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 **[**15**]** *four* passenger motor vehicles for replacement only, including not to exceed one ambulance, **[**$3,451,700,000**]** *$3,431,718,000* to remain available until expended. *(Energy and Water Development Appropriations Act, 2004.)*

[SEC. 130. DEPARTMENT OF ENERGY, ENERGY PROGRAMS, SCIENCE. For an additional amount for "Science", $50,000,000, to remain available until expended, is provided for the Coralville, Iowa, project, which is to utilize alternative energy sources.**]**

[SEC. 131. For an additional amount for the "Science" account of the Department of Energy in the Energy and Water Development Appropriations Act, 2004, there is appropriated $250,000, to remain available until expended, for Biological Sciences at DePaul University; $500,000, to remain available until expended; for the Cedars-Sinai Gene Therapy Research Program; and $500,000, to remain available until expended, for the Hartford Hospital Interventional Electrophysiology Project.**]**
(Division H, H.R. 2673 Consolidated Appropriations Bill, FY 2004.)

Explanation of Change

Changes are proposed to reflect the FY 2005 funding and vehicle request. No further funding is proposed for the Coralville, Iowa, project; Biological Sciences and DePaul University; the Cedars-Sinai Gene Therapy Research Program; or the Hartford Hospital Interventional Electrophysiology Project.

Science
Office of Science

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2003 Comparable Appropriation	FY 2004 Original Appropriation	FY 2004 Adjustments	FY 2004 Comparable Appropriation	FY 2005 Request
Science					
Basic Energy Sciences (BES	1,001,941	1,016,575	-5,984[a]	1,010,591	1,063,530
Advanced Scientific Computing Research (ASCR)	163,185	203,490	-1,198[a]	202,292	204,340
Biological & Environmental Research (BER)	494,360	592,000	+49,454[ab]	641,454	501,590
High Energy Physics (HEP)	702,038	737,978	-4,347[a]	733,631	737,380
Nuclear Physics (NP)	370,655	391,930	-2,307[a]	389,623	401,040
Fusion Energy Sciences (FES)	240,695	264,110	-1,555[a]	262,555	264,110
Science Laboratories Infrastructure (SLI)	45,109	54,590	-310[a]	54,280	29,090
Science Program Direction (SCPD)	137,425	147,053	+5,528 [ac]	152,581	155,268
Workforce Development for Teachers and Scientists (WDTS)	5,392	6,470	-38[a]	6,432	7,660
Small Business Innovation Research/ Small Business Technology Transfer	100,172 [d]	0	0	0	0
Safeguards and Security (S&S)	66,877	51,887	+10,441[ae]	62,328	73,315
Subtotal, Science	3,327,849	3,466,083	+49,684	3,515,767	3,437,323
Use of Prior Year Balances	0	-10,000	0	-10,000	0
Less security charge for reimbursable work	-5,605	-4,383	-1,215[f]	-5,598	-5,605
Total, Science	3,322,244	3,451,700	+48,469	3,500,169	3,431,718

[a] Excludes $20,679,205 for a rescission in accordance with the Consolidated Appropriations Act, 2004, as reported in conference report H.Rpt. 108-401, dated November 25, 2003, as follows: BES $-5,984,276; ASCR $-1,197,753; BER $-3,795,588; HEP $-4,346,960; NP $-2,307,254; FES $-1,555,128; SLI $-310,110; SCPD $-864,126; WDTS $-37,736; and S&S $-280,274.

[b] Includes $53,250,000 provided by the Consolidated Appropriations Act, 2004, as reported in conference report H.Rpt. 108-401, dated November 25, 2003.

[c] Includes $6,236,000 for the transfer in FY 2005 of 46 FTEs from the Office of Environmental Management (EM) to the Office of Science (SC) for the establishment of the Pacific Northwest Site Office (PNSO) and $1,100,000 for the transfer in FY 2005 of 10 FTEs from the National Nuclear Security Administration to SC for site office activities previously under Oakland Operations Office. Excludes $944,000 for the transfer in FY 2005 to the Office of Nuclear Energy, Science, and Technology of 7 FTEs associated with uranium management activities at Oak Ridge Operations Office.

[d] Includes $65,695,000 reprogrammed within the SC and $34,477,000 transferred from other DOE programs.

[e] Includes $10,721,000 for the transfer in FY 2005 of the newly established PNSO safeguards and security activities from EM to SC.

[f] Reflects security charges to reimbursable customers associated with the transfer in FY 2005 of the newly established PNSO safeguards and security activities from EM to SC.

Preface

The Office of Science (SC) requests $3,431,718,000 for the Fiscal Year (FY) 2005 Science appropriation, a decrease of $68,451,000 from FY 2004, for investments in basic research that are critical 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. When $140,762,000 for FY 2004 Congressional earmarks are set aside, there is an increase of $72,311,000 in FY 2005.

Within the Science appropriation, the Office of Science has ten programs: Advanced Scientific Computing Research, Basic Energy Sciences, Biological and Environmental Research, Fusion Energy Sciences, High Energy Physics, Nuclear Physics, Safeguards and Security, Science Laboratories Infrastructure, Workforce Development for Teachers and Scientists, and Science Program Direction.

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 also address the 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 program 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 (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 Program Assessment Rating Tool (PART). A unique program goal was developed for each GPRA unit. A numbering scheme has been established for tracking performance and reporting[a].

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).

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[a] The numbering scheme uses the following numbering convention: First 2 digits identify the General Goal (01 through 07); second two digits identify the GPRA Unit; last four digits are reserved for future use.

Mission

The mission of the Office of Science 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

The Office of Science plays five key roles in the U.S. research enterprise: *we support the missions of the Department of Energy*, delivering the scientific knowledge for solutions to our Nation's most critical energy and environmental challenges; *we are the Nation's leading supporter of the physical sciences,* which includes physics, chemistry and materials science; *we are the stewards of world-class scientific tools*, building and operating major research facilities for use by the world's scientific community; *we are the lead Federal agency for the creation of leadership class computational facilities for open science,* enabling solutions to problems in science and industry not attainable by simple extrapolation of existing architectures; and *we support a diverse set of researchers*, including those at more than 280 universities in every state in the Nation, scientists and technicians at the DOE national laboratories and in industry.

The Office of Science has proven its ability to deliver results over the past 50 years. That legacy includes 70 Nobel Laureates since 1954. Our science has spawned entire new industries, including nuclear medicine technologies that save thousands of lives each year, and the nuclear power industry that now contributes 20% of the power to our Nation's electricity grid. The Office of Science has taken the lead on new research challenges for the Nation, such as launching the Human Genome Project in 1986.

Strategic 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 goals:

Energy Strategic Goal: To protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy.

General Goal 4, Energy Security: Enhance energy security by developing technologies that foster a diverse supply of affordable and environmentally sound energy, improving energy efficiency, providing for reliable delivery of energy, exploring advanced technologies that make a fundamental change in our mix of energy options, and guarding against energy emergencies.

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; to 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 Goals 4 and 5 in the “goal cascade”:

Program Goal 04.24.00.00/05.24.00.00: Bring the Power of the Stars to Earth — Answer the key scientific questions and overcome enormous technical challenges to harness the power that fuels a star.

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 elements in the Universe created by stars; to unique isotopes created in the laboratory that exist at the limits of stability, possessing radically different properties from known matter.

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 05.21.00.0: 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 alter the future of medical care and human health.

Contribution to General Goals

The *Fusion Energy Sciences (FES)* program contributes to General Goal 4 through participation in ITER, an experiment to study and demonstrate the sustained burning of fusion fuel. This proposed international collaboration will provide an unparalleled scientific research opportunity and will test the scientific and technical feasibility of fusion power. ITER is the penultimate step before a demonstration fusion power plant.

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

The *Advanced Scientific Computing Research (ASCR)* program contributes to General Goal 5 by significantly advancing scientific simulation and computation, applying new approaches, algorithms, and software and hardware combinations to address the critical science challenges of the future, and by providing access to world-class, scientific computation and networking facilities to the Nation’s scientific community to support advancements in practically every field of science and industry. ASCR will continue to advance the transformation of scientific simulation and computation into the third pillar of scientific discovery enabling scientists to look inside an atom or across a galaxy; inside a chemical reaction that takes a millionth of a billionth of a second; or across a climate change process that lasts for a thousand years. In addition, ASCR will shrink the distance between scientists and the resources — experiments, data and other scientists — they need, and accelerate scientific discovery by making interactions that used to take months happen almost instantaneously. ASCR will strengthen its contribution to Advanced Scientific Computing Research for SC in two main areas that specifically address ASCR's long term goals. First, we will acquire additional advanced computing capability to support existing users in the near term and to initiate longer-term research and development on next generation computer architectures, leading to leadership class machines. This critical investment will support the High End Computing Revitalization Task Force established by the Office of Science and Technology Policy, maintaining the Department's full participation in this interagency effort. Second, we will enhance ASCR's applied mathematics research to enable investigation of mathematics for modeling complex systems that will underpin SC's success in fields ranging from nanoscience to biology to global climate. This will develop the new area of "Atomic to Macroscopic Mathematics," also called *multiscale mathematics.* The new mathematical understanding of multiscale phenomena will engender the development of numerical algorithms and software that enable effective models of systems such as the Earth's climate, the behavior of materials, or the behavior of living cells that involve the interaction of complex processes taking place on vastly different time and/or length scales.

The *Basic Energy Sciences (BES)* program contributes to General Goal 5 by advancing nanoscale 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, 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. The next steps in the characterization and the ultimate control of materials properties and chemical reactivity are to improve spatial resolution of imaging techniques; to enable a wide variety of samples, sample sizes, and sample environments to be used in imaging experiments; and to make measurements on very short time scales, much shorter than the time of a chemical reaction or even the motion of molecule. With these tools, we will be able to understand how the composition of materials affects its properties, to watch proteins fold, to see chemical reactions, and to design for desired outcomes. Theory, modeling, and computer simulations will play a major role in achieving these outcomes and will be a companion to all of the experimental work. BES also supports basic research aimed at advancing hydrogen production, storage, and use for the coming hydrogen economy.

