Office of Science 5-Year Budget Plan

FY 2007–FY 2011

Overview:

"The Office of Science plays a critical role in ensuring America's scientific leadership and economic dynamism" [Opening Statement, Energy Secretary Samuel Bodman, House Committee on Science Hearing, February 15, 2006.]

The mission of the Science program 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.

The Science program funds energy related basic research in the following areas: fundamental research in energy, matter, and the basic forces of nature; health and environmental consequences of energy production and development; fundamental science that supports the foundations for new energy technologies and environmental mitigation; a science base for fusion as a potential future energy source; and advanced computational and networking tools critical to research. Office of Science (SC) participates in research on the President's initiatives in hydrogen, fusion energy, nanoscale science, information technology, and climate change science and technology.

In support of its mission, the Science program has responsibilities in three main areas: selection and management of research; operation of world-class, state-of-the-art scientific facilities; and design and construction of new facilities.

"Investment in these facilities is much more than bricks and mortar: it is an investment in discovery, and in the future of our nation." *Ibid*

American Competitiveness Initiative

In the President's State of the Union Address on January 31, 2006, President Bush stated,

> *We must continue to lead the world in human talent and creativity. Our greatest advantage in the world has always been our educated, hardworking, ambitious people—and we're going to keep that edge. Tonight I announce an American Competitiveness Initiative, to encourage innovation throughout our economy, and to give our nation's children a firm grounding in math and science.*
>
> *I propose to double the federal commitment to the most critical basic research program in the physical sciences over the next ten years. This funding will support the work of America's most creative minds as they explore promising areas such as nanotechnology, supercomputing, and alternative energy sources.*

"This reflects the President's commitment to double the federal investment in the most critical basic research programs in the physical sciences over the next ten years. Developing revolutionary, science-driven technology is at the heart of the Department of Energy's mission. And to ensure that America remains at the forefront in an increasingly competitive world, our Department is pursuing transformational new technologies in the cutting-edge scientific fields of the 21st century—areas like nanotechnology, material science, biotechnology, and high-speed computing." Secretary Bodman, *Ibid*

The American Competitiveness Initiative recognizes that scientific discovery and understanding drive economic strength and security. Federal investment in research and development has proved critical to keeping America's economy strong by generating knowledge and tools upon which new technologies are developed. To ensure our continued leadership in the world, we are building on our record of results with new investments in the fields of physical sciences—advances in these areas will generate scientific and technological discoveries for decades to come. The FY 2007 Budget includes a $505 million increase for SC as part of the President's commitment to double, over 10 years, the sum of the research investment at SC, the National Science Foundation, and the Department of Commerce's National Institute of Standards and Technology. Although future individual agency allocations within the Initiative have yet to be determined, the funding profile for this five-year plan reflects a default assumption that the SC budget would double in size by FY 2016. Since the Administration determines the details of its appropriations request one year at a time, the budget allocations shown in the tables that follow represent placeholders, pending decisions in the future years.

Five Year Plan—Funding Summary

B/A (dollars in thousands)

	FY 2006 Approp.	FY 2007 Request	FY 2008	FY 2009	FY 2010	FY 2011
Basic Energy Sciences	1,134,557	1,420,980	1,469,000	1,576,000	1,678,000	1,826,000
Advanced Scientific Computing Research	234,684	318,654	350,000	370,000	385,000	405,000
Biological and Environmental Research	579,831	510,263	526,000	551,000	609,000	638,000
High Energy Physics	716,694	775,099	785,000	810,000	890,000	975,000
Nuclear Physics	367,034	454,060	470,000	505,000	563,000	592,000
Fusion Energy Sciences	287,644	318,950	427,000	494,000	501,000	484,000
Other	275,947	303,704	339,000	341,000	321,000	345,000
Total, Office of Science	3,596,391	4,101,710	4,366,000	4,647,000	4,947,000	5,265,000

Office of Science 5-Year Budget Plan

FY 2007–FY 2011

Basic Energy Sciences (BES)

	B/A (dollars in thousands)					
	FY 2006 Approp.	FY 2007 Request	FY 2008	FY 2009	FY 2010	FY 2011
User Facility Operations	450,926	651,690	699,222	768,765	803,329	853,612
Construction	176,292	148,269	108,822	124,000	140,000	175,000
Research	507,339	621,021	660,956	683,235	734,671	797,388
Total, BES	1,134,557	1,420,980	1,469,000	1,576,000	1,678,000	1,826,000

Priorities:

User Facility Operations

- The Spallation Neutron Source (SNS) begins initial operations in FY 2006. When it reaches full power operations in FY 2008, the SNS will be significantly more powerful (by about a factor of 10) than the best spallation neutron source now in existence—ISIS at the Rutherford Laboratory in England. It is estimated that SNS will be used by 1,000–2,000 scientists and engineers annually for research in broad classes of experiments that cannot be done with today's low flux sources.
- Planned funding for other BES user facilities (four light sources, five Nanoscale Science Research Centers (NSRCs) in FY 2008 and beyond, the High Flux Isotope Reactor, and the Combustion Research Facility) is at optimal levels of operations in FY 2007 through FY 2011.
- BES began partial funding of the Stanford Linear Accelerator Center (SLAC) linac in FY 2006 for the Linac Coherent Light Source (LCLS) project. Transition of SLAC linac operations from the High Energy Physics program to BES will occur incrementally until BES supports all SLAC linac operations in FY 2009.

