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).

[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 ft² parking court for approximately 60 cars and a 20,000 ft² 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%