science Program Direction	39	——	——
Workforce Development for Teachers and Scientists	1,470	853	1,545
Safeguards and Security	1,403	1,359	1,489
Total, Oak Ridge Institute for Science and Education	15,335	10,333	9,494
Oak Ridge National Laboratory			
Basic Energy Sciences	263,802	276,351	322,480
Advanced Scientific Computing Research	68,786	61,098	82,822
Biological and Environmental Research	45,408	39,746	36,266
High Energy Physics	836	180	182
Nuclear Physics	20,941	19,668	23,349
Fusion Energy Sciences	22,340	20,560	18,650
Science Laboratories Infrastructure	2,188	1,283	8,047
Safeguards and Security	11,891	9,461	8,396
Total, Oak Ridge National Laboratory	436,192	428,347	500,192
Oak Ridge Office			
Basic Energy Sciences	106	80	80
Advanced Scientific Computing Research	200	80	——
Biological and Environmental Research	694	677	373
High Energy Physics	108	16	80
Nuclear Physics	106	80	——
Fusion Energy Sciences	106	80	——
Science Laboratories Infrastructure	5,039	5,028	5,079
Science Program Direction	42,422	42,534	44,252
Workforce Development for Teachers and Scientists	90	90	90
Safeguards and Security	12,862	16,107	17,975
Total, Oak Ridge Office	61,733	64,772	67,929

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Pacific Northwest National Laboratory			
Basic Energy Sciences	15,149	14,763	15,182
Advanced Scientific Computing Research	3,408	6,690	350
Biological and Environmental Research	86,647	80,203	85,695
Fusion Energy Sciences	1,330	1,285	815
Science Laboratories Infrastructure	4,960	4,950	—
Workforce Development for Teachers and Scientists	917	514	1,035
Safeguards and Security	11,133	10,044	10,993
Total, Pacific Northwest National Laboratory	123,544	118,449	114,070
Pacific Northwest Site Office			
Science Program Direction	5,277	5,438	5,553
Princeton Plasma Physics Laboratory			
Advanced Scientific Computing Research	573	1,143	—
High Energy Physics	225	225	249
Fusion Energy Sciences	74,999	90,953	129,956
Science Laboratories Infrastructure	239	119	—
Workforce Development for Teachers and Scientists	135	115	392
Safeguards and Security	1,938	1,819	1,953
Total, Princeton Plasma Physics Laboratory	78,109	94,374	132,550
Princeton Site Office			
Science Program Direction	1,554	1,618	1,668
Sandia National Laboratories			
Basic Energy Sciences	54,225	38,808	43,822
Advanced Scientific Computing Research	10,693	4,122	2,595
Biological and Environmental Research	7,125	4,631	4,213
Fusion Energy Sciences	3,454	2,022	1,655
Workforce Development for Teachers and Scientists	—	—	258
Total, Sandia National Laboratories	75,497	49,583	52,543
Savannah River National Laboratory			
Basic Energy Sciences	200	200	200
Biological and Environmental Research	873	804	691
Fusion Energy Sciences	37	10	—
Workforce Development for Teachers and Scientists	—	—	258
Total, Savannah River National Laboratory	1,110	1,014	1,149

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Savannah River Operations Office			
Biological and Environmental Research	7,748	1,000	——
Stanford Linear Accelerator Center			
Basic Energy Sciences	95,232	150,763	215,469
Advanced Scientific Computing Research	485	57	——
Biological and Environmental Research	4,150	4,350	4,311
High Energy Physics	169,036	144,574	145,964
Science Laboratories Infrastructure	3,275	5,539	5,770
Workforce Development for Teachers and Scientists	150	135	150
Safeguards and Security	2,335	2,377	2,437
Total, Stanford Linear Accelerator Center	274,663	307,795	374,101
Stanford Site Office			
Science Program Direction	1,647	1,670	2,134
Thomas Jefferson National Accelerator Facility			
Advanced Scientific Computing Research	50	——	——
Biological and Environmental Research	810	400	400
High Energy Physics	50	480	927
Nuclear Physics	86,815	78,127	96,371
Science Laboratories Infrastructure	——	175	——
Workforce Development for Teachers and Scientists	332	95	502
Safeguards and Security	1,468	1,231	1,311
Total, Thomas Jefferson National Accelerator Facility	89,525	80,508	99,511
Thomas Jefferson Site Office			
Science Program Direction	1,407	1,457	1,500

	(dollars in thousands)		
	FY 2005	FY 2006	FY 2007
Washington Headquarters			
Basic Energy Sciences	2,054	85,299	189,160
Advanced Scientific Computing Research	1,333	49,649	104,403
Biological and Environmental Research	11,766	170,455	137,076
High Energy Physics	18,505	76,054	99,639
Nuclear Physics	1,118	16,564	32,910
Fusion Energy Sciences	958	11,021	13,683
Science Laboratories Infrastructure	—	1,505	175
Science Program Direction	63,683	68,105	75,045
Workforce Development for Teachers and Scientists	—	3,457	119
Safeguards and Security	299	2,485	437
Total, Washington Headquarters	99,716	484,594	652,647
Total, Science	3,646,317	3,601,996	4,107,315

Major Changes or Shifts by Site

Argonne National Laboratory

Basic Energy Sciences

- The **Center for Nanoscale Materials**, one of five DOE Nanoscale Science Research Centers, will be fully operational in FY 2007.