Construction

- A critical component of SC's contribution to the National Nanotechnology Initiative is the construction and operation of NSRCs. Four centers are finished by FY 2007. NSRCs are user facilities for the synthesis, processing, fabrication, and analysis of materials at the nanoscale, and the fifth center will be complete in FY 2008. They are designed to contribute to the nanoscale revolution by collocating multiple research disciplines, multiple techniques, and a wide variety of state-of-the-art instrumentation.
- The LCLS project will provide laser-like radiation in the x-ray region of the spectrum that is 10 billion times greater in peak power and peak brightness than any existing coherent x-ray light source, with pulse lengths of femtoseconds—the timescale of atomic motion. Beginning in FY 2006, SC supports construction of the LCLS, including the necessary SLAC infrastructure, with operations planned to begin in FY 2009.
- The National Synchrotron Light Source II (NSLS-II), a planned replacement of the current NSLS at the Brookhaven National Laboratory, would be the most highly optimized storage ring synchrotron in the world. Formal design begins in FY 2007. Construction starts in FY 2009 and continues

through the rest of the 5-year period with initial operations tentatively slated for 2014. Due to improved brightness, flux, and stability, the NSLS-II will deliver an order of magnitude improvement in spatial resolution over any other facility worldwide—whether currently operating, in construction, or in design—enabling the study of materials with 1 nanometer spatial resolution and with 0.1 millielectron volt energy resolution. These beam parameters will provide the world's finest capabilities for x-ray imaging, and, for the first time, it will be possible to do direct x-ray imaging of materials at the nanometer scale.

- Design of a User Support Building for the Advanced Light Source (ALS) begins in FY 2007 to accommodate the very rapid growth in the number of ALS users and to accommodate projected future expansion, with construction completed in FY 2009.
- An additional instrument fabrication project for the SNS would complete nineteen of the full suite of twenty-four beam lines for the target station at the SNS.
- An additional instrument fabrication project for the LCLS would address all of the science thrust areas in the LCLS First Experiments report except for high-energy-density physics.

Research

- New research thrusts initiated in FY 2007 are continued through the planning window to further DOE mission needs in the following six new areas: effective solar energy utilization; advanced nuclear energy systems; ultrafast science; chemical imaging; complex systems or emergent behavior; and mid-scale instrumentation.
- There are significant increases in BES nanoscale science and engineering research activities in support of the National Nanotechnology Initiative (NNI). In addition to the operations of the Nanoscale Science Research Centers, funding for research at the nanoscale increases very significantly owing to new funding for activities related to the hydrogen economy, solar energy conversion, advanced nuclear energy systems, fundamental studies of materials at the nanoscale, and instrumentation for characterizing materials at the nanoscale. BES NNI funding increases 66% by FY 2011 over the FY 2006 level.
- The basic research component of the Hydrogen Fuel Initiative (HFI) continues to increase throughout the SC planning horizon. BES HFI funding increases 115% by FY 2011 over the FY 2006 level. The basic research efforts continue to target critical scientific and technical hurdles in hydrogen production, storage, and distribution aimed at the long-term viability of a future hydrogen economy.
- All BES research programs are maintained at an approximately constant effort with the FY 2007 level.

Reallocations to support SC priorities:

User Facility Operations

- In FY 2007, support for continued operations of the Intense Pulsed Neutron Source and the Manuel Lujan Jr. Neutron Scattering Center will be evaluated following the commissioning and first year of operation of the Spallation Neutron Source. It is anticipated that one or both of the smaller facilities will be phased out during the five-year planning period.

Basic Energy Sciences

Performance Targets

FY 2007 Targets	FY 2008 Targets	FY 2009 Targets	FY 2010 Targets	FY 2011 Targets
Program Goal 5.22.00.00 Advance the Basic Science for Energy Independence				
Materials Sciences and Engineering				
Improve Spatial Resolution: Demonstrate measurement of spatial resolutions for imaging in the hard x-ray region of <100 nm (nanometers) and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm.[1]	Improve Spatial Resolution: Demonstrate measurement of spatial resolutions for imaging in the hard x-ray region of <100 nm and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm.[1]	Improve Spatial Resolution: Demonstrate measurement of spatial resolutions for imaging in the hard x-ray region of <100 nm and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm.[1]	Improve Spatial Resolution: Demonstrate measurement of spatial resolutions for imaging in the hard x-ray region of <100 nm and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm.[1]	Improve Spatial Resolution: Demonstrate measurement of spatial resolutions for imaging in the hard x-ray region of <100 nm and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm.[1]
Improve Temporal Resolution: Demonstrate measurement of x-ray pulses that are <100 femtoseconds in duration and have an intensity of >100 million photons per pulse (>10^8 photons/pulse).[1]	Improve Temporal Resolution: Demonstrate measurement of x-ray pulses that are <100 femtoseconds in duration and have an intensity of >100 million photons per pulse (>10^8 photons/pulse).[1]	Improve Temporal Resolution: Demonstrate measurement of x-ray pulses that are <100 femtoseconds in duration and have an intensity of >100 million photons per pulse (>10^8 photons/pulse).[1]	Improve Temporal Resolution: Demonstrate measurement of x-ray pulses that are <100 femtoseconds in duration and have an intensity of >100 million photons per pulse (>10^8 photons/pulse).[1]	Improve temporal resolution: Demonstrate measurement of x-ray pulses that are <100 femtoseconds in duration and have an intensity of >100 million photons per pulse (>10^8 photons/pulse).[1]
Chemical Sciences, Geosciences, and Energy Biosciences				
Improve Simulation: Beginning in FY 2007, increasing the size of the simulation will no longer provide useful new information. Thus, this measure is being discontinued.				
Materials Sciences and Engineering				
Maintain and operate the scientific user facilities to achieve an average at least 90% of the total scheduled operating time.	Maintain and operate the scientific user facilities to achieve an average at least 90% of the total scheduled operating time.	Maintain and operate the scientific user facilities to achieve an average at least 90% of the total scheduled operating time.	Maintain and operate the scientific user facilities to achieve an average at least 90% of the total scheduled operating time.	Maintain and operate the scientific user facilities to achieve an average at least 90% of the total scheduled operating time.