The *Biological and Environmental Research (BER)* program 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 hydrogen; in climate change, by including the development of models to predict climate over decades to centuries; by developing science-based methods for cleaning up environmental contaminants; in radiation biology, by providing regulators with a stronger scientific basis for developing future radiation protection standards; and in the medical sciences, by developing new diagnostic and therapeutic tools, technology for disease diagnosis and treatment, non-invasive medical imaging, and biomedical engineering such as an artificial retina that will restore sight to the blind.

The *Fusion Energy Sciences (FES)* program contributes to General Goal 5 by advancing the theoretical and experimental understanding of plasma and fusion science, including a close collaboration with international partners in identifying and exploring plasma and fusion physics issues through specialized facilities. This includes: 1) exploring basic issues in plasma science; 2) developing the scientific basis and computational tools to predict the behavior of magnetically confined plasmas; 3) using the advances in tokamak research to enable the initiation of the burning plasma physics phase of the Fusion Energy Sciences program; 4) exploring innovative confinement options that offer the potential of more attractive fusion energy sources in the long term; 5) focusing on the scientific issues of nonneutral plasma physics and High Energy Density Physics; 6) developing the cutting edge technologies that enable fusion facilities to achieve their scientific goals; and 7) advancing the science base for innovative materials to establish the economic feasibility and environmental quality of fusion energy.

The *High Energy Physics (HEP)* program contributes to General Goal 5 by advancing understanding of dark energy and dark matter, the lack of symmetry in the current universe, the basic constituents of matter, and the possible existence of other dimensions, collectively revealing key secrets of the universe. HEP expands the energy frontier with particle accelerators to study fundamental interactions at the highest possible energies, which may reveal new particles, new forces or undiscovered dimensions of space and time; explain the origin of mass; and illuminate the pathway to the underlying simplicity of the universe. At the same time, the HEP program sheds new light on other mysteries of the cosmos, uncovering what holds galaxies together and what is pushing the universe apart; understanding why there is any matter in the universe at all; and exposing how the tiniest constituents of the universe may have the largest role in shaping its birth, growth, and ultimate fate.

The *Nuclear Physics (NP)* program 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 that 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. Scientific discoveries at the frontiers of Nuclear Physics further the nation's energy-related research capacity, which in turn provides for the nation's security, economic growth and opportunities, and improved quality of life.

Funding by General Goal

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	$ Change	% Change
General Goal 4, Energy Security					
Program Goal 04.24.00.00, Fusion Energy..........	0	3,000[a]	7,000[b]	+4,000	+133.3%
General Goal 5, World-Class Scientific Research Capacity					
Program Goal 05.19.00.00, High Energy Physics ..	702,038	733,631	737,380	+3,749	+0.5%
Program Goal 05.20.00.00, Nuclear Physics..........	370,655	389,623	401,040	+11,417	+2.9%
Program Goal 05.21.00.00, Biological and Environmental Research..	494,360	641,454	501,590	-139,864	-21.8%
Program Goal 05.22.00.00, Basic Energy Sciences..	1,001,941	1,010,591	1,063,530	+52,939	+5.2%

[a] Reflects $3,000,000 in direct funding for ITER preparations. An additional $5,000,000 for ITER supporting activities is reflected within Goal 5, bringing the total Fusion program resources in preparation for ITER to $8,000,000 in FY 2004.

[b] Reflects $7,000,000 in direct funding for ITER preparations. An additional $31,000,000 for ITER supporting activities is reflected within Goal 5, bringing the total Fusion program resources in preparation for ITER to $38,000,000 in FY 2005.

(dollars in thousands)	FY 2003	FY 2004	FY 2005	$ Change	% Change
Program Goal 05.23.00.00, Advanced Scientific Computing Research	163,185	202,292	204,340	+2,048	+1.0%
Program Goal 05.24.00.00, Fusion Energy	240,695	259,555	257,110	-2,445	-0.9%
Total, General Goal 5, World-Class Scientific Research Capacity	2,972,874	3,237,146	3,164,990	-72,156	-2.2%
All Other					
Science Laboratories Infrastructure	45,109	54,280	29,090	-25,190	-46.4%
Program Direction	137,425	152,581	155,268	+2,687	+1.8%
Workforce Development for Teachers and Scientists	5,392	6,432	7,660	+1,228	+19.1%
SBIR/STTR	100,172	0	0	0	0.0%
Safeguards and Security	61,272	56,730	67,710	+10,980	+19.4%
Total, All Other	349,370	270,023	259,728	-10,295	-3.8%
Subtotal, General Goal 4 and 5, and All Other (Science)	3,322,244	3,510,169	3,431,718	-78,451	-2.2%
Use of Prior-Year Balances	0	-10,000	0	+10,000	+100.0%
Total, General Goal 4 and 5, and All Other (Science)	3,322,244	3,500,169	3,431,718	-68,451	-2.0%

R&D Investment Criteria

The President's Management Agenda identified the need to tie R&D investment to performance and well-defined practical outcomes. One criterion by which the Department's performance is measured involves using a framework in the R&D funding decision process and then referencing the use and outcome of the framework in budget justification material.

The goal is to develop highly analytical justifications for research portfolios in future budgets. This will require the development and application of a uniform cost and benefit evaluation methodology across programs to allow meaningful program comparisons.

The R&D Investment Criteria — *Quality, Relevance,* and *Performance* — help the Office of Science to take a portfolio approach to selecting the investments included in this budget request, in the recently released *Facilities for the Future of Science: a Twenty-Year Outlook*, and in the soon to be released *Office of Science Strategic Plan*. In addition, the business management practices and evaluation activities in the Office of Science remain focused on the principles of the Administration's R&D Investment Criteria. The R&D Program Assessment Rating Tool (PART) measures the degree to which the R&D Investment Criteria are implemented in the Office of Science.

Program Assessment Rating Tool (PART)

In addition to the use of R&D investment criteria, 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 that, when successfully completed, 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 2005 budget request, and the Department will take the necessary steps to continue to improve performance.

In its PART review, OMB assessed six Office of Science programs: Advanced Scientific Computing Research (ASCR), Basic Energy Sciences (BES), Biological and Environmental Research (BER), Fusion Energy Sciences (FES), High Energy Physics (HEP), and Nuclear Physics (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." This is a significant improvement from the FY 2004 PART review, which rated all SC programs as "Results Not Demonstrated" and scores ranged from 53-63%.

The improvements made by SC, based on the FY 2004 PART results and recommendations by OMB include the expanded use of Committees of Visitors (COVs) — outside experts who review a program's portfolio for quality and consistent application of business practices, a complete reworking of the long-term and annual performance measures in partnership with OMB, drafting of a new Office of Science Strategic Plan, developing some program-specific strategic plans with input from Advisory Committees, and improving the documentation of evidence.

OMB has identified other areas in the FY 2005 PART that SC will work to improve, including concerns about the degree of DOE's budget and performance integration and the comprehensiveness of the Department's Annual Performance Report. OMB also found that while the Department's Inspector General contracts with an outside auditor to check internal controls for performance reporting and periodically conducts limited reviews of performance measurement in the Office of Science, it is not clear that these audits check the credibility of performance data reported by DOE contractors. Although OMB is pleased with the SC commitment to COVs, answers to some questions, particularly in the Program Management section of the PART, will remain "No" until after COVs have reported positive reviews. In addition, a few program specific performance issues were raised in the Results section of the PART particularly in regard to the operation of some facilities. The full PARTs are available on the OMB website at http://www.whitehouse.gov/omb/budget/fy2005/pma.html

Significant Program Shifts

The FY 2005 budget request sets the Office of Science on the path toward addressing the challenges that face our Nation in the 21st Century. Our Strategic Plan, to be (published in February 2004), and a 20-Year Science Facilities Plan set an ambitious agenda for scientific discovery over the next decade that reflects national priorities set by the President and the Congress, our commitment to the missions of the Department of Energy, and the views of the U.S. scientific community. Pursuing the following research priorities will be challenging, but they hold enormous promise for the overall well-being of all of our citizens:

- *Fusion:* Develop a predictive understanding of fusion plasmas, including a burning plasma, for an enduring solution to our Nation's energy challenge.
- *Scientific Discovery and Innovation through Advanced Scientific Computing:* Expand the broad frontiers of scientific discovery and innovation through the power of advanced computation.
- *Nanoscale Science for New Materials and Processes:* Master the ability to construct revolutionary new materials and processes…atom-by-atom and build upon nature's self-assembling techniques.
- *Taming the Microbial World — the Next Revolution in Genomics:* Harness microbial genomes and the molecular machines of life for clean energy and a cleaner environment.
- *Dark Energy and the Search for the Genesis:* Illuminate the basic forces of creation and the origins of matter, energy, space and time.
- *Nuclear Matter at the Extremes:* Explore new forms of nuclear matter at high energy densities and at the extreme limits of stability.
- *Facilities for the Future of Science:* Pursue the required scientific tools that support the Nation's research in areas that are traditionally the responsibility of DOE.

The Office of Science is ready to meet the scientific challenges of our age. We have established clear research priorities for the present and for the next decade. We have identified the key research facilities our Nation needs to build to maintain scientific excellence. We have restructured our workforce and our business practices to achieve greater efficiencies and economies of scale that will improve the performance of the 10 national laboratories we manage. This FY 2005 budget request is a major step toward achieving our national goals energy independence, economic security, environmental quality, and intellectual leadership.