Advanced Scientific Computing Research

- The Leadership Computing activity will be initiated to provide up to 100 teraflops of high-performance computing capability with low electrical power consumption to enable scientific advances.

Science Laboratories Infrastructure

- The Argonne National Laboratory (ANL) Building Electrical Services Upgrade, Phase II project is initiated to upgrade critical portions of the electrical power distribution system in twelve research buildings and support facilities, including the Canal Water Plant supplying cooling water for site experiments.

Lawrence Berkeley National Laboratory

Basic Energy Sciences

- The Molecular Foundry, one of five DOE Nanoscale Science Research Centers, will be fully operational in FY 2007.
- Advanced Light Source (ALS) User Support Building (USB) will begin design in FY 2007. The USB will provide user support space to accommodate the growth in the number of users and future expansion of the ALS.

Advanced Scientific Computing Research

- Funding for the National Energy Research Scientific Computing Center (NERSC) and the Energy Science Network (ESnet) is increased from FY 2006. This will enable significant increases in the high performance production computing capacity and network capacity to meet SC's needs.

Science Laboratories Infrastructure

- The Seismic Safety Upgrade of Buildings, Phase I project is initiated to address the seismic upgrade of laboratory buildings where high life-safety risks have been identified.
- Demolition of the Bevatron is fully funded to free-up about 7.5% of the total building space for future missions.

Brookhaven National Laboratory

Basic Energy Sciences

- The **Center for Functional Nanomaterials**, one of five DOE Nanoscale Science Research Centers, is in its final year of construction in FY 2007.
- Support is provided for Project Engineering Design and Other Project Costs for the **National Synchrotron Light Source-II** (NSLS-II), which will be built as a replacement for NSLS-I, to enable the study of material properties and functions, particularly materials at the nanoscale, at a level of detail and precision never before possible. NSLS-II will provide the world's finest capabilities for x-ray imaging.

Science Laboratories Infrastructure

- The Renovate Science Laboratory, Phase I project is initiated to upgrade and rehabilitate existing obsolete and unsuitable laboratory facilities into modern, efficient facilities compatible with world-class scientific research.

Los Alamos National Laboratory

Basic Energy Sciences

- The **Center for Integrated Nanotechnologies**, one of five DOE Nanoscale Science Research Centers, will be fully operational in FY 2007.

Oak Ridge National Laboratory

Basic Energy Sciences

- Construction of the **Spallation Neutron Source** (SNS) will be completed during the 3rd quarter of FY 2006. Over the next two to three years, the facility will continue to fabricate and commission instruments, funded both as part of the SNS project and from other sources including non-DOE sources, and will increase power to full levels. A new Major Item of Equipment is funded in FY 2007 that will allow the fabrication of approximately four to five additional instruments for the SNS, thus nearly completing the initial suite of 24 instruments that can be accommodated in the high-power target station. Support also is provided for research and development (R&D) for a power upgrade to the SNS.
- The **Center for Nanophase Materials Sciences**, one of five DOE Nanoscale Science Research Centers, will be fully operational in FY 2007.

Advanced Scientific Computing Research

- The Leadership Computing Facility (LCF) at the Oak Ridge National Laboratory (ORNL) will be enhanced to deliver 250 teraflops of peak capability in FY 2007 for scientific applications.

Fusion Energy Sciences

- ORNL, in partnership with Princeton Plasma Physics Laboratory (PPPL), shares the responsibility for managing the U.S. contributions to the ITER project by further engaging the U.S. fusion community and industry to provide the U.S. hardware contributions and the U.S. secondees to be assigned to the ITER Organization abroad. There will be significant international cooperation between the U.S. ITER Project Office (a partnership between PPPL and ORNL), the international ITER Organization, and the other ITER parties.

Science Laboratories Infrastructure

- The Modernization of Building 4500N, Wing 4, Phase I, project is initiated to rehabilitate a facility housing many of the laboratory's chemical laboratory facilities, as well as administrative offices and the medical clinic.

Princeton Plasma Physics Laboratory

Fusion Energy Sciences

- PPPL, in partnership with ORNL, will continue to manage the U.S. contributions to the ITER project by further engaging the U.S. fusion community and industry to provide the U.S. hardware contributions and the U.S. secondees to be assigned to the ITER Organization abroad. There will be significant international cooperation and coordination between the U.S. ITER Project Office (a partnership between PPPL and ORNL), the international ITER Organization, and the other ITER parties.

Sandia National Laboratories

Basic Energy Sciences

- The **Center for Integrated Nanotechnologies**, one of five DOE Nanoscale Science Research Centers, will be fully operational in FY 2007.

Fusion Energy Sciences

- Research in plasma-facing components and plasma materials interactions for the base program will be reduced; however, Sandia is expected to play a major role in the first wall and shield area of the ITER project.

Stanford Linear Accelerator Center

Basic Energy Sciences

- The **Linac Coherent Light Source (LCLS)** will continue Project Engineering Design and construction. Funding is provided separately for preconceptual design and fabrication of instruments for the facility. Funding is also provided to partially support operation of the SLAC linac. This marks the second year of the transition to LCLS operations at SLAC.