[1] No further improvement is expected in FY 2006–FY 2011 as compared to the level of achievement for FY 2005. Performance levels for resolution (temporal and spatial) have reached the maximum for the current suite of available instruments. This target is a measure of SC's intent to maintain the maximum level of performance for users of the current SC facilities until the next generation of instruments and facilities becomes available.

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FY 2007 Targets	FY 2008 Targets	FY 2009 Targets	FY 2010 Targets	FY 2011 Targets
Construction				
Meet the cost and timetables within 10% of the baselines given in the construction project data sheets for all ongoing construction projects.	Meet the cost and timetables within 10% of the baselines given in the construction project data sheets for all ongoing construction projects.	Meet the cost and timetables within 10% of the baselines given in the construction project data sheets for all ongoing construction projects.	Meet the cost and timetables within 10% of the baselines given in the construction project data sheets for all ongoing construction projects.	Meet the cost and timetables within 10% of the baselines given in the construction project data sheets for all ongoing construction projects.

Office of Science 5-Year Budget Plan

FY 2007–FY 2011

Advanced Scientific Computing Research (ASCR)

	B/A (dollars in thousands)					
	FY 2006 Approp.	FY 2007 Request	FY 2008	FY 2009	FY 2010	FY 2011
User Facility Operations	91,191	157,294	164,790	169,790	174,790	185,000
Research	143,493	161,360	185,210	200,210	210,210	220,000
Total, ASCR	234,684	318,654	350,000	370,000	385,000	405,000

Priorities:

User Facility Operations

- The Oak Ridge Leadership Computing Facility (LCF) provides high performance sustained capability to researchers based on peer review. Computers acquired in FY 2004 and FY 2005 are upgraded to provide more than 250 teraflops peak capability by the end of FY 2007, placing the Oak Ridge LCF on a path to provide over 1,000 teraflops by the end of FY 2008.
- An IBM Blue Gene P high-performance computer system with low-electrical power requirements was an important element of the joint Oak Ridge, Argonne, and Pacific Northwest national laboratories' proposal for a Leadership Class Computing Facility that was selected in 2004. The 100 teraflop system to be acquired by the Argonne National Laboratory (ANL) in FY 2007, creating the Argonne Leadership Computing Facility, is planned to be increased to a capability in the range of 250–500 teraflops by the end of FY 2008.
- The National Energy Research Scientific Computing Center (NERSC) is upgraded to a peak capacity in the range of 100–150 teraflops by the end of FY 2007 to alleviate the current backlog of meritorious requests for high-performance production computing resources. Another upgrade of NERSC to 500 teraflops peak capacity, planned for the end of the decade, ensures that SC's high-performance production computing needs continue to be met into the next decade.
- Energy Science Network (ESnet) evolves over the 5 year period to dual backbone rings at 40 gigabits per second with fault tolerant 10 gigabit per second connections to most major SC laboratories and higher bandwidth connections to NERSC, the Oak Ridge and Argonne LCFs, and other sites with exceptional data requirements, such as Fermilab.

Research

- Research efforts in applied mathematics and computer science are focused and strengthened to deliver the operating systems, programming models, software tools, and mathematical algorithms and libraries needed for scientists to make effective use of Leadership Class Computing and high-performance production computing resources.
- In FY2008 and beyond, software efforts will ramp-up to deliver operating systems, file systems and knowledge extraction software required by petascale computers that result from the Defense Advanced Research Projects Administration (DARPA) High Productivity Computing Systems (HPCS) program partnership.

- The Scientific Discovery through Accelerated Computing (SciDAC) program, based on peer review, strengthens activities at the software centers initiated in FY 2006. In addition, SciDAC initiates research investments in applied mathematics and computer science to accelerate efforts in modeling and simulation on Leadership Class Computing resources in specified high-priority application areas.
- The Research and Evaluation Prototype computers effort will be coordinated with the National Nuclear Security Administration (NNSA) and focused on the Defense Advanced Research Projects Administration (DARPA) High Productivity Computing Systems (HPCS) program partnership.
- As a result of the activities described above, users will be prepared for the introduction of next generations of scientific computers and the overall risk associated with future computer system acquisitions will be reduced.

Reallocations to support SC priorities:

Research

Basic research investments that do not directly contribute to the effective use of Leadership Class computing and high-performance production computing resources will be de-emphasized.