The Office of Science is proposing a restructuring and reengineering project, *OneSC*, and anticipates that this effort will result in functional consolidations, process reengineering, and elimination of skills imbalances throughout the organization. Full implementation of this realignment is expected to begin in FY 2004. This project reflects the changes envisioned by the President's Management Agenda (PMA) and directly supports the PMA objective to manage government programs more economically and effectively. The *OneSC* project will determine the best alternatives for obtaining essential services and support for the Office of Science field organizations. In addition, in response to the functional transfer within the Richland Operations Office from the Office of Environmental Management in support of the PNNL, the Office of Science will establish a Pacific Northwest Site Office (PNSO).

The *Advanced Scientific Computing Research* program will support planned research efforts in the Scientific Discovery through Advanced Computing (SciDAC) program — a set of coordinated investments across all Office of Science mission areas with the goal of achieving breakthrough scientific advances via computer simulation that were impossible using theoretical or laboratory studies alone. In addition, the Next Generation Computer Architecture (NGA) effort will enable DOE and the Nation to evaluate the potential increases in delivered computing capability available to address the Office of Science mission through optimization of computer architectures to meet the special requirements of scientific problems. The NGA effort complements SciDAC and integrates advanced computer architecture researchers and engineers, application scientists, computer scientists, and applied mathematicians. The Laboratory Technology Research subprogram was brought to a successful conclusion in FY 2004, with the orderly completion of all existing CRADAs. The FY 2005 budget also includes funding for the new "Atomic to Macroscopic Mathematics" (AMM) research effort to provide the research support in applied mathematics needed to break through the current barriers in our understanding of complex physical processes that occur on a wide range of interacting length- and time-scales.

In the *Basic Energy Sciences* program, Project Engineering and Design (PED) and construction will proceed on four Nanoscale Science Research Centers (NSRCs) and funding will be provided for a Major Item of Equipment for the fifth and final NSRC. NSRCs are user facilities for the synthesis, processing, fabrication, and analysis of materials at the nanoscale. They are designed to enable the nanoscale revolution by collocating multiple research disciplines, multiple techniques, and a wide variety of state-of-the-art instrumentation in a single building. The NSRCs are designed to promote rapid advances in the various areas of nanoscale science and technology. The FY 2005 budget request includes new funding for activities that support the President's Hydrogen Fuel Initiative. This research program is based on the BES workshop report *Basic Research Needs for the Hydrogen Economy,* which highlights the enormous gap between our present capabilities and those required for a competitive hydrogen economy. The FY 2005 budget request also funds long-lead procurement activities for a revolutionary x-ray laser light source—located on the Stanford University campus—that would open entirely new realms of discovery in the chemical, materials, and biological sciences.

The *Biological and Environmental Research* program will support a facility for the Production and Characterization of Proteins and Molecular Tags, a facility that will help move the excitement of the Genomics: GTL program systems biology research to a new level by mass producing and characterizing proteins directly from microbial DNA sequences and creating affinity reagents — or "tags"— to identify, capture, and monitor the proteins from living systems. BER will focus its atmospheric sciences research on key uncertainties that currently limit our ability to accurately simulate and predict the direct and indirect effect of aerosols on climate. Aerosols play a significant but poorly understood role in climate.The Environmental Remediation subprogram will integrate research from a number of other programs (Environmental Management Science Program, Natural and Accelerated Bioremediation Research Program, Environmental Molecular Sciences Laboratory, Savannah River Ecology Laboratory) to perform "comprehensive" field studies. In FY 2005, BER will: (1) greatly increase our understanding of biological systems important to DOE's energy and environmental needs by increasing its rate of DNA sequencing to produce at least 20 billion base pairs of high quality DNA microbial and model organism genome sequence; (2) increase the accuracy (and more accurately depict the complexity) of climate models by including new information on the global cycling of carbon dioxide into and out of the atmosphere, atmospheric aerosols, and interactions between the climate system and the terrestrial biosphere; (3) improve our ability to treat environmental contamination by carrying out complex studies that span field sites, research laboratories, and computational models that can predict the behavior of contaminants in the environment; and (4) complete the testing on an artificial retina with 60 microelectrodes and insert this prototype device into a blind patient.

In the *Fusion Energy Sciences* program, the FY 2005 budget continues the redirection of the fusion program to prepare for participation in the ITER program, while also supporting many of the program priorities recommended by the Fusion Energy Sciences Advisory Committee and supported by the Secretary of Energy Advisory Board and the National Research Council. Assuming a successful outcome of ongoing ITER negotiations, in FY 2005 FES scientists and engineers will be supporting the technical R&D and the preparations to start project construction in FY 2006. Support will continue for the Scientific Discovery through Advanced Computing (SciDAC) program, which is being refocused on the physics of a burning plasma. The Inertial Fusion Energy research program will be redirected toward high energy density physics research based on recommendations of the recently established Interagency Task Force on High Density Physics. Fabrication of the National Compact Stellarator Experiment (NCSX) will also continue with a target of FY 2008 for the initial operation of this innovative new confinement system: the product of advances in physics understanding and computer modeling. In addition, work will be initiated on the Fusion Simulation Project — a joint effort with the Advanced Scientific Computing Research program — to provide an integrated simulation and modeling capability for magnetic fusion energy confinement systems over a 15-year development period.

To fully exploit their unique discovery potential, high priority in the *High Energy Physics* program will be given to the operations, upgrades, and infrastructure for the Tevatron at Fermi National Accelerator Laboratory and B-Factory at Stanford Linear Accelerator Laboratory. These include upgrades to the two accelerators to provide increased luminosity, detector component replacements to accommodate the higher intensities, and additional computational resources to support analysis of the anticipated larger volume of data. Planned accelerator and detector upgrades are scheduled for completion in 2006. Infrastructure spending is increased to improve Tevatron reliability and B-factory performance by installing new and upgraded diagnostic and feedback systems and by replacing outdated technology components. The FY 2005 budget request also supports engineering design activities for a new Major Item of Equipment, the BTeV ("B Physics at the TeVatron") experiment at Fermilab to enable new physics inaccessible to existing B-factories. This project is part of the 20-Year Science Facilities Plan.

In the *Nuclear Physics* program, the FY 2005 budget gives highest priority to exploiting the unique discovery potentials of the facilities at the RHIC and Continuous Electron Beam Accelerator Facility (CEBAF) by increasing operating time by 26% compared with FY 2004. Operations of the MIT/Bates facility will be terminated as planned, following three months of operations in FY 2005 to complete its research program. This facility closure follows the transitioning of operations of the Lawrence Berkeley National Laboratory 88-Inch Cyclotron in FY 2004 from a user facility to a dedicated facility for the testing of electronic circuit components for use in space (using funds from other agencies) and a small in-house research program. These resources have been redirected to better utilize and increase science productivity of the remaining user facilities and provide for new opportunities in the low-energy subprogram. Momentum will be maintained in exploiting the new opportunity presented with intense cold and ultra cold neutron sources at Los Alamos National Laboratory and at the Spallation Neutron Source. Funding for capital equipment will address opportunities identified in the recently completed 2002 Nuclear Science Advisory Committee Long Range Plan. R&D funding is provided for the proposed Rare Isotope Accelerator (RIA) and 12 GeV upgrade of CEBAF at Thomas Jefferson National Accelerator Facility.

Workforce Development for Teachers and Scientists will run Laboratory Science Teacher Professional Development activities at five or more DOE national laboratories with about 30 participating teachers, in response to the national need for science teachers who have strong content knowledge in the classes they teach. A new Faculty Sabbatical activity, proposed in FY 2005, will provide sabbatical opportunities for 12 faculty from minority serving institutions (MSIs). This proposed activity is an extension of the successful Faculty Student Teams (FaST) program where teams of faculty members and two or three undergraduate students, from colleges and universities with limited prior research capabilities, work with mentor scientists at a National Laboratory to complete a research project that is formally documented in a paper or presentation.

The purpose of the *Safeguards and Security* program is to ensure appropriate levels of protection against unauthorized access, theft, diversion, loss of custody or destruction of Department of Energy (DOE) assets and hostile acts that may cause adverse impacts on fundamental science, national security or the health and safety of DOE and contractor employees, the public or the environment. In FY05, increased funding is primarily in cyber security and in the areas of protective forces and security systems for projected maintenance of elevated emergency security conditions (SECON) levels. The increases will enable continued self-assessment activities, full implementation of Integrated Safeguards and Security Management, and adequate support for the Foreign Visits and Assignments program.

Institutional General Plant Projects

Institutional General Plant Projects (IGPPs) are miscellaneous construction projects that are less than $5,000,000 in Total Estimated Cost 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.

IGPP projects at SC sites include the following:

- Building 1506 Renovation at Oak Ridge National Laboratory. This FY 2003 and FY 2004 effort includes structural upgrades to comply with DOE and international codes, greenhouse replacements, laboratory reconfigurations, and HVAC modifications. TEC: $3,000,000.
- East Campus Entry and Parking design and construction at Oak Ridge National Laboratory. This FY 2003 and FY 2004 effort includes construction of a new 25,000 ft^2 parking court for approximately 60 cars and a 20,000 ft^2 terrace area with seating and informal gathering areas. TEC: $2,725,000.
- Central Avenue Extension design and construction at Oak Ridge National Laboratory. The effort, initiated in FY 2002, will extend Central Avenue by approximately 680 feet to the east, from the current intersection at 6th Street, to improve traffic flow at the site. TEC: $1,725,000.