Site Description

Ames Laboratory

Introduction

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 37 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 (MPC)**, which is dedicated to the preparation, purification, and characterization of rare-earth, alkaline-earth, and refractory metal and oxide materials. Established in 1981, the MPC is a one-of-a-kind resource that provides scientists at university, industrial, and government laboratories with research and developmental quantities of high purity materials and unique analytical and characterization services that are not available from commercial suppliers. The MPC is renowned for its technical expertise in alloy design and for creating materials that exhibit ultrafine microstructures, high strength, magnetism, and high conductivity.

Advanced Scientific Computing Research

Ames conducts research in computer science and participates on SciDAC teams. Ames also participates in Integrated Software Infrastructure Center (ISIC) activities that focus on specific software challenges confronting users of terascale computers.

Science Laboratories Infrastructure

The Science Laboratories Infrastructure (SLI) program enables Departmental research missions at the laboratory by funding line item construction to maintain the general purpose infrastructure, and the cleanup and removal of excess facilities.

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

Introduction

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 Office of Science (SC) presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Argonne National Laboratory

Introduction

The Argonne National Laboratory (ANL) in Argonne, Illinois, is a multiprogram laboratory located on 1,508 acres in suburban Chicago. The laboratory consists of 99 buildings (4.5 million gross square feet of space) with an average building age of 34 years.

Basic Energy Sciences

ANL is home to research activities in broad areas of materials and chemical sciences. It is also the site of four user facilities—the Advanced Photon Source (APS), the Intense Pulsed Neutron Source (IPNS), 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 high-quality, reliable x-ray beams at the APS have already brought about new discoveries in materials structure.

The **Intense Pulsed Neutron Source** is a short-pulsed spallation neutron source that first operated all of its instruments in the user mode in 1981. Twelve neutron beam lines serve 14 instruments. Distinguishing characteristics of IPNS include its innovative instrumentation and source technology and its dedication to serving the users. The first generation of virtually every pulsed source neutron scattering instrument was developed at IPNS. In addition, the source and moderator technologies developed at IPNS, including uranium targets, liquid hydrogen and methane moderators, solid methane moderators, and decoupled reflectors, have impacted spallation sources worldwide. Research at IPNS is conducted on the structure of high-temperature superconductors, alloys, composites, polymers, catalysts, liquids and non-crystalline materials, materials for advanced energy technologies, and biological materials.

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. It is the only instrumentation of its type in the western hemisphere. 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 and consequently attracts users from around the world. 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 participates on a number of the SciDAC teams. Further, it participates in ISIC activities that focus on specific software challenges confronting users of terascale computers. As part of the Leadership Computing Facility (LCF) activity, ANL will acquire up to 100 teraflops of high-performance computing with low electrical power consumption to advance science and will continue to focus on testing and evaluating leading edge computers.

Biological and Environmental Research

ANL operates a high-throughput national user facility for protein crystallography at APS that also supports a growing environmental science community. In support of climate change research, it coordinates the operation and development of the Southern Great Plains, Tropical Western Pacific, and North Slope of Alaska Atmospheric Radiation Measurement (ARM) sites. ANL also conducts research on aerosol processes and properties and to develop and apply software to enable efficient long-term climate simulations on distributed-memory multiprocessor computing platforms. Research is conducted to understand the molecular control of genes and gene pathways in microbes. In conjunction with the ORNL and the Pacific Northwest National Laboratory (PNNL) and six universities, ANL is a participating lab in the Carbon Sequestration in Terrestrial Ecosystems (CSiTE) consortium, focusing on research to understand the processes controlling the rate of soil carbon accretion. APS supports environmental remediation sciences researchers and ANL conducts environmental remediation sciences research.

High Energy Physics

The High Energy Physics (HEP) program supports physics research and technology R&D at ANL, using unique capabilities of the laboratory in the areas of engineering and detector technology and advanced accelerator and computing techniques.

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 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, such as the proposed Rare Isotope Accelerator (RIA) facility; 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** 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% of the beams are exotic (radioactive) 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 exotic beam facilities. The combination of versatile beams and powerful instruments enables ~200 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 a Californium source to provide new capabilities in neutron-rich radioactive beams.

Fusion Energy Sciences

Argonne contributes to the plasma facing components area of the enabling R&D program activities, focusing on modeling of plasma-materials interaction phenomena of interest for ITER and current plasma experiments.

Science Laboratories Infrastructure

The SLI program enables Departmental research missions at the laboratory 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

Introduction

The Argonne Site Office provides the single federal presence with responsibility for contract performance at the Argonne National Laboratory (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

Introduction

The Berkeley Site Office provides the single federal presence with responsibility for contract performance at the Lawrence Berkeley National Laboratory (LBNL). 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

Introduction

The Brookhaven National Laboratory is a multiprogram laboratory located on 5,300 acres in Upton, New York. The laboratory consists of 345 SC buildings (3.9 million gross square feet of space) with an average building age of 36 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** is among the largest and most diverse scientific user facilities in the world. The NSLS, commissioned in 1982, has consistently operated at >95% reliability 24 hours a day, 7 days a week, with scheduled periods for maintenance and machine studies. Adding to its breadth is the fact that the NSLS 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. These data are fundamentally important to virtually all of the physical and life sciences as well as providing immensely useful information for practical applications. The petroleum industry, for example, uses the NSLS to develop new catalysts for refining crude oil and making by-products like plastics.