- The Research and Evaluation prototype activity is being redirected to support the DOE partnership with the DARPA High Productivity Computing Systems (HPCS) program.
- Network research activities will be focused on evaluating the feasibility of sharing file systems and archival systems between leadership computing sites.
- SciDAC is being refocused, as a result of a recompetition in FY2006, to develop petascale applications and the supporting software infrastructure.

Advanced Scientific Computing Research

Performance Targets

FY 2007 Targets	FY 2008 Targets	FY 2009 Targets	FY 2010 Targets	FY 2011 Targets
Program Goal 05.23.00.00 Deliver forefront computational and networking capabilities				
Mathematical, Information and Computational Sciences				
Improve Computational Science Capabilities. Average annual percentage increase in the computational effectiveness (either by simulating the same problem in less time or simulating a larger problem in the same time) of a subset of application codes within the SciDAC effort. FY 2007— >50%	Improve Computational Science Capabilities. Average annual percentage increase in the computational effectiveness (either by simulating the same problem in less time or simulating a larger problem in the same time) of a subset of application codes within the SciDAC effort. FY 2008— >50%	Improve Computational Science Capabilities. Average annual percentage increase in the computational effectiveness (either by simulating the same problem in less time or simulating a larger problem in the same time) of a subset of application codes within the SciDAC effort. FY 2009— >50%	Improve Computational Science Capabilities. Average annual percentage increase in the computational effectiveness (either by simulating the same problem in less time or simulating a larger problem in the same time) of a subset of application codes within the SciDAC effort. FY 2010— >50%	Improve Computational Science Capabilities. Average annual percentage increase in the computational effectiveness (either by simulating the same problem in less time or simulating a larger problem in the same time) of a subset of application codes within the SciDAC effort. FY 2011—>50%
Focus usage of the primary supercomputer at the NERSC on capability computing. Percentage of the computing time used that is accounted for by computations that require at least 1/8 of the total resource. FY 2007— 40%	Focus usage of the primary supercomputer at the NERSC on capability computing. Percentage of the computing time used that is accounted for by computations that require at least 1/8 of the total resource. FY 2008— 40%	Focus usage of the primary supercomputer at the NERSC on capability computing. Percentage of the computing time used that is accounted for by computations that require at least 1/8 of the total resource. FY 2009— 40%	Focus usage of the primary supercomputer at the NERSC on capability computing. Percentage of the computing time used that is accounted for by computations that require at least 1/8 of the total resource. FY 2010— 40%	Focus usage of the primary supercomputer at the NERSC on capability computing. Percentage of the computing time used that is accounted for by computations that require at least 1/8 of the total resource. FY 2011— 40%

Biological and Environmental Research (BER)

B/A (dollars in thousands)

	FY 2006 Approp.	FY 2007 Request	FY2008	FY2009	FY2010	FY2011
User Facility Operations	122,965	136,063	129,591	156,508	221,195	228,489
Construction (TEC)	—	—	42,000	30,000	—	—
Research (including Congressionally directed projects)................................	456,866					
Research (excluding Congressionally directed projects)................................	(328,166)	374,200	354,409	364,492	387,805	409,511
Total BER...........................	579,831	510,263	526,000	551,000	609,000	638,000

Priorities:

User Facility Operations

- The Joint Genome Institute/Production Genomics Facility (JGI/PGF) operates at full capacity supporting merit based Deoxyribonucleic Acid (DNA) sequencing open to all scientists to address DOE and national mission needs. The Atmospheric Radiation Measurement (ARM) facilities operate at full capacity with an additional ARM mobile facility added for increasing observations in key climate regions that are under-observed. Structural biology user facilities operate at full capacity.
- The Environmental Molecular Sciences Laboratory (EMSL) budget is increased to maintain operations at optimal capacity and to accelerate the replacement and refurbishment of user instrumentation.

Construction

- Design and construction funds for Genomics: GTL facilities are included within the planning window. The Department is currently in the process of reviewing its plans for these facilities based on the recommendations of a recent National Academies report.

Research

- GTL research is increased to implement an accelerated program of microbe-based biotechnology in support of the Administration's Advanced Energy Initiative for production of ethanol from cellulose and for generation of hydrogen, bioremediation, and sequestration of carbon dioxide. The program includes multiple research paths to maximize opportunities for success and to optimize systems design options. The additional funds would be used to ensure that focused research investments are made across the range of parallel GTL program scientific and technical needs, including computing/information, high-throughput proteomics and analysis of molecular machines, synthetic genome development, microbial community analytic capabilities, etc. Finally, this accelerated research effort will be coordinated across DOE programs (both within and outside SC), across federal agencies (including the Department of Agriculture, National Science Foundation (NSF), and National Institutes of Health), and across DOE laboratories, academia, industry, and nongovernmental organizations. Increased SciDAC research supports development of mathematical and computational tools needed for complex biological system modeling; analysis of complex data sets, such as mass spectrometry; and development of predictive models of complex microbial communities.