The following displays IGPP funding by site:

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	$ Change	% Change
Oak Ridge National Laboratory	6,000	6,000	3,000	-3,000	-50.0%
Pacific Northwest National Laboratory	0	1,000	3,500	+2,500	+250.0%
Total, IGPP	6,000	7,000	6,500	-500	-7.1%

Office of Science

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	$ Change	% Change
President's Hydrogen Initiative	7,640	7,737	29,183	+21,446	+277.2%
Genomics: GTL	42,081	71,327	79,993	+8,666	+12.1%
Climate Change Science Program	118,060	133,275	134,169	+894	+0.7%
High Performance Computing and Communications	180,628	218,613	225,938	+7,325	+3.4%
Nanoscience Engineering and Technology	133,607	203,352	211,225	+7,873	+3.9%

Science
Office of Science

Funding by Site by Program

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	$ Change	% Change
Chicago Operations Office					
Ames Laboratory					
Basic Energy Sciences	17,970	18,310	16,547	-1,763	-9.6%
Advanced Scientific Computing Research	1,873	1,587	1,538	-49	-3.1%
Biological and Environmental Research	887	305	0	-305	-100.0%
Science Laboratories Infrastructure	0	150	150	0	0.0%
Safeguards and Security	395	409	505	+96	+23.5%
Total, Ames Laboratory	21,125	20,761	18,740	-2,021	-9.7%
Argonne National Laboratory – East					
Basic Energy Sciences	156,193	169,725	171,403	+1,678	+1.0%
Advanced Scientific Computing Research	12,413	11,394	10,682	-712	-6.2%
Fusion Energy Sciences	1,333	920	976	+56	+6.1%
High Energy Physics	9,539	8,926	9,512	+586	+6.6%
Nuclear Physics	20,829	17,720	19,098	+1,378	+7.8%
Biological and Environmental Research	25,048	26,423	24,454	-1,969	-7.5%
Science Laboratories Infrastructure	4,107	5,901	2,120	-3,781	-64.1%
Workforce Development for Teachers and Scientists	1,550	1,307	2,560	+1,253	+95.9%
Safeguards and Security	7,680	7,651	9,784	+2,133	+27.9%
Total, Argonne National Laboratory	238,692	249,967	250,589	+622	+0.2%
Brookhaven National Laboratory					
Basic Energy Sciences	65,782	67,649	80,382	+12,733	+18.8%
Advanced Scientific Computing Research	1,162	761	611	-150	-19.7%
High Energy Physics	36,342	22,022	19,884	-2,138	-9.7%
Nuclear Physics	146,721	147,861	155,892	+8,031	+5.4%
Biological and Environmental Research	18,638	18,531	17,960	-571	-3.1%
Science Laboratories Infrastructure	8,244	6,696	4,758	-1,938	-28.9%
Workforce Development for Teachers and Scientists	517	517	725	+208	+40.2%
Safeguards and Security	10,929	10,756	11,342	+586	+5.4%
Total, Brookhaven National Laboratory	288,335	274,793	291,554	+16,761	+6.1%

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	$ Change	% Change
Fermi National Accelerator Laboratory					
Advanced Scientific Computing Research	226	115	146	+31	+27.0%
High Energy Physics	313,506	300,311	303,629	+3,318	+1.1%
Nuclear Physics	48	0	0	0	0.0%
Science Laboratories Infrastructure	362	233	125	-108	-46.4%
Workforce Development for Teachers and Scientists	50	70	98	+28	+40.0%
Safeguards and Security	2,805	2,837	3,067	+230	+8.1%
Total, Fermi National Accelerator Laboratory	316,997	303,566	307,065	+3,499	+1.2%
Chicago Operations Office					
Basic Energy Sciences	132,240	132,967	117,872	-15,095	-11.4%
Advanced Scientific Computing Research	27,512	20,199	23,902	+3,703	+18.3%
Fusion Energy Sciences	50,484	120,796	123,308	+2,512	+2.1%
High Energy Physics	81,571	115,797	109,613	-6,184	-5.3%
Nuclear Physics	55,659	69,550	66,011	-3,539	-5.1%
Biological and Environmental Research	130,017	111,901	96,167	-15,734	-14.1%
Science Laboratories Infrastructure	1,007	0	1,520	+1,520	+100.0%
Science Program Direction	32,043	37,924	39,517	+1,593	+4.2%
SBIR/STTR	87,495	0	0	0	0.0%
Total, Chicago Operations Office	598,028	609,134	577,910	-31,224	-5.1%
Princeton Plasma Physics Laboratory					
Advanced Scientific Computing Research	455	150	345	+195	+130.0%
Fusion Energy Sciences	62,230	70,454	67,977	-2,477	-3.5%
High Energy Physics	225	225	364	+139	+61.8%
Science Laboratories Infrastructure	545	980	0	-980	-100.0%
Workforce Development for Teachers and Scientists	90	80	110	+30	+37.5%
Safeguards and Security	3,489	1,855	1,945	+90	+4.9%
Total, Princeton Plasma Physics Laboratory	67,034	73,744	70,741	-3,003	-4.1%
Total, Chicago Operations Office	1,542,888	1,531,965	1,516,599	-15,366	-1.0%

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	$ Change	% Change
Idaho Operations Office					
Idaho National Engineering and Environmental Laboratory					
Basic Energy Sciences	1,911	1,045	1,494	+449	+43.0%
Fusion Energy Sciences	2,322	2,048	2,172	+124	+6.1%
Biological and Environmental Research	3,073	3,750	3,495	-255	-6.8%
Workforce Development for Teachers and Scientists	70	90	100	+10	+11.1%
Total, Idaho National Engineering and Environmental Laboratory	7,376	6,933	7,261	+328	+4.7%
Idaho Operations Office					
Biological and Environmental Research	4,805	5,456	1,135	-4,321	-79.2%
Total, Idaho Operations Office	12,181	12,389	8,396	-3,993	-32.2%
Livermore Site Office					
Lawrence Livermore National Laboratory					
Basic Energy Sciences	4,374	4,537	4,676	+139	+3.1%
Advanced Scientific Computing Research	5,965	5,313	3,023	-2,290	-43.1%
Fusion Energy Sciences	14,114	14,266	13,408	-858	-6.0%
High Energy Physics	1,531	650	436	-214	-32.9%
Nuclear Physics	823	690	500	-190	-27.5%
Biological and Environmental Research	22,351	24,426	23,645	-781	-3.2%
Science Laboratories Infrastructure	250	250	300	+50	+20.0%
Total, Lawrence Livermore National Laboratory	49,408	50,132	45,988	-4,144	-8.3%
Los Alamos Site Office					
Los Alamos National Laboratory					
Basic Energy Sciences	29,554	34,192	23,663	-10,529	-30.8%
Advanced Scientific Computing Research	3,990	3,448	3,030	-418	-12.1%
Fusion Energy Sciences	6,661	3,868	3,574	-294	-7.6%
High Energy Physics	964	695	825	+130	+18.7%
Nuclear Physics	9,678	8,963	9,107	+144	+1.6%
Biological and Environmental Research	24,091	21,134	19,600	-1,534	-7.3%
Total, Los Alamos National Laboratory	74,938	72,300	59,799	-12,501	-17.3%

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	$ Change	% Change
NNSA Service Center/Albuquerque					
Golden Field Office					
Workforce Development for Teachers and Scientists	200	265	350	+85	+32.1%
National Renewable Energy Laboratory					
Basic Energy Sciences	5,598	5,705	4,562	-1,143	-20.0%
Advanced Scientific Computing Research	0	150	0	-150	-100.0%
Total, National Renewable Energy Laboratory	5,598	5,855	4,562	-1,293	-22.1%
NNSA Service Center/Albuquerque					
Biological and Environmental Research	850	850	850	0	0.0%
Total, NNSA Service Center/Albuquerque	6,648	6,970	5,762	-1,208	-17.3%
NNSA Service Center/Oakland					
Lawrence Berkeley National Laboratory					
Basic Energy Sciences	96,683	121,083	106,615	-14,468	-11.9%
Advanced Scientific Computing Research	55,348	56,020	54,886	-1,134	-2.0%
Fusion Energy Sciences	6,140	5,909	5,909	0	0.0%
High Energy Physics	43,507	39,339	38,323	-1,016	-2.6%
Nuclear Physics	20,435	16,407	17,955	+1,548	+9.4%
Biological and Environmental Research	66,885	66,946	64,207	-2,739	-4.1%
Science Laboratories Infrastructure	6,961	2,500	6,185	+3,685	+147.4%
Workforce Development for Teachers and Scientists	572	705	783	+78	+11.1%
Science Program Direction	0	0	50	+50	+100.0%
Safeguards and Security	4,649	4,689	5,165	+476	+10.2%
Total, Lawrence Berkeley National Laboratory	301,180	313,598	300,078	-13,520	-4.3%
NNSA Service Center/Oakland					
Basic Energy Sciences	29,487	0	0	0	0.0%
Advanced Scientific Computing Research	2,495	0	0	0	0.0%
Fusion Energy Sciences	69,520	4,644	0	-4,644	-100.0%
High Energy Physics	37,895	0	0	0	0.0%
Nuclear Physics	15,849	0	0	0	0.0%
Biological and Environmental Research	36,048	0	0	0	0.0%
SBIR/STTR	12,677	0	0	0	0.0%
Total, NNSA Service Center/Oakland	203,971	4,644	0	-4,644	-100.0%