Advanced Scientific Computing Research

BNL conducts basic research in applied mathematics and participates on SciDAC teams. It also participates in ISIC activities that focus on specific software challenges confronting users of terascale 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. BNL conducts research into new instrumentation for detecting x-rays and neutrons. Research is also conducted on the molecular mechanisms of cell responses to low doses of radiation. BNL conducts molecular nuclear medicine research developing advanced medical imaging technologies including radiopharmaceuticals for medical imaging. The 2005 BER Distinguished Scientist for Medical Sciences is at BNL.

Climate change research includes the operation of the 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 atmospheric field campaigns and aerosol research to the program. The ASP chief scientist is at BNL. BNL scientists play a leadership role in the operation of the Free-Air Carbon Dioxide Enrichment (FACE) facility at the Duke Forest used to understand how plants respond to elevated carbon dioxide concentrations in the atmosphere.

BNL supports environmental remediation sciences research and is participating in the National Science Foundation (NSF)/DOE Environmental Molecular Sciences Institute at State University of New York-Stony Brook and has instituted a new internal initiative EnviroSuite to support a growing community of environmental users at NSLS.

High Energy Physics

The HEP program supports physics research and technology R&D at BNL, using unique resources of the laboratory, including engineering and technology for future accelerators and detectors, computational resources, and the Accelerator Test Facility.

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; a smaller R&D activity directed towards the ATLAS detector within the heavy-ion program at the LHC at CERN; research on the properties of neutrinos at the Sudbury Neutrino Observatory (SNO); 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 1,000 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. It 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 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 have been fabricated to provide complementary measurements, with some overlap in order to cross-calibrate the measurements. (1) 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. (2) 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. Scientists using the other two smaller detectors, Phobos and Broad RAnge Hadron Magnetic Spectrometer (BRAHMS), have or are expected to complete their research programs and focus on data analysis in the near future. International participation has been 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 will be 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 (NNDC)** 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. Nuclear Data program-funded scientists at U.S. national laboratories and universities contribute to the activities and responsibilities of the NNDC.

Science Laboratories Infrastructure

The SLI program enables Departmental research missions at the laboratory by funding line item construction to maintain the general purpose infrastructure, and the cleanup and removal of excess facilities.

Safeguards and Security

The Safeguards and Security (S&S) program activities 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

Introduction

The Brookhaven Site Office provides the single federal presence with responsibility for contract performance at the Brookhaven National Laboratory (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

Introduction

The Chicago 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. Chicago directly supports site offices responsible for program management oversight of seven major management and operating laboratories—Ames Laboratory, Argonne National Laboratory, Lawrence Berkeley National Laboratory, Brookhaven National Laboratory, Fermi National Accelerator Laboratory, Princeton Plasma Physics Laboratory, and Stanford Linear Accelerator Center—and one government-owned and government-operated Federal laboratory, New Brunswick Laboratory. Additionally, the administrative, business and technical expertise of Chicago is shared SC-wide through the Integrated Support Center concept. Chicago 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

The BES program funds research at 190 academic institutions located in 48 states.

Advanced Scientific Computing Research

The Advanced Scientific Computing Research (ASCR) program funds research at over 70 colleges/universities located in 24 states supporting approximately 126 principal investigators.

Biological and Environmental Research

The Biological and Environmental Research (BER) program funds research at some 220 institutions, including colleges/universities, private industry, and other federal and private research institutions located in 44 states.

High Energy Physics

The HEP program supports about 260 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

The Nuclear Physics (NP) program funds 185 research grants at 90 colleges/universities located in 35 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; Texas A&M (TAMU) Cyclotron; the Yale Tandem Van de Graaff; University of Washington Tandem Van de Graaff and Center for Experimental Nuclear and Particle Astrophysics (CENPA); and the newly established Research and Engineering Center at the Massachusetts Institute for Technology. These accelerator facilities 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. Also supported is the Institute for Nuclear Theory (INT) at the University of Washington, a premier international center for new initiatives and collaborations in nuclear theory research.

Fusion Energy Sciences

The Fusion Energy Sciences (FES) program funds research at more than 50 colleges and universities located in approximately 30 states. FES also funds the DIII-D tokamak experiment and related programs at General Atomics, an industrial firm located in San Diego, California.

Fermi National Accelerator Laboratory

Introduction

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 358 buildings (2.3 million gross square feet of space) with an average building age of 39 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 2,500 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 teams.

High Energy Physics

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 is the highest energy proton accelerator in the world, and will remain so until the LHC begins commissioning at CERN in 2007. With the shutdown of the Large Electron-Positron (LEP) collider at CERN in 2000, the Tevatron became the only operating particle accelerator at the energy frontier. The Tevatron complex also includes the Booster and the Main Injector, pre-accelerators to the Tevatron. The Main Injector, which is used for the pre-acceleration of protons and production of antiprotons as a part of the Tevatron complex, is also used independently of the Tevatron for a 120 GeV fixed target program, including the **Neutrinos at the Main Injector (NuMI)** beamline which started operation in 2005. Fermilab is the principal experimental facility for HEP. The HEP program also supports physics research and technology R&D at Fermilab, using unique resources of the laboratory, including state-of-the-art engineering and technology for future generations of accelerators and detectors and computational resources.