- New carbon sequestration research continues on microbial processes that affect carbon transformation/sequestration in soils using technologies and methods developed by GTL. Structural Biology infrastructure and innovative research on the biological effects of low dose radiation needed for future radiation protection standards is sustained. Ethical/societal issues research on bio- and nano-technology will continue to be coordinated across SC.
- Climate Change Research continues to support the Administration's Climate Change Science and Technology Programs, providing data to develop, test, and improve climate models to simulate and predict responses of climate to increased atmospheric carbon dioxide and aerosols and deliver predictions at regional scales. SciDAC research continues to develop mathematical and computational tools needed for climate modeling. Climate modeling research continues to advance climate models by building cloud system resolving models and including the effect of sulfate aerosols on climate, giving scientists better decadal and centennial scale climate simulations for predicting regional climate.
- Environmental Remediation Research continues to address fundamental questions at the interfaces of biology, chemistry, geology and physics for science-based solutions to DOE clean-up needs at molecular to field scales. Planned increases support additional field research sites to speed transfer of laboratory results to diverse DOE environments enabling scientists to understand, compare, and contrast different contaminated DOE sites whose contaminated subsurface environments differ widely with respect to their biological, geological, hydrological, and chemical characteristics. Increased funding for SciDAC would provide an opportunity for subsurface and computational scientists to develop and improve methods for simulating subsurface reactive transport processes on "discovery class" computers. The intent is to explore potential advantages that high-end computing can bring to the understanding of optimal model complexity, the scalability of biogeochemical reactions, model abstraction methods, sources of uncertainty, parameter estimation, and characterization measurements as input in subsurface reactive transport modeling.
- Within the context of the larger interagency effort, the Medical Sciences research program will likely continue to support radiopharmaceutical computational, and instrument development for more precise localization of radiotracers, as well as radiochemist training programs for nuclear medicine research. SC support for the artificial retina activity will be phased out upon the submission of a human study application to the Food and Drug Administration in FY 2009.

Reallocations to support SC priorities:

User Facility Operations

- Support for Free Air Carbon Dioxide Enrichment (FACE) facilities is no longer distinguished from research costs beginning in FY 2008 to fund new FACE-type experiments as part of competitive research awards.

- Support for the mouse facility is progressively reduced during the planning window as support for genomics research transitions from human to biological systems important for DOE's energy and environmental needs. Necessary low dose research at the Mouse Facility continues.

Research

- Funding for some Genomics: GTL technology development activities will be redirected toward building GTL facilities and centers as appropriate.

Biological and Environmental Research

Performance Targets

FY 2007 Targets	FY 2008 Target	FY 2009 Target	FY 2010 Target	FY 2011 Target
Program Goal 05.21.00.00 (Harness the Power of Our Living World)				
Life Sciences				
Increase the rate and decrease the cost of DNA sequencing—Cost reductions will increase the number of high quality base pairs determined (less than one error in 10,000 bases) by 25% from the FY 2006 target of 582 base pairs per dollar to 781 base pairs per dollar.	Increase the rate and decrease the cost of DNA sequencing—Cost reductions will increase the number of high quality base pairs determined (less than one error in 10,000 bases) by 44% to 1,128 base pairs per dollar..	Increase the rate and decrease the cost of DNA sequencing—Cost reductions will increase the number of high quality base pairs determined (less than one error in 10,000 bases) by 20% to 1,354 base pairs per dollar..	Increase the rate and decrease the cost of DNA sequencing—Cost reductions will increase the number of high quality base pairs determined (less than one error in 10,000 bases) by 20% to 1,624 base pairs per dollar.	Increase the rate and decrease the cost of DNA sequencing—Cost reductions will increase the number of high quality base pairs determined (less than one error in 10,000 bases) by 20% to 1,949 base pairs per dollar.
Climate Change Research				
Provide new mixed-phase cloud parameterization for incorporation in atmospheric GCMs and evaluate extent of agreement between climate model simulations and observations for cloud properties in the arctic.	Report results of decade-long control simulation using geodesic grid coupled climate model and produce new continuous time series of retrieved cloud, aerosol, and dust properties, based on results from the AMF deployment in Niger, Africa.	Provide improved climate simulations on subcontinental, regional, and large watershed scales, with an emphasis on improved simulation of precipitation and produce new continuous time series of retrieved cloud, aerosol, and radiation for Arctic region.	Complete development and testing of atmospheric GCM with interactive atmospheric chemistry and aerosols and produce improved model parameterizations of land surface and cloud interactions.	Complete coupled earth system model to be used in generating scenarios for the IPCC Fifth Assessment Report and provide integrated aerosol sub-model that includes direct and indirect forcing.
Environmental Remediation				
Implement a field-oriented, integrated experimental research program to quantify coupled processes that control reactive transport of at least one key DOE contaminant.	Identify the critical redox reactions and metabolic pathways involved in the transformation/ sequestration of at least one key DOE contaminant in a field environment.	Test geophysical techniques that measure parameters controlling contaminant movement under field conditions in at least two distinct subsurface environments.	Evaluate contaminant transport model in the context of field results and initiate revisions to model.	Conduct subsurface field studies to test predictions from previously developed models.
Medical Applications and Measurement Science[1]				
Advanced blind patient sight: complete design and construction of final 256 electrode array. Begin *in vitro* testing and non-stimulating testing in animals.	Advance blind patient sight: Complete *in vitro* testing of 256 electrode array and continue animal studies of final design 256 electrode array.	Advance blind patient sight: Complete *in vitro* and *in vivo* studies of final design 256 electrode device. Submit test data to FDA for approval of 256 electrode array for human studies.		

[1] This is not a part measure.