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	$ Change	% Change
Stanford Linear Accelerator Center					
Basic Energy Sciences	45,313	43,629	85,218	+41,589	+95.3%
Advanced Scientific Computing Research	613	281	160	-121	-43.1%
High Energy Physics	160,033	168,982	169,175	+193	+0.1%
Biological and Environmental Research	5,450	3,675	3,200	-475	-12.9%
Science Laboratories Infrastructure	13	2,138	7,508	+5,370	+251.2%
Workforce Development for Teachers and Scientists	150	150	150	0	0.0%
Safeguards and Security	2,211	2,207	2,341	+134	+6.1%
Total, Stanford Linear Accelerator Center	213,783	221,062	267,752	+46,690	+21.1%
Total, NNSA Service Center/Oakland	706,257	539,304	567,830	+28,526	+5.3%
Oak Ridge Operations Office					
Oak Ridge Institute For Science and Education					
Basic Energy Sciences	2,130	1,069	872	-197	-18.4%
Advanced Scientific Computing Research	325	250	200	-50	-20.0%
Fusion Energy Sciences	896	1,002	919	-83	-8.3%
High Energy Physics	130	0	130	+130	+100.0%
Nuclear Physics	726	678	669	-9	-1.3%
Biological and Environmental Research	5,848	4,161	3,977	-184	-4.4%
Science Laboratories Infrastructure	0	0	565	+565	+100.0%
Workforce Development for Teachers and Scientists	1,217	1,132	1,340	+208	+18.4%
Science Program Direction	25	0	55	+55	+100.0%
Safeguards and Security	1,250	1,254	1,410	+156	+12.4%
Total, Oak Ridge Institute for Science and Education	12,547	9,546	10,137	+591	+6.2%
Oak Ridge National Laboratory					
Basic Energy Sciences	365,058	277,590	235,239	-42,351	-15.3%
Advanced Scientific Computing Research	34,894	20,677	21,833	+1,156	+5.6%
Fusion Energy Sciences	20,935	20,236	19,868	-368	-1.8%
High Energy Physics	663	200	623	+423	+211.5%
Nuclear Physics	18,188	19,484	20,423	+939	+4.8%
Biological and Environmental Research	46,204	43,360	39,431	-3,929	-9.1%
Science Laboratories Infrastructure	12,839	10,360	780	-9,580	-92.5%
Safeguards and Security	9,433	6,894	8,713	+1,819	+26.4%
Total, Oak Ridge National Laboratory	508,214	398,801	346,910	-51,891	-13.0%

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	$ Change	% Change
Office of Scientific Technical Information					
Advanced Scientific Computing Research	10	10	0	-10	-100.0%
Biological and Environmental Research	22	236	236	0	0.0%
Safeguards and Security	265	60	590	+530	+883.3%
Workforce Development for Teachers and Scientists	75	80	90	+10	+12.5%
Total, Office of Scientific Technical Information	372	386	916	+530	+137.3%
Thomas Jefferson National Accelerator Facility					
Advanced Scientific Computing Research	19	0	0	0	0.0%
High Energy Physics	10	0	0	0	0.0%
Nuclear Physics	80,060	81,601	86,345	+4,744	+5.8%
Biological and Environmental Research	1,080	775	525	-250	-32.3%
Science Laboratories Infrastructure	1,481	9,019	0	-9,019	-100.0%
Workforce Development for Teachers and Scientists	10	261	291	+30	+11.5%
Safeguards and Security	1,132	972	1,174	+202	+20.8%
Total, Thomas Jefferson National Accelerator Facility	83,792	92,628	88,335	-4,293	-4.6%
Oak Ridge Operations Office					
Biological and Environmental Research	464	373	371	-2	-0.5%
Science Laboratories Infrastructure	5,015	5,049	5,079	+30	+0.6%
Science Program Direction	44,116	48,556	50,134	+1,578	+3.2%
Safeguards and Security	11,593	11,688	15,872	+4,184	+35.8%
Total, Oak Ridge Operations Office	61,188	65,666	71,456	+5,790	+8.8%
Total, Oak Ridge Operations Office	666,113	567,027	517,754	-49,273	-8.7%

	(dollars in thousands)				
	FY 2003	FY 2004	FY 2005	$ Change	% Change
Richland Operations Office					
Pacific Northwest National Laboratory					
Basic Energy Sciences	13,115	13,821	11,648	-2,173	-15.7%
Advanced Scientific Computing Research	3,932	2,839	2,826	-13	-0.5%
Fusion Energy Sciences	1,436	1,365	1,384	+19	+1.4%
High Energy Physics	49	0	0	0	0.0%
Nuclear Physics	49	0	0	0	0.0%
Biological and Environmental Research	85,304	86,912	80,287	-6,625	-7.6%
Science Laboratories Infrastructure	0	1,979	0	-1,979	-100.0%
SLI — use of prior year balances	0	-3,950	0	+3,950	+100.0%
Workforce Development for Teachers and Scientists	748	838	931	+93	+11.1%
Science Program Direction	63	0	0	0	0.0%
Safeguards and Security	10,716	10,721	11,070	+349	+3.3%
Total, Pacific Northwest National Laboratory	115,412	114,525	108,146	-6,379	-5.6%
Richland Operations Office					
Workforce Development for Teachers and Scientists	25	0	0	0	0.0%
Total, Richland Operations Office	115,437	114,525	108,146	-6,379	-5.6%
Sandia Site Office					
Sandia National Laboratories					
Basic Energy Sciences	31,047	47,260	54,548	+7,288	+15.4%
Advanced Scientific Computing Research	9,735	9,318	8,572	-746	-8.0%
Fusion Energy Sciences	3,107	2,678	2,812	+134	+5.0%
Biological and Environmental Research	7,447	6,814	6,646	-168	-2.5%
Science Program Direction	163	0	0	0	0.0%
Total, Sandia National Laboratories	51,499	66,070	72,578	+6,508	+9.9%
Savannah River Site					
Westinghouse - Savannah River					
Fusion Energy Sciences	45	45	44	-1	-2.2%
Biological and Environmental Research	653	803	232	-571	-71.1%
Total, Westinghouse – Savannah River	698	848	276	-572	-67.5%
Savannah River Site Office					
Biological and Environmental Research	6,800	7,599	7,776	+177	+2.3%
Total, Savannah River Site	7,498	8,447	8,052	-395	-4.7%

	FY 2003	FY 2004	FY 2005	$ Change	% Change
	(dollars in thousands)				
Headquarters					
Basic Energy Sciences	5,486	72,009	148,791	+76,782	+106.6%
Advanced Scientific Computing Research	2,218	69,780	72,586	+2,806	+4.0%
Fusion Energy Sciences	1,472	14,324	21,759	+7,435	+51.9%
High Energy Physics	16,073	76,484	84,866	+8,382	+11.0%
Nuclear Physics	1,590	26,669	25,040	-1,629	-6.1%
Biological and Environmental Research	2,395	207,024	107,396	-99,628	-48.1%
Workforce Development for Teachers and Scientists	118	937	132	-805	-85.9%
Science Laboratories Infrastructure	4,285	12,975	0	-12,975	-100.0%
Science Program Direction	61,015	66,101	65,512	-589	-0.9%
Safeguards and Security	330	335	337	+2	+0.6%
Total, Headquarters	94,982	546,638	526,419	-20,219	-3.7%
Subtotal, Science	3,327,849	3,515,767	3,437,323	-78,444	-2.2%
Use of Prior Year Balances	0	-10,000	0	+10,000	+100.0%
Less Security Charge for Reimbursable Work	-5,605	-5,598	-5,605	-7	-0.1%
Total, Science	3,322,244	3,500,169	3,431,718	-68,451	-2.0%

Site Description

Ames Laboratory

Introduction

Ames Laboratory is a Multiprogram Laboratory located on 10 acres of land owned by the University of Iowa, in Ames, Iowa. The laboratory consists of 10 buildings (320,000 gross square feet of space) with the average age of the buildings being 39 years.

The laboratory was built on the campus of Iowa State University during World War II to emphasize the purification and science of rare earth materials. Ames conducts fundamental research in the physical, chemical, and mathematical sciences associated with energy generation and storage. Ames 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. It 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 one of the SciDAC teams. Ames also participates in Integrated Software Infrastructure Center activities that focus on specific software challenges confronting users of terascale computers.

Biological and Environmental Research

Ames, conducts research into new biological imaging techniques such as the study of gene expression in real time and fluorescence spectroscopy to study environmental carcinogens.

Safeguards and Security

This program coordinates planning, policy, implementation, and oversight in the areas of security systems, protective forces, personnel security, 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.

Argonne National Laboratory

Introduction

Argonne National Laboratory (ANL) in Argonne, Illinois, is a Multiprogram Laboratory located on 1,700 acres in suburban Chicago. The laboratory consists of 106 buildings (4.6 million gross square feet of space) with the average age of the buildings being 32 years. ANL has a satellite site located in Idaho Falls, Idaho.

Basic Energy Sciences

ANL is home to research activities in broad areas of materials and chemical sciences. It is also the site of three user facilities -- the Advanced Photon Source, the Intense Pulsed Neutron Source, and the Electron Microscopy Center for Materials Research.

The **Advanced Photon Source** (APS) 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** (IPNS) 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** (EMC) 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.

Advanced Scientific Computing Research

ANL conducts basic research in mathematics and computer science, as well as research in advanced computing software tools and collaboratory tools. ANL also participates in several scientific applications and collaboratory pilot projects as well as supporting an advanced computing research testbed and participates on a number of the SciDAC teams. It also focuses on testing and evaluating leading edge research computers and participates in Integrated Software Infrastructure Center activities that focus on specific software challenges confronting users of terascale computers.

Fusion Energy Sciences

Argonne contributes to a variety of enabling R&D program activities. It has a lead role internationally in analytical models and experiments for liquid metal cooling in fusion devices. Studies of coatings for candidate structural alloy materials are conducted in a liquid lithium flow loop. Argonne’s capabilities in the engineering design of fusion energy systems have contributed to the design of components, as well as to analysis supporting the studies of fusion power plant concepts.

High Energy Physics

HEP supports a program of physics research and technology R&D, using unique capabilities of the laboratory in the areas of advanced accelerator and computing techniques.

Nuclear Physics

The major ANL activity is the operation and research program at the ATLAS national user facility. Other activities include a Medium Energy group which carries out a program of research at TJNAF, Fermilab, RHIC and DESY in Germany; R&D directed towards the possible Rare Isotope Accelerator (RIA) facility; a Nuclear Theory group, which carries out 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 (ATLAS)** 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 6% 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 is a world leader in superconducting linear accelerator technology, with particular application to the possible Rare Isotope Accelerator (RIA) facility. The combination of versatile beams and powerful instruments enables the ~230 users annually at ATLAS to conduct research in a broad program in nuclear structure and dynamics, nuclear astrophysics, and fundamental interaction studies.