Science Laboratories Infrastructure

The SLI program enables Departmental research missions at the laboratory by funding line item construction to maintain the general purpose infrastructure, and the cleanup and removal of excess facilities.

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. Limited funding increases would be applied to security systems and the Foreign Visits and Assignments program.

Fermi Site Office

Introduction

The Fermi Site Office provides the single federal presence with responsibility for contract performance at the Fermi National Accelerator Laboratory (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

Introduction

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 subsurface science.

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 completed fabrication of the Safety and Tritium Applied Research (STAR) Facility, which is 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 codes and standards within the ITER program.

Lawrence Berkeley National Laboratory

Introduction

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 106 buildings (1.6 million gross square feet of space) with an average building age of 36 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. Collocated with the University of California at Berkeley, the Laboratory benefits from regular collaborations and joint appointments with numerous outstanding faculty members. The Laboratory is the home to the research of many students and postdoctoral appointees. It is also the site of three Basic Energy Sciences (BES) 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 begin design in FY 2007.

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 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. Several research laboratories at LBNL with capabilities that complement those at the facilities also are open to Foundry users.

Advanced Scientific Computing Research

LBNL conducts basic research in the mathematics and computer science, as well as research in advanced computing software tools. It participates in several scientific application partnerships, including the partnership with the BES program in nanoscale science, and participates on a number of the SciDAC teams. 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 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. LBNL participates in ISIC activities that focus on specific software challenges confronting users of terascale computers.

Biological and Environmental Research

LBNL is one of the major national laboratory partners forming the Joint Genome Institute (JGI) whose principal goals are high-throughput DNA sequencing techniques and studies on the biological functions associated with the newly sequenced human DNA. The laboratory also conducts research on the molecular mechanisms of cell responses to low doses of radiation, on the use of model organisms to understand and characterize the human genome, and on microbial systems biology research as part of Genomics:GTL. 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 beam lines for determination of protein structure at the ALS for use by the national and international biological research community. The ALS is also used by a growing environmental science community. LBNL also supports the environmental remediation sciences research and the geophysical and biophysical and biochemical research capabilities for field sites in that program.

LBNL conducts research on carbon cycling and carbon sequestration on terrestrial ecosystems. It also conducts research on biological and ecological responses to climatic and atmospheric changes.

LBNL conducts research into new technologies for the detailed characterization of complex environmental contamination. It also develops scalable implementation technologies that allow widely used climate models to run effectively and efficiently on massively parallel processing supercomputers. LBNL also conducts research on terrestrial carbon cycling to understand the processes controlling the exchange of CO_2 between terrestrial ecosystems and the atmosphere.

High Energy Physics

The HEP program supports physics research 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.

Nuclear Physics

The Low Energy subprogram has supported operations and the research program of the 88-Inch Cyclotron, whose operations transitioned in FY 2004 from a national user facility to a dedicated in-house facility with partial operational support from other federal agencies to carry out their programs. Other activities 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; R&D and conceptual design activities directed towards a detector upgrade for the ALICE detector heavy-ion program at the Large Hadron Collider (LHC) at Organisation Européanne pour la Recherche Nucléaire (CERN); operation of the Sudbury Neutrino Observatory (SNO) detector in Canada and the KamLAND detector in Japan that are performing neutrino studies; development of next generation neutrino detectors; 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.

Fusion Energy Sciences

LBNL has been conducting research in developing ion beams for applications to high energy density physics 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 (NDCX) and the High Current Experiment (HCX). Both experiments are directed at answering the question of how ion beams can be produced with the intensity required for research in high energy density physics and inertial fusion. LBNL conducts this research together with the Lawrence Livermore National Laboratory and Princeton Plasma Physics Laboratory through the Heavy Ion Fusion Virtual National Laboratory.

Science Laboratories Infrastructure

The SLI program enables Departmental research missions at the laboratory 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 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

Introduction

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 and SciDAC efforts. It also participates in ISIC activities that focus on specific software challenges confronting users of terascale computers.

Biological and Environmental Research

LLNL is one of the major national laboratory partners that comprise the Joint Genome Institute (JGI) whose principal goals are high-throughput DNA sequencing and studies on the biological functions associated with newly sequenced human DNA. 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, and on the use of model organisms to understand and characterize the human genome.

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

The HEP program supports 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, 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 physics in the near term. It also conducts research in the concept of Fast Ignition for applications in high energy density physics and inertial fusion energy. The LLNL program also includes collaborations with General Atomics on the DIII-D tokamak, operation of an innovative concept experiment, the Sustained Spheromak Physics Experiment at LLNL, and benchmarking of fusion physics computer models with experiments such as DIII-D. It 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 magnets and plasma chamber and plasma-material interactions.

Science Laboratories Infrastructure

The SLI program enables the cleanup and removal of excess SC facilities at LLNL.

Los Alamos National Laboratory

Introduction

Los Alamos National Laboratory (LANL) is a multiprogram laboratory located on 27,000 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. A 30 Tesla magnet is also available for use with neutron scattering to study samples in high-magnetic fields. 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 will provide 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 the mathematics and computer science and in advanced computing software tools. It also participates in several scientific application partnerships and participates on a number of the SciDAC teams. LANL participates in ISIC activities that focus on specific software challenges confronting users of terascale computers.

Biological and Environmental Research

LANL is one of the major national laboratory partners that comprise the JGI whose principal goals are 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 provides the site manager for the Tropical Western Pacific ARM site. LANL also has a crucial role in the development, optimization, and validation of coupled atmospheric and oceanic general circulation models using massively parallel computers. LANL also conducts research into advanced medical imaging technologies for studying brain function including optical imaging and magnetoencephology, novel radionuclide dosimetry and therapy, and research into new techniques for rapid characterization and sorting of mixtures of cells and cell fragments. 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 National Science Foundation (NSF)/DOE Environmental Molecular Sciences Institute at the Pennsylvania State University.

High Energy Physics

The HEP program supports physics research and technology R&D at LANL, using unique capabilities of the laboratory primarily in the areas of theoretical studies, engineering, and detector technology.

Nuclear Physics

NP supports a broad program of research including: a program of neutron beam research that utilized beams from LANSCE facility to make fundamental physics measurements (to be completed in FY 2006); the conceptual design and R&D of an experiment to search for the electric dipole moment of the neutron; 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; research at the Sudbury Neutrino Observatory (SNO) and at MiniBooNE directed at studies of the properties of neutrinos including development of the next generation detector; 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.

Fusion Energy Sciences

LANL has developed a substantial experimental system for research in Magnetized Target Fusion, one of the major innovative confinement concepts in magnetic alternates. 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

Introduction

The National Renewable Energy Laboratory (NREL) is a program-dedicated laboratory (Solar) located on 300 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.

Oak Ridge Institute for Science and Education

Introduction

The Oak Ridge Institute for Science and Education, 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 support for education activities.

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 most of the submitted research proposals.

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 (FESAC) 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, the ORO, participating universities, DOE laboratories, and industries.

Science Laboratories Infrastructure

The SLI program enables the cleanup and removal of excess facilities at the facility.

Safeguards and Security

The S&S program 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

Introduction

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 303 buildings (3.5 million gross square feet of space) with an average building age of 35 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), which is under construction and scheduled for commissioning in FY 2006; the High Flux Isotope Reactor (HFIR); and the Center for Nanophase Materials Sciences (CNMS). ORNL has perhaps the most comprehensive materials research program in the country.

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 the best spallation neutron source now 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 began full-power operations in 1966. HFIR 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. Recently, 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. These upgrades include the installation of larger beam tubes and shutters, a high-performance liquid hydrogen cold source, and neutron scattering instrumentation.

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 the mathematics and computer science, as well as research in advanced computing software tools. It also participates in several scientific application partnerships and participates on a number of the SciDAC teams. Integrated Software Infrastructure Center activities are focused on specific software challenges confronting users of terascale 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.

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 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 the environmental remediation sciences research Field Research Center, a field site for developing and testing bioremediation methods for metal and radionuclide contaminants in subsurface environments.

ORNL is one of the major national laboratory partners that comprise the JGI whose principal goals are high-throughput DNA sequencing and studies on the biological functions associated with newly sequenced human DNA. 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," which uses mice as model organisms to understand and characterize the human genome. The laboratory conducts research into new instrumentation for the analytical chemistry of complex environmental contamination using new types of biosensors. The laboratory is developing a new experimental station for biological small angle neutron scattering.

High Energy Physics

The HEP program supports a small research effort using unique capabilities of ORNL primarily in the area of particle beam shielding calculations.

Nuclear Physics

The major effort at ORNL is the research, development, and operations of the 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 at 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 **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 90 scientists for studies in nuclear structure, dynamics, and astrophysics using radioactive beams. The 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. The HRIBF conducts R&D on ion sources and low energy ion transport for radioactive beams. The capabilities of HRIBF are being augmented by the construction of the High Power Test Laboratory (HPTL) which will provide capabilities which will be unique in the world for the development and testing of new ion source techniques.

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 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 National Compact Stellarator Experiment (NCSX) being built at PPPL. ORNL, in partnership with PPPL, shares responsibility for managing the U.S. ITER Project Office, effective July 2004. ORNL has led the fusion materials science program. This program will be reduced significantly in FY 2007.

Science Laboratories Infrastructure

The SLI program enables Departmental research missions at the laboratory by funding line item construction to maintain the general purpose infrastructure, and the cleanup and removal of excess facilities.

Safeguards and Security

The S&S program 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

Introduction

The Oak Ridge Office (ORO) 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 two major management and operating laboratories: PNNL and TJNAF. Oak Ridge also oversees the Oak Ridge Reservation and other DOE facilities in the City of Oak Ridge. Together on the Reservation and in the City of Oak Ridge there are 24 buildings (362,700 square feet) with a total replacement plant value (RPV) of $29.0 million. The RPV of the roads and other structures on the Reservation is $48.2 million. As a result of the recent A-76 competition for financial services, the Oak Ridge Financial Service Center provides payment services for the entire Department of Energy/NNSA, nation-wide. The administrative, business, and technical expertise of Oak Ridge is shared SC-wide through the Integrated Support Center concept. The ORO 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 provides for centralized ORO infrastructure requirements and general operating costs for activities (e.g., roads) on the Oak Ridge Reservation outside plant fences plus DOE facilities in the town of Oak Ridge, PILT, and other needs related to landlord activities.

Safeguards and Security

The S&S program 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

Introduction

The Office of Scientific and Technical Information (OSTI) is located on an 8-acre site in Oak Ridge, Tennessee. The 134,000 square foot OSTI facility houses both Federal and contractor staff; the E-Government infrastructure handling over 15 million downloads and views of DOE's R&D results per year; and over 1.2 million classified and unclassified documents dating from the Manhattan Project to the present. These resources enable OSTI to fulfill its mission to advance science and sustain technological creativity by making R&D findings available and useful to DOE researchers and the American people. OSTI hosts web sites for BER programs and maintains on-line databases.

Safeguards and Security

The S&S program physical security is achieved through a graded protection system including protective forces, security systems, cyber security and program management. The S&S program also incorporates lock and key control, closed circuit television (CCTV), electronic access control and physical access control whereby visitors and employees attain building access via a lobby post where a receptionist is stationed.

Pacific Northwest National Laboratory

Introduction

Pacific Northwest National Laboratory is a multiprogram laboratory located on 132 acres at the Department's Hanford site in Richland, Washington. The laboratory consists of one 8 year old government-owned building (200,000 gross square feet of space). PNNL conducts research in the area of environmental science and technology and carries out related national security, energy, and human health

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 the mathematics and computer science, as well as research in advanced computing software tools. It also participates in several scientific application partnerships, participates on a number of the SciDAC teams, and participates in Integrated Software Infrastructure Center activities that focus on specific software challenges confronting users of terascale computers.

Biological and Environmental Research

PNNL is home to the William R. Wiley **Environmental Molecular Sciences Laboratory (EMSL),** a national scientific user facility. PNNL scientists, including EMSL scientists, play important roles in performing environmental remediation sciences research with representation in most areas within that program. PNNL operates the unique ultrahigh field mass spectrometry and nuclear magnetic resonance spectrometry instruments as well as a wide variety of other cutting edge analytical capabilities at the EMSL for use by the national research community.

PNNL provides expertise in research on aerosol properties and processes and in field campaigns for atmospheric sampling and analysis of aerosols. 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 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 charges. It also conducts research into new instrumentation for microscopic imaging of biological systems and for characterization of complex radioactive contaminants by highly automated instruments.

PNNL is one of the major national laboratory partners that comprise the JGI whose principal goals are high-throughput DNA sequencing and studies on the biological functions associated with newly sequenced human DNA. 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.

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.

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. These programs will be reduced significantly in FY 2007.

Science Laboratories Infrastructure

The SLI program enables Departmental research missions at the laboratory 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

Introduction

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

Introduction

Princeton Plasma Physics Laboratory (PPPL) is a program-dedicated laboratory (Fusion Energy Sciences) located on 88.5 acres in Plainsboro, New Jersey. The laboratory consists of 35 buildings (725,000 gross square feet of space) with an average building age of 30 years. DOE does not own the land.

Advanced Scientific Computing Research

PPPL participates in several SciDAC projects.

High Energy Physics

The HEP program 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 U.S. Department of Energy (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 NSTX, which is an innovative toroidal confinement device, closely related to the tokamak, and has started construction of another innovative toroidal concept, the NCSX, a compact stellarator. 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. and several large tokamak facilities abroad, including JET (Europe), JT-60U (Japan), and KSTAR (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 through the heavy ion beams Fusion Virtual National Laboratory. Effective July 2004, PPPL, in partnership with ORNL, was selected to manage the U.S. ITER Project Office. Through its association with Princeton University, PPPL provides high quality education in fusion-related sciences, having produced more than 185 Ph.D. graduates since its founding in 1951.

Science Laboratories Infrastructure

The SLI program enables Departmental research missions at the laboratory by funding line item construction to maintain the general purpose infrastructure, and the cleanup and removal of excess facilities.

Safeguards and Security

The S&S program 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 PPPL S&S program consists of protective forces, security systems, cyber security, and program management.

Princeton Site Office

Introduction

The Princeton Site Office provides the single federal presence with responsibility for contract performance at the Princeton Plasma Physics Laboratory. 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

Introduction

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/CA is also the site of the Combustion Research Facility (CRF). 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 two BES supported user facilities—the Combustion Research Facility (CRF) and the Center for Integrated Nanotechnologies (CINT).

The **Combustion Research Facility** at SNL/CA is an internationally recognized facility for the study of combustion science and technology. In-house efforts combine theory, modeling, and experiment including diagnostic development, kinetics, and dynamics. Several innovative non-intrusive optical diagnostics such as degenerate four-wave mixing, cavity ring-down spectroscopies, high resolution optical spectroscopy, and ion-imaging techniques have been developed to characterize combustion intermediates. Basic research is often conducted in close collaboration with applied programs. A principal effort in turbulent combustion is coordinated among the chemical physics program, and programs in Fossil Energy and Energy Efficiency and Renewable Energy.

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 will provide 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. It also participates in several scientific application partnerships, participates on a number of the SciDAC teams, and participates in ISIC activities that focus on specific software challenges confronting users of terascale computers.

Biological and Environmental Research

SNL provides the site manager for the North Slope of Alaska ARM site. The chief scientist for the ARM-Unmanned Aerial Vehicles (UAV) program is at SNL, and SNL takes the lead role in coordinating and executing ARM-UAV missions. 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, and fundamental chemistry for the treatment of high-level waste.

To support environmental cleanup, SNL conducts research into novel sensors for analytical chemistry of contaminated environments.

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. It selects, specifies, and develops materials for components exposed to high heat and particles fluxes and conducts extensive analysis of prototypes to qualify components before their use in fusion devices. Materials 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. Tested materials are characterized using Sandia's accelerator facilities for ion beam analysis. 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. A number of these activities will be reduced in FY 2007. Sandia also works with LBNL through the Heavy Ion-Fusion Virtual National Laboratory in developing high-brightness ion source and other science issues of heavy ion beams. 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

Introduction

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 bioimmobilization of heavy metals and radionuclides.

Stanford Linear Accelerator Center

Introduction

The Stanford Linear Accelerator Center (SLAC) is located on 426 acres of Stanford University land in Menlo Park, California, and is also the home of the Stanford Synchrotron Radiation Laboratory (SSRL). The facility is now comprised of 25 experimental stations and is used each year by over 700 researchers from industry, government laboratories, and universities. SLAC (including SSRL) consists of 114 buildings (1.7 million gross square feet of space) with the average age of 29 years. 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 synchrotron radiation research. SLAC operates the 2 mile long Stanford Linear Accelerator which began operating in 1966. The SSRL was built in 1974 to utilize the intense x-ray beams from the Stanford Positron Electron Accelerating Ring (SPEAR) that was built for particle physics by the SLAC laboratory. Over the years, SSRL grew to be one of the main innovators in the production and use of synchrotron radiation with the development of wigglers and undulators that form the basis of all third generation synchrotron sources.

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 researchers from industry, government laboratories, and universities. These include astronomers, biologists, chemical engineers, chemists, electrical engineers, environmental scientists, geologists, materials scientists, and physicists. A research program is conducted at SSRL with emphasis in both the x-ray and ultraviolet regions of the spectrum. SSRL scientists are experts in photoemission studies of high-temperature superconductors and in x-ray scattering. The SPEAR 3 upgrade at SSRL provides major improvements that will increase the brightness of the ring for all experimental stations.

Advanced Scientific Computing Research

SLAC participates on a number of SciDAC teams.

Biological and Environmental Research

SLAC operates nine SSRL beam lines 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 serve the growing environmental science user community.

High Energy Physics

SLAC operates the **B-factory** and its detector, BaBar, and a small program of experiments in accelerator science and technology. The B-factory, a high energy electron-positron collider, was constructed to support a search for and high-precision study of CP symmetry violation in the B meson system. All of these facilities make use of the two-mile long linear accelerator, or linac. The HEP program also supports physics research and technology R&D at SLAC, using unique resources of the laboratory, including engineering and detector technology, advanced accelerator technology, and computational resources.

Science Laboratories Infrastructure

The SLI program enables Departmental research missions at the laboratory by funding line item construction to maintain the general purpose infrastructure, and the cleanup and removal of excess facilities.

Safeguards and Security

The S&S program 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

Introduction

The Stanford Site Office provides the single federal presence with responsibility for contract performance at the Stanford Linear Accelerator Center (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

Introduction

Thomas Jefferson National Accelerator Facility is an Office of Science laboratory (Nuclear Physics) located on 162 acres (DOE-owned) in Newport News, Virginia focused on the exploration of nuclear and nucleon structure. The laboratory consists of 62 buildings with an average building age of 14 years, 2 state leased buildings, 23 real property trailers, and 10 other structures and facilities totaling over 764,000 gross square feet of space. The laboratory was constructed over the period FY 1987–1995.

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

The HEP program 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 a user community of ~1,200 researchers and is used annually by ~800 U.S. and foreign 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, a joint NSF-DOE project in Hall C, will allow 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 as well as for other accelerator projects such as the Spallation Neutron Source.

Science Laboratories Infrastructure

The SLI program enables Departmental research missions at the laboratory by funding line item construction to maintain the general purpose infrastructure, and the cleanup and removal of excess facilities.

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

Introduction

The Thomas Jefferson Site Office provides the single federal presence with responsibility for contract performance at Thomas Jefferson National Accelerator Facility (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 directing, administering, and supporting a broad spectrum of scientific disciplines. These disciplines include the HEP, NP, BES, BER, FES, ASCR, and WDTS programs. In addition, Federal staff are responsible for SC-wide management, operational policy, and technical/administrative support activities in budget and planning; information technology; infrastructure management; construction management; safeguards and security; environment, safety and health; and general administration. Funded expenses include salaries, benefits, travel, general administrative support services and technical expertise, information technology maintenance and enhancements, as well as other costs funded through interdepartmental transfers and interagency transfers.