FY 2007 Targets	FY 2008 Target	FY 2009 Target	FY 2010 Target	FY 2011 Target
All BER Facilities				
Maintain and operate BER facilities (Life Science—PGF and the Mouse facility; Climate Change Research—ARM and FACE; and Environmental Remediation—EMSL) such that achieved operation time is on average greater than 98% of the total scheduled annual operation time for each group of facilities.	Maintain and operate BER facilities (Life Science—PGF; Climate Change Research—ARM; and Environmental Remediation—EMSL) such that achieved operation time is on average greater than 98% of the total scheduled annual operation time for each group of facilities.[1]	Maintain and operate BER facilities (Life Science—PGF; Climate Change Research—ARM; and Environmental Remediation—EMSL) such that achieved operation time is on average greater than 98% of the total scheduled annual operation time for each group of facilities.	Maintain and operate BER facilities (Life Science—PGF; Climate Change Research—ARM; and Environmental Remediation—EMSL) such that achieved operation time is on average greater than 98% of the total scheduled annual operation time for each group of facilities.	Maintain and operate BER facilities (Life Science—PGF; Climate Change Research—ARM; and Environmental Remediation—EMSL) such that achieved operation time is on average greater than 98% of the total scheduled annual operation time for each group of facilities.

[1] Note the Mouse Facility and the FACE facility are discontinued as user facilities in FY 2008.

High Energy Physics (HEP)

B/A (dollars in thousands)

	FY 2006 Approp.	FY 2007 Request	FY 2008	FY 2009	FY 2010	FY 2011
User Facility Operations	309,139	308,647	277,000	241,400	215,000	215,000
Construction	–	10,3(	18,9(	51,2(	43,5(	26,1(
Research	407,55:	456,15:	489,10(	517,40(	631,50(	733,90(
Total, HEP	716,69⁴	775,09!	785,00(	810,00(	890,00(	975,00(

Priorities:

User Facility Operations

- To fulfill its mission to address the fundamental questions of how the universe works, by discovering the most elementary constituents of matter and energy, and exploring the basic nature of space and time itself, HEP supports Tevatron collider and Neutrinos at the Main Injector (NuMI) operations at Fermilab, and B-factory operations at the Stanford Linear Accelerator Center (SLAC) through FY 2008.

Construction

- Measuring the neutrino's properties may provide a key to unlocking the secret of why such a large variety of elementary particles exist, and why there is such a stark imbalance of matter over antimatter in the universe. The recently completed NuMI neutrino beam at Fermilab is the world's most prolific source of accelerator neutrinos: a vigorous research program is planned to fully exploit our investment in this facility. HEP plans support for construction of new facilities and experiments to further extend our knowledge of neutrinos, beginning with project engineering and design in FY 2007 for an Electron Neutrino Appearance (E_A) experiment that utilizes the NuMI beam, with construction complete by FY 2011.
- HEP supports the proposed space-based Joint Dark Energy Mission (JDEM), in cooperation with the National Aeronautics and Space Administration (NASA), to determine the nature of the mysterious dark energy which is pushing the universe apart. Dark energy makes up over two-thirds of the energy content of the universe and its nature is one of the outstanding unanswered questions in physics. Following a near-term coordinated competition, fabrication of the experiment chosen for JDEM could begin near the end of the planning horizon.
- The proposed International Linear Collider (ILC)—HEP's highest priority—is expected to provide a far deeper understanding of the unification of forces, the origin of mass, and the character of the dark matter pervading the universe. Its precision would allow a much sharper understanding of discoveries made at the Large Hadron Collider (LHC), now under construction at CERN. The Department has expressed its interest in siting the ILC at Fermilab should it be built and the United States be chosen as the host country. The outyear profile includes support for technology R&D activities aimed at various technical design goals while reducing project risk and cost to support an international decision-making process near the end of this decade. A future decision to proceed with

construction rests on two conditions: the ILC is deemed a priority and affordable by its international partners; and the anticipated new science at the ILC is supported by clear physics results at the LHC.

Research

The HEP program has prioritized its planned future efforts to select those which will provide the most compelling science opportunities in the coming decade, and those where we can establish a U.S. leadership role by developing and constructing new cutting edge scientific facilities.

- The centerpiece of world-wide HEP research in the next decade will be the LHC, which is expected to begin physics operations in FY 2008. U.S. researchers will take leading roles in LHC discoveries.
- Neutrino Physics—In parallel with the construction of new facilities, the HEP program supports a ramp-up of research and development (R&D) efforts that are expected to lead to fabrication of new experiments and proposals for new facilities which can address the important questions in this research area. This includes a reactor-based neutrino detector which begins fabrication in FY 2007, and a joint experiment with Nuclear Physics (and perhaps the NSF) to measure the absolute mass of the neutrino.
- Dark Energy—HEP continues support of R&D activities for several concepts for a space-based Joint Dark Energy Mission with NASA, including the Supernova/Acceleration Probe (SNAP) mission concept. Because of the scientific advisability of pursuing alternative methods and techniques in this fast-developing area of research, HEP may also support R&D for ground-based dark energy experiments (such as new telescopes or cameras on existing telescopes), in collaboration with the NSF.

Reallocations to support SC priorities:

User Facility Operations

- Operations of the SLAC B-factory are to be completed by FY 2008. The impact at the laboratory is offset by BES support for LCLS construction and operations, and ILC R&D activities.
- Operations of the Fermilab Tevatron Collider and its two major experiments (CDF and D-Zero) complete during the planning horizon and Fermilab's primary focus in operations then transitions to a world-leading neutrino program.

Research

- Research activities in the HEP program are redirected as the B-factory and Tevatron Run II research programs conclude and new research programs (at LHC and NuMI) ramp-up and R&D activities for future projects (such as ILC, dark energy, and neutrino experiments) expand.

High Energy Physics

Performance Targets

FY 2007 Targets	FY 2008 Targets	FY 2009 Targets	FY 2010 Targets	FY 2011 Targets
Program Goal 05.19.00.00 (Explore the Fundamental Interactions of Energy, Matter, Time and Space)				
All HEP Facilities				
Maintain and operate HEP facilities such that unscheduled downtime is on average less than 20% of the total scheduled operating time.	Maintain and operate HEP facilities such that unscheduled downtime is on average less than 20% of the total scheduled operating time.	Maintain and operate HEP facilities such that unscheduled downtime is on average less than 20% of the total scheduled operating time.	Maintain and operate HEP facilities such that unscheduled downtime is on average less than 20% of the total scheduled operating time.	Maintain and operate HEP facilities such that unscheduled downtime is on average less than 20% of the total scheduled operating time.
Proton Accelerator-Based Physics/Facilities				
Deliver data as planned within 20% of the baseline estimate (800 pb^{-1} [inverse picobarns]) to CDF and D-Zero detectors at the Tevatron.	Deliver data as planned within 20% of the baseline estimate (1,000 pb^{-1}) to CDF and D-Zero detectors at the Tevatron.	Deliver data as planned within 20% of the baseline estimate (1,000 pb^{-1}) to CDF and D-Zero detectors at the Tevatron.		
Deliver data as planned within 20% of the baseline estimate ($1.5x10^{20}$ protons on target) for the MINOS experiment using the NuMI facility.[a]	Deliver data as planned within 20% of the baseline estimate ($2x10^{20}$ protons on target) for the MINOS experiment using the NuMI facility.	Deliver data as planned within 20% of the baseline estimate ($2x10^{20}$ protons on target) for the MINOS experiment using the NuMI facility.	Deliver data as planned within 20% of the baseline estimate ($2x10^{20}$ protons on target) for the MINOS experiment using the NuMI facility.	Deliver data as planned within 20% of the baseline estimate ($2x10^{20}$ protons on target) for the EvA experiment using the NuMI facility.
Electron Accelerator-Based Physics/Facilities				
Deliver data as planned within 20% of the baseline estimate (150 fb^{-1} [inverse femtobarns]) to the BaBar detector at the SLAC B-factory.	Deliver data as planned within 20% of the baseline estimate (250 fb^{-1}) to the BaBar detector at the SLAC B-factory.			
Construction/Major Items of Equipment				
Maintain cost and schedule milestones for major items of equipment and new construction projects within 10% of baseline estimates.	Maintain cost and schedule milestones for major items of equipment and new major construction projects within 10% of baseline estimates.	Maintain cost and schedule milestones for major items of equipment and new major construction projects within 10% of baseline estimates.	Maintain cost and schedule milestones for major items of equipment and new major construction projects within 10% of baseline estimates.	Maintain cost and schedule milestones for major items of equipment and new major construction projects within 10% of baseline estimates.

Office of Science 5-Year Budget Plan
FY 2007–FY 2011

Nuclear Physics (NP)

	B/A (dollars in thousands)					
	FY 2006 Approp.	FY 2007 Request	FY 2008	FY 2009	FY 2010	FY 2011
User Facility Operations	213,006	255,754	258,558	267,193	277,050	276,990
Construction	1,980	14,520	16,200	30,000	59,000	71,000
Research	152,048	183,786	195,242	207,807	226,950	244,010
Total, NP	367,034	454,060	470,000	505,000	563,000	592,000

Priorities:

User Facility Operations

- The Relativistic Heavy Ion Beam Collider (RHIC) at the Brookhaven National Laboratory operates at near optimum levels to study new states of matter created with heavy ion beams that were not previously in existence since microseconds after the Big Bang. RHIC is also operated to study the spin structure of the proton with polarized proton beams. RHIC is the world's premier facility for these studies.
- The Continuous Electron Beam Accelerator Facility (CEBAF) at the Thomas Jefferson National Accelerator Facility provides beams for its planned experimental program while proceeding in parallel with the 12 GeV CEBAF Upgrade construction project. CEBAF is the world's leading facility for the study of the internal quark structure of the nucleon with electron beams.
- Important advances will be made in understanding energy production in stars, the formation of heavy elements, and explosive stellar events in nuclear structure and astrophysics studies at NP's low energy National User Facilities: the Argonne Tandem Linear Accelerator System (ATLAS) and the Oak Ridge Holifield Radioactive Ion Beam Facility (HRIBF). These facilities operate at near optimum levels and research capabilities are developed to mount forefront programs in the first part of the next decade with both stable and radioactive beams.

Construction

- Funding is provided during this period for construction of the 12 GeV CEBAF Upgrade project. This upgrade will double the energy of CEBAF and provide research capabilities for precision studies of the quark substructure of the nucleon and nuclei and the opportunity to learn about the mechanism of quark "confinement."
- A new pre-injector for RHIC, the Electron Beam Ion Source (EBIS), is brought into operation during this period. A joint project with NASA, this injector replaces the aging tandems at RHIC and will provide new ion beams for research and result in more cost-effective operations.
- R&D is supported for a potential upgrade project for the RHIC facility (RHIC II) to increase the beam luminosity by a factor of 10, thereby enabling researchers to fully characterize the new states of matter discovered there and to study saturated gluonic matter.

- R&D is supported to provide the basis for a possible decision to initiate conceptual and project engineering design at the end of this planning period leading toward the construction of a U.S. world-class exotic beam facility. It is conceivable that this facility, after input from the scientific community and various advisory panels, would be focused on reaccelerated exotic beams to complement exotic beam capabilities elsewhere in the world and to allow U.S. researchers to be among the leaders in nuclear structure and astrophysics studies. Such a facility would allow researchers to discover new states/structures of nuclear matter, to measure reaction rates to understand what happens in cataclysmic astrophysics events such as supernovae and the origin of the chemical elements, and to create specific nuclei whose properties and decays can be used to search for new physics beyond the Standard Model.

Research

- Research efforts at RHIC are aimed at characterizing the newly discovered new states of matter with heavy ion beams and establishing the contributions of gluons to the spin of the proton (an unanswered question at this time) using a polarized beam. The answers to these fundamental questions cannot be obtained at any other existing or planned facility world-wide.
- The GRETINA gamma-ray tracking array, a major item of equipment to be completed by the end of this decade, will provide up to two-orders of magnitude improvement in sensitivity and can be used at ATLAS, HRIBF, and the National Superconducting Cyclotron Laboratory at Michigan State University to discover new structures and behaviors of the atomic nucleus.
- The Fundamental Neutron Physics Beamline (FNPB), under fabrication at the SNS, will provide world-leadership neutron beams for measuring the properties of the neutron, including a high precision measurement of the electric dipole moment of the neutron with a high-potential for revealing new physics beyond the Standard Model.
- U.S. participation in the heavy-ion program at the LHC, when it begins physics operations around FY 2008, will provide U.S. researchers with the opportunity to search for new states of matter under substantially different initial conditions than those provided by RHIC, providing another piece of the puzzle regarding the matter that existed during the infant universe.
- Following the highly successful Sudbury Neutrino Observatory and Kamioka Liquid-scintillator Anti-Neutrino Detector (KamLAND) experiments, which have revealed new properties of neutrinos, a neutrinoless Double Beta Decay experiment is planned to measure the nature and mass of the neutrino. Neutrinos play a critical role in the explosions of supernovae and the evolution of the cosmos, as well as new physics beyond the Standard Model.
- Planned investments in Lattice Quantum ChromoDynamic Computing with HEP provide the opportunity for model simulations that could lead to dramatic breakthroughs in our understanding of the interactions of the fundamental building blocks of nature and the forces involved.
- Accelerator R&D efforts directed at next-generation nuclear physics research capabilities as well as core competencies in superconducting radio-frequency (SRF) accelerator technologies and in advanced cooling techniques of accelerator beams are supported.
- NP contributes to an SC effort directed at basic research leading to transformational energy technologies by supporting nuclear data measurements and code development relevant to the design of next generation nuclear reactors.

- During this period over 400 graduate students supported by the Nuclear Physics program would receive their Ph.D. degrees and enter the workforce.

Reallocations to support SC priorities:

User Facility Operations

- With the completion of their planned scientific programs, the small experiments at RHIC are phased out. The Phobos detector has already terminated operations and the BRAHMS detector would do so in this planning period.

Research

- The Laser Electron Gamma Source (LEGS) program at the BNL NSLS facility, which studies the nucleon's structure, completes taking data at the end of FY 2006 and is phased out as data analyses are completed.
- Operations of the MIT/Bates Linear Accelerator Center were phased out in FY 2005. DOE intends to provide funding to MIT in FY 2006 through FY 2008 as part of an agreement that turns ownership of the facility over to MIT in exchange for MIT assuming responsibility for all future decontamination and decommissioning activities and liability for the facility.

Nuclear Physics

Performance Targets

FY 2007 Targets	FY 2008 Targets	FY 2009 Targets	FY 2010 Targets	FY 2011 Targets
Program Goal 05.20.00.00 – Explore Nuclear Matter, from Quarks to the Stars				
Average achieved operation time of the scientific user facilities as a percentage of the total scheduled annual operation time will be greater than 80%.	Average achieved operation time of the scientific user facilities as a percentage of the total scheduled annual operation time will be greater than 80%.	Average achieved operation time of the scientific user facilities as a percentage of the total scheduled annual operation time will be greater than 80%.	Average achieved operation time of the scientific user facilities as a percentage of the total scheduled annual operation time will be greater than 80%.	Average achieved operation time of the scientific user facilities as a percentage of the total scheduled annual operation time will be greater than 80%.
Medium Energy Nuclear Physics				
Weighted average number (within 20% of baseline estimate) of billions of events recorded by experiments in Hall A (2.2), Hall B (11.6), and Hall C (2.6), respectively, at the Continuous Electron Beam Accelerator Facility.	Weighted average number (within 20% of baseline estimate) of billions of events recorded by experiments in Hall A, Hall B, and Hall C, respectively, at the Continuous Electron Beam Accelerator Facility. The actual targets will be established in the FY 2008 Budget Request.	Weighted average number (within 20% of baseline estimate) of billions of events recorded by experiments in Hall A, Hall B, and Hall C, respectively, at the Continuous Electron Beam Accelerator Facility. The actual targets will be established in the FY 2009 Budget Request.	Weighted average number (within 20% of baseline estimate) of billions of events recorded by experiments in