Biological and Environmental Research

ANL operates a high-throughput national user facility for protein crystallography at the Advanced Photon Source. 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 ARM sites. Research is conducted to understand the molecular control of genes and gene pathways in microbes. In conjunction with ORNL and PNNL and six universities, ANL co-hosts the terrestrial carbon sequestration research consortium, Carbon Sequestration in Terrestrial Ecosystems (CSiTE).

Science Laboratories Infrastructure

The SLI program enables the conduct of 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. The laboratory also provides Payments in Lieu of Taxes (PILT) to local communities around the laboratory.

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, and personnel security. In addition, a protective force is maintained. These activities ensure that the facility, personnel, and assets remain safe from potential threats.

Brookhaven National Laboratory

Introduction

Brookhaven National Laboratory (BNL) is a Multiprogram Laboratory located on 5,200 acres in Upton, New York. The laboratory consists of 371 buildings (4.1 million gross square feet of space) with the average age of the buildings being 34 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 major research efforts in materials and chemical sciences as well as to efforts in geosciences and biosciences. It is also the site of 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, seven 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 has a computing capability for Quantum Chromodynamics (QCD) simulations and participates on one of the SciDAC teams. It also participates in Integrated Software Infrastructure Center activities that focus on specific software challenges confronting users of terascale computers.

High Energy Physics

HEP supports a program of physics research and technology R&D, using unique capabilities of the laboratory, including the Accelerator Test Facility and its capability for precise experimental measurement.

Nuclear Physics

Research activities include use of polarized protons in the Relativistic Heavy Ion Collider (RHIC) to understand the internal "spin" structure of the protons, the Laser Electron Gamma Source (LEGS) group, that uses a unique polarized photon beam to carry out a program of photonuclear spin physics at the National Synchrotron Light Source (NSLS), research primarily in the area of relativistic heavy ion physics, an important role in the research program at the Sudbury Neutrino Observatory (SNO) that is measuring the solar neutrino flux, and the National Nuclear Data Center (NNDC) that is the central U.S. site for national and international nuclear data and compilation efforts.

The Relativistic Heavy Ion Collider (RHIC) Facility, completed in 1999, is a major new and unique international facility used by about 1,100 scientists from 19 countries. RHIC uses the Tandem Van de Graaff, Booster Synchrotron, and Alternating Gradient Synchrotron (AGS) accelerators in combination to inject beams into two rings of superconducting magnets of almost 4 km circumference with 6 intersection regions where the beams collide. It can accelerate and collide a variety of heavy ions, including gold beams, up to an energy of 100 GeV per nucleon. RHIC will search for the predicted "quark-gluon plasma," a form of nuclear matter thought to have existed microseconds after the "Big Bang."

The **Alternating Gradient Synchrotron (AGS)** 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. Operation of the AGS for fixed targets and secondary beams for medium energy physics experiments was terminated in FY 2003; however, the AGS will still be utilized to produce beams for tests of proton radiography for NNSA and 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 as a Work-for-Others project completed in FY 2003. Operational costs for this facility are being provided by NASA.

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 that maintains the U.S. expertise in low- and intermediate-energy nuclear physics by providing evaluated nuclear data for the user community. The NNDC is assisted in carrying out this responsibility by other Nuclear Data program funded scientists at U.S. National Laboratories and universities.

Biological and Environmental Research

BNL operates the beam lines for protein crystallography at the NSLS for use by the national biological research community, research in biological structure determination, and research into new instrumentation for detecting x-rays and neutrons. Research is also conducted on the molecular mechanisms of cell responses to low doses of radiation.

The radiotracer chemistry, radiopharmaceutical technology, and magnetic resonance imaging research and development programs support applications of novel techniques for imaging brain function in normal and diseased states, and to study the biochemical basis of disease.

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, providing special expertise in atmospheric field campaigns and aerosol research. BNL scientists play a leadership role in the development of, and experimentation at, the Free-Air Carbon Dioxide Enhancement (FACE) facility at the Duke Forest used to understand how plants respond to elevated carbon dioxide concentrations in the atmosphere.

Science Laboratories Infrastructure

The SLI program enables the conduct of 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. The laboratory also provides Payments in Lieu of Taxes (PILT) to local communities around the laboratory.

Safeguards and Security

S&S program activities are focused on protective forces, cyber security, physical security, 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.

Chicago Operations Office

Chicago 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, 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--Argonne National Laboratory, Brookhaven National Laboratory, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, Princeton Plasma Physics Laboratory, Stanford Linear Accelerator Center, and Ames Laboratory; and New Brunswick Laboratory, a government-owned and government-operated Federal laboratory. Chicago serves as SC's grant center, administering grants to universities as determined by the DOE-SC Program Offices as well as non-SC offices.

Fermi National Accelerator Laboratory

Introduction

Fermi National Accelerator Laboratory (Fermilab) is a program-dedicated laboratory (High Energy Physics) located on a 6,800-acre site in Batavia, Illinois. The laboratory consists of 337 buildings (2.2 million gross square feet of space) with the average age of the buildings being 38 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, in the world. 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 learn what the universe is made of and how it works.

Advanced Scientific Computing Research

Fermilab conducts research in networking and collaboratories.

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 in 2007. With the shutdown of the LEP machine at CERN in Switzerland 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 is also used to produce antiprotons for the Tevatron and will be used independently of the Tevatron for a 120 GeV fixed target program, including NuMI beamline which starts operation in 2005. The Booster is used to accelerate low-energy protons, and a small part of the beam that is not used for Tevatron collider operations is provided to produce neutrinos for short-baseline oscillation experiments. Fermilab and SLAC are the principal experimental facilities of the DOE High Energy Physics program.

Science Laboratories Infrastructure

The SLI program enables the conduct of 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, 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.

Idaho National Engineering and Environmental Laboratory

Introduction

Idaho National Environmental and Engineering Laboratory (INEEL) 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, operated by Bechtel, B&W Idaho for the U.S. Department of Energy.

Basic Energy Sciences

INEEL supports studies to understand and improve the life expectancy of material systems used in engineering such as welded systems and to develop new diagnostic techniques for engineering systems.

Fusion Energy Sciences

Since 1978, INEEL 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 INEEL focuses on the safety aspects of magnetic fusion concepts for existing and planned domestic experiments and developing further our domestic safety database using existing collaborative arrangements to conduct work on international facilities. In addition, with the shutdown of the Tritium Systems Test Assembly (TSTA) facility at LANL, INEEL will expand their research and facilities capabilities to include tritium science activities. In FY 2003, INEEL will complete a small tritium laboratory (Safety and Tritium Applied Research Facility).

Biological and Environmental Research

Using unique DOE capabilities such as advanced software for controlling neutron beams and calculating dose, INEEL supports research into boron chemistry, radiation dosimetry, analytical chemistry of boron in tissues, and engineering of new computational systems for application of radiation treatment to tumors, including brain tumors. Research is also supported into the analytical chemistry of complex environmental and biological systems using the technique of mass spectrometry.

Lawrence Berkeley National Laboratory

Introduction

Lawrence Berkeley National Laboratory (LBNL) is a Multiprogram Laboratory located in Berkeley, California, on a 200-acre site adjacent to the Berkeley campus of the University of California. The laboratory consists of 107 buildings (1.68 million gross square feet of space) with the average age of the buildings being 34 years. LBNL is dedicated to performing leading-edge research in the biological, physical, materials, chemical, energy, and computer sciences.

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 two BES supported user facilities -- the Advanced Light Source (ALS) and the National Center for Electron Microscopy (NCEM).

The **Advanced Light Source** began operations in October 1993 and now serves over 1,000 users as one of the world's brightest sources of high-quality, reliable vacuum-ultraviolet (VUV) light and long wavelength (soft) x-rays. Soft x-rays and VUV light are used by the researchers at the ALS as high-resolution tools 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.

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.

Advanced Scientific Computing Research

LBNL conducts basic research in the mathematics and computer science, as well as research in advanced computing software tools and collaboratory tools. It participates in several scientific application and collaboratory pilot projects and participates on a number of the SciDAC teams. LBNL manages the Energy Sciences Network (ESnet). ESnet is one of the worlds most effective and progressive science-related computer networks that provides worldwide access and communications to Department of Energy facilities. LBNL is also the site of the National Energy Research Scientific Computing Center (NERSC), which provides a range of high-performance, state-of-the-art computing resources that are a critical element in the success of many SC research programs. LBNL participates in Integrated Software Infrastructure Center activities that focus on specific software challenges confronting users of terascale computers.

Fusion Energy Sciences

The laboratory's current mission is to study and apply the physics of heavy ion beams and to advance related accelerator technologies. LBNL, LLNL, and PPPL work together in advancing the physics of heavy ion drivers through the Heavy Ion Fusion Virtual National Laboratory.

High Energy Physics

LBNL supports a program of physics research and technology R&D, using unique capabilities of the laboratory primarily in the areas of superconducting magnet R&D, world-forefront expertise in laser driven particle acceleration, expertise in design of advanced electronic devices, and design of modern, complex software codes for acquisition and analysis of data from HEP experiments.

Nuclear Physics

The Low Energy (LE) subprogram has supported operations and the research program of the 88-Inch Cyclotron, whose operations are transitioning in FY 2004 to a dedicated in-house facility. Other activities include the development of a next-generation gamma-ray detector system, GRETINA; the development of the STAR detector, and a smaller activity directed towards development of the ALICE detector within the heavy ion program at the Large Hadron Collider at CERN; the implementation and operation of the Sudbury Neutrino Observatory (SNO) detector in Canada and the KamLAND detector in Japan that are performing neutrino studies; a program with emphasis on the theory of relativistic heavy ion physics; activities supporting the National Nuclear Data Center at BNL; and a technical effort in RIA R&D with the development of electron-cyclotron resonance (ECR) ion sources.

Biological and Environmental Research

LBNL is one of the major national laboratory partners that comprise the Joint Genome Institute (JGI) whose principal goals are high-throughput DNA sequencing techniques and studies on the biological functions associated with newly sequenced human DNA. The laboratory 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. LBNL operates beam lines for determination of protein structure at the Advanced Light Source for use by the national and international biological research community, research into new detectors for x-rays, and research into the structure of proteins, including membrane proteins. The nuclear medicine program supports research into novel radiopharmaceuticals for medical research and studies of novel instrumentation for imaging of living systems for medical diagnosis. LBNL also supports the Natural and Accelerated Bioremediation Research (NABIR) program and the geophysical and biophysical research capabilities for NABIR field sites.

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. The carbon cycle field experiment at the ARM Southern Great Plains site is maintained and operated by LBNL.

Science Laboratories Infrastructure

The SLI program enables the conduct of 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 physical protection of personnel and laboratory facilities. This is accomplished with protective forces, security systems, cyber security, 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 positron materials science, superplasticity in alloys, adhesion and bonding at interfaces, and kinetics of phase transformations in welds; and 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 Advanced Scientific Computing research and SciDAC efforts. It also participates in Integrated Software Infrastructure Center activities that focus on specific software challenges confronting users of terascale computers.

Fusion Energy Sciences

LLNL works with LBNL on the physics of heavy ion beam. 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 (SSPX) 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. LLNL, LBNL, and PPPL work together in advancing the physics of heavy ion drivers through the Heavy Ion Fusion Virtual National Laboratory.

High Energy Physics

LLNL supports a program of physics research and technology R&D at LLNL, using unique capabilities of the laboratory primarily in the areas of experimental research and advanced accelerator R&D.

Nuclear Physics

The LLNL program supports research in nuclear structure studies, in relativistic heavy ion experiments as part of the PHENIX collaboration, for nuclear data and compilation activities, and for a technical effort involved in RIA R&D.

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. 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 understand and improve climate models. Virtually every climate modeling center in the world participates in this unique program.

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 major research efforts in materials sciences with other efforts in chemical sciences, geosciences, and engineering. It is also the site of the Manuel Lujan Jr., Neutron Scattering Center at the Los Alamos Neutron Science Center (LANSCE). 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.

The **Los Alamos Neutron Science Center** provides an intense pulsed source of neutrons for both national security research and civilian research. LANSCE is comprised of a high-power 800-MeV proton linear accelerator, a proton storage ring, production targets to the Manuel Lujan Jr. Neutron Scattering Center and the Weapons Neutron Research facility, and a variety of associated experiment areas and spectrometers. 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 new 30 Tesla magnet is available for use with neutron scattering to study samples in high-magnetic fields.

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 and collaboratory pilot projects and participates on a number of the SciDAC teams. LANL participates in Integrated Software Infrastructure Center activities that focus on specific software challenges confronting users of terascale computers.

Fusion Energy Sciences

LANL supports the creation of computer codes for modeling the stability of plasmas, as well as work in diagnostics, innovative fusion plasma confinement concepts such as Magnetized Target Fusion, and the removal of the remainder of the recoverable tritium from and completion of the stabilization of the Tritium Systems Test Assembly facility prior to turning the facility over to the Office of Environmental Management for Decontamination and Decommissioning at the end of FY 2003.

High Energy Physics

HEP supports a program of physics research and technology R&D at LANL, using unique capabilities of the laboratory primarily in the area of theoretical studies, experimental research, and development of computational techniques for accelerator design.

Nuclear Physics

NP supports a broad program of research including: a program of neutron beam research that utilizes beams from the LANSCE facility to make fundamental physics measurements, such as the development of an experiment to search for the electric dipole moment of the neutron; a relativistic heavy ion effort using the PHENIX detector at the Relativistic Heavy Ion Collider (RHIC); research directed at the study of the quark substructure of the nucleon in experiments at Fermilab, and at the "spin" structure of nucleons at RHIC using polarized proton beams; the development of the Sudbury Neutrino Observatory (SNO) and MiniBooNE research programs measuring neutrino; a broad program of theoretical research; nuclear data and compilation activities as part of the national nuclear data program; and a technical effort involved in RIA R&D.

Biological and Environmental Research

LANL 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. 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 Los Alamos Neutron Science Center for use by the national biological research community and research into new techniques for determination of the structure of proteins.

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 and research into new techniques for rapid characterization and sorting of mixtures of cells and cell fragments.

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, for example 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 (ORISE), operated by Oak Ridge Associated Universities (ORAU), is located on a 150-acre site in Oak Ridge, Tennessee. Established in 1946, ORAU is a consortium of 88 colleges and universities. The institute undertakes national and international programs in education, training, health, and the environment. ORISE is an academic and training facility providing specialized scientific and safety training to DOE and other institutions. ORISE is an international leader in radiation-related emergency response and epidemiological studies.

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 Oak Ridge National Laboratory. 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.

Fusion Energy Sciences

ORISE supports the operation of the Fusion Energy Sciences Advisory Committee and administrative aspects of some FES program peer reviews. It also acts as an independent and unbiased agent to administer the FES Graduate and Postgraduate Fellowship programs, in conjunction with FES, the Oak Ridge Operations Office, participating universities, DOE laboratories, and industries.

High Energy Physics

ORISE provides HEP support in the area of program planning and review.

Nuclear Physics

ORISE supports the Holifield Radioactive Ion Beam Facility (HRIBF) and its research program.

Biological and Environmental Research

ORISE coordinates research fellowship programs. It also coordinates activities associated with the peer review of most of the submitted research proposals. ORISE also conducts research into modeling radiation dosages for novel clinical diagnostic and therapeutic procedures.

Science Program Direction

ORISE facilitates and coordinates communication and outreach activities, and conducts studies on workforce trends in the sciences.

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, personnel security, protective forces, security systems, and cyber security.

Oak Ridge National Laboratory

Introduction

Oak Ridge National Laboratory (ORNL) is a Multiprogram Laboratory located on 24,000 acres in Oak Ridge, Tennessee. The laboratory's 1,100 acre main site on Bethel Valley Road contains 335 buildings (3 million gross square feet of space) with the average age of the buildings being 33 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 clear, abundant energy; restore and protect the environment; and contribute to national security.

Basic Energy Sciences

ORNL is home to major research efforts in materials and chemical sciences with additional programs in engineering and geosciences. It is the site of the High Flux Isotope Reactor (HFIR) and the Radiochemical Engineering Development Center (REDC). ORNL also is the site of the Spallation Neutron Source (SNS), which is under construction and scheduled for commissioning in FY 2006. ORNL has perhaps the most comprehensive materials research program in the country.

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 **Radiochemical Engineering Development Center**, located adjacent to HFIR, provides unique capabilities for the processing, separation, and purification of transplutonium elements.

Advanced Scientific Computing Research

ORNL conducts basic research in the mathematics and computer science, as well as research in advanced computing software tools and collaboratory tools. It also participates in several scientific application and collaboratory pilot projects and participates on a number of the SciDAC teams. Advanced Computing Research Testbeds (ACRTs) are focused on the evaluation of leading edge research computers. Integrated Software Infrastructure Center activities are focused on specific software challenges confronting users of terascale computers.

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. Computer codes developed at the laboratory are also used to model plasma processing in industry. While some ORNL scientists are located full-time at off-site locations, others carry out their collaborations with short visits to the host institutions, followed by extensive computer communications from ORNL for data analysis and interpretation, and theoretical studies. ORNL is also a leader in stellarator theory and design and is a major partner with PPPL on the NCSX. It leads the advanced fusion structural materials science program, contributes to research on all materials systems of fusion interest, coordinates experimental collaborations for two U.S.-Japan programs, and coordinates fusion materials activities.

High Energy Physics

A small research effort using unique capabilities of ORNL primarily in the area of particle beam shielding calculations is supported. Through the Scientific Discovery through Advanced Computing (SciDAC) program, ORNL will support an effort to model the physics processes that drive supernova explosions.

Nuclear Physics

The major effort at ORNL is the research and operations of the Holifield Radioactive Ion Beam Facility (HRIBF) that is operated as a national user facility. Also supported are a relativistic heavy ion group that is involved in a research program using the PHENIX detector at RHIC; the development of the fundamental newtron physics beam line at the Spallation Newtron Source; 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 RIA R&D.

The **Holifield Radioactive Ion Beam Facility (HRIBF)** 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..

Biological and Environmental Research

ORNL has a leadership role in research focused on the ecological aspects of global environmental change. The Throughput Displacement Experiment at the Walker Branch Watershed is a unique resource for long term ecological experiments. ORNL is the home of the newest FACE experiment. It also houses the ARM archive, providing data to ARM scientists and to the general scientific community. ORNL scientists provide improvement in formulations and numerical methods necessary to improve climate models. ORNL scientists make important contributions to the NABIR program, providing special leadership in microbiology applied in the field. ORNL also manages the NABIR Field Research Center, a field site for developing and testing bioremediation methods for metal and radionuclide contaminants in subsurface environments. ORNL, in conjunction with ANL and PNNL and six universities, co-hosts a terrestrial carbon sequestration research consortium, CSiTE.

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. 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. ORNL conducts research into the application of radioactively labeled monoclonal antibodies in medical diagnosis and therapy, particularly of cancer, as well as research into new instrumentation for the analytical chemistry of complex environmental contamination using new types of biosensors.

Science Laboratories Infrastructure

The SLI program enables the conduct of 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. The program also supports SC landlord responsibilities for the 36,000 acre Oak Ridge Reservation, and for Federal facilities in the city of Oak Ridge. The laboratory also provides Payments in Lieu of Taxes (PILT) to local communities around the laboratory.

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 Safeguards and Security programs.

Oak Ridge Operations Office

Introduction

Oak Ridge supports almost every major Departmental mission in science, defense, energy resources, and environmental quality. Oak Ridge provides world-class scientific research capacity while advancing scientific knowledge through such major Departmental initiatives as the Spallation Neutron Source, the Supercomputing program, and in Nanoscience research. Research is conducted at facilities at the Oak Ridge National Laboratory and Thomas Jefferson National Accelerator Facility. In the defense mission area, programs include those which protect our 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 for the implementation of domestic and international policy aimed at reducing threats, both internal and external, to the U.S. from weapons of mass destruction. Oak Ridge also supports various Energy Efficiency and Renewable Energy programs and facilitates the R&D on energy efficiency and renewable energy technologies. All of the missions under Oak Ridge management are supported through centralized administrative and specialized technical personnel in the financial, legal, procurement, personnel, security, and various other support organizations.

Science Laboratories Infrastructure

The Oak Ridge Landlord subprogram provides for centralized Oak Ridge Operations Office (ORO) infrastructure requirements and general operating costs for activities on the Oak Ridge Reservation

(ORR) outside plant fences and activities to maintain a viable operations office, including maintenance of roads and grounds, 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 Oak Ridge National Laboratory. This includes protection of a category 1 Special Nuclear Material Facility, Building 3019. Other small activities include security systems, information security, and personnel security.

Office of Scientific and Technical Information

The Office of Scientific and Technical Information (OSTI) is located on an 8-acre site in Oak Ridge, Tennessee. The 133,000 square foot OSTI facility houses both Federal and contractor staff and over 1.2 million classified and unclassified documents dating from the Manhattan Project to the present. The large collection represents a critical component of the OSTI mission to collect, preserve, disseminate, and leverage the scientific and technical information resources of DOE to expand the knowledge base of science and technology and facilitate scientific discovery and application.

Pacific Northwest National Laboratory

Introduction

Pacific Northwest National Laboratory (PNNL) is a Multiprogram Laboratory located on 640 acres at the Department's Hanford site in Richland, Washington. The laboratory consists of 40 government-owned buildings (900,000 gross square feet of space) with the average age of the buildings being 33 years. PNNL conducts research in the area of environmental science and technology and carries out related national security, energy, and human health programs.

Basic Energy Sciences

PNNL supports research in interfacial chemistry of water-oxide systems, near-field optical microscopy of single molecules on surfaces, inorganic molecular clusters, and direct photon and/or electron excitation of surfaces and surface species. Programs in analytical chemistry and in applications of theoretical chemistry to understanding surface catalysis are also supported. Geosciences research includes theoretical and experimental studies to improve our understanding of phase change phenomena in microchannels. Also supported is research on molecularly tailored nanostructured materials, 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 and collaboratory tools. It also participates in several scientific application pilot projects, 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.

Fusion Energy Sciences

PNNL is focused on research on materials that can survive in a fusion neutron environment. The available facilities used for this research include mechanical testing and analytical equipment, including state-of-the-art electron microscopes, that are either located in radiation shielded hot cells or have been adapted for use in evaluation of radioactive materials after exposure in fission test reactors. 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 ferritic steels as part of the U.S. fusion materials team. It also plays a leadership role in a fusion materials collaboration with Japan, with Japanese owned test and analytical equipment located in PNNL facilities and used by both PNNL staff and up to ten Japanese visiting scientists per year.

Biological and Environmental Research

PNNL is home to the William R. Wiley **Environmental Molecular Sciences Laboratory** (EMSL). PNNL scientists, including EMSL scientists, play important roles in performing research for NABIR. PNNL operates the unique ultrahigh field mass spectrometry and nuclear magnetic resonance spectrometry instruments at the EMSL for use by the national research community.

PNNL provides the lead scientist for the Environmental Meteorology Program, the G-1 research aircraft, and expertise in field campaigns for atmospheric sampling and analysis. The ARM program office is located at PNNL, as is the ARM chief scientist and the project manager for the ARM engineering activity; this provides invaluable logistical, technical, and scientific expertise for the program. 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 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, in conjunction with ANL and ORNL and six universities, co-hosts a terrestrial carbon sequestration research consortium: CSiTE. PNNL also conducts research on the integrated assessment of global climate change.

Science Laboratories Infrastructure

The SLI program enables the conduct of 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.

Science Program Direction

PNNL conducts assessments of trends in R&D and the development of science management tools, for R&D portfolio and outcome analyses; and provides expert assistance in state-of-the-art science communications. As part of the organizational restructuring of PNNL from an Environmental Management Site to an SC Site, a Pacific Northwest Site Office is being established.

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.

Princeton Plasma Physics Laboratory

Introduction

Princeton Plasma Physics Laboratory (PPPL) is a program-dedicated laboratory (Fusion Energy Sciences) located on 72 acres in Princeton, New Jersey. The laboratory consists of 35 buildings (700,000 gross square feet of space) with the average age of the buildings being 28 years.

Advanced Scientific Computing Research

PNNL participates in a collaboratory pilot project and several SciDAC projects.

Fusion Energy Sciences

PPPL is the only U.S. Department of Energy (DOE) laboratory devoted primarily to plasma and fusion science. It 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. It 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 in the U.S. and the large JET (Europe) and JT-60U (Japan) tokamaks abroad. 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. It 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, through its association with Princeton University, provides high quality education in fusion-related sciences, having produced more than 175 Ph.D. graduates since it's founding in 1951. PPPL, LBNL, and LLNL currently work together in advancing the physics of heavy ion drivers through the heavy ion beams Fusion Virtual National Laboratory.

High Energy Physics

PPPL supports a small theoretical research effort using unique capabilities in the area of advanced accelerator R&D.

Science Laboratories Infrastructure

The SLI program enables the conduct of 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.

Richland Operations Office

Richland is responsible for and manages all environmental cleanup and science and technology development at the 560 square mile Hanford Site, coordinating closely with contractor companies hired to manage and complete the work of the world's largest cleanup project.

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.

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.

Advanced Scientific Computing Research

SNL conducts basic research in mathematics and computer science, as well as research in advanced computing software tools and collaboratory tools. It also participates in several scientific application and collaboratory pilot projects, 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.

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. 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.

Biological and Environmental Research

SNL provides the site manager for the North Slope of Alaska ARM site. The chief scientist for the ARM-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, and computational modeling of biological systems.

To support environmental cleanup, SNL conducts research into novel sensors for analytical chemistry of contaminated environments. It also conducts computational and biological research in support of the GTL research program.

Science Program Direction

SNL carries out research in areas of technical program planning and merit review practices. This activity includes assessments of best practices in R&D organizations.

Savannah River Site

Introduction

The Savannah River Site complex covers 198,344 acres, or 310 square miles encompassing parts of Aiken, Barnwell and Allendale counties in South Carolina bordering the Savannah River.

Biological and Environmental Research

The Savannah River Site supports the Savannah River Ecology Laboratory (SREL), a research unit of the University of Georgia operating at the site for over forty years. The SREL conducts research aimed at reducing the cost of environmental cleanup and remediation while ensuring biodiversity to the restored environment. It supports the SREL through a cooperative agreement with the University of Georgia.

Stanford Linear Accelerator Center

Introduction

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 166 buildings (1.8 million gross square feet of space) with the average age of 27 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, the 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** (SSRL) and peer-reviewed research projects associated with SSRL. Over the years, the 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. 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.

High Energy Physics

SLAC operates the B-factory and its detector, BaBar, and a small program of fixed target experiments. 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. SLAC and Fermilab are the principal experimental facilities of the HEP program.

Biological and Environmental Research

SLAC operates nine SSRL beam lines for structural 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.

Science Laboratories Infrastructure

The SLI program enables the conduct of 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 and cyber security program elements.

Thomas Jefferson National Accelerator Facility (TJNAF)

Introduction

Thomas Jefferson National Accelerator Facility (TJNAF) is a laboratory operated by the Nuclear Physics program located on 162 acres in Newport News, Virginia. The laboratory consists of 65 buildings (500,000 gross sq. ft. of space) with the average age of the buildings being 12 years. Constructed over the period FY 1987-1995 at a cost of $513,000,000, TJNAF began operations in FY 1995.

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 that has a user community of ~1200 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, to measure the weak charge of the proton, is being developed by a collaboration of laboratory and university groups in partnership with the National Science Foundation.

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.

Science Laboratories Infrastructure

The SLI program enables the conduct of 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 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, and security systems.

Washington Headquarters

The Office of Science 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 High Energy Physics, Nuclear Physics, Basic Energy Sciences, Biological and Environmental Research, Fusion Energy Sciences and Advanced Scientific Computing Research. In addition, Federal staff responsible for management, policy, personnel, and technical/administrative support activities in budget, finance, grants, contracts, information technology, construction management, safeguards, security, environment, safety, 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.

All Other Sites

The Office of Science funds 272 colleges/universities located in all 50 states and Puerto Rico.

Basic Energy Sciences

The BES program funds research at 168 colleges/universities located in 48 states.

Advanced Scientific Computing Research

The ASCR program funds research at 71 colleges/universities located in 24 states supporting approximately 126 principal investigators.

Fusion Energy Sciences

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

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 NP program funds 185 research grants at 85 colleges/universities located in 35 states. Among these is a cooperative agreement with the Massachusetts Institute of Technology (MIT) for the operation of the Bates Linear Accelerator Center as a national user facility used by about 110 scientists; the Triangle Universities Nuclear Laboratory (TUNL); Texas A&M (TAMU) Cyclotron; the Yale Tandem Van de Graaff; and the University of Washington Tandem Van de Graaff. 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, the premier international center for new initiatives and collaborations in nuclear theory research.

Biological and Environmental Research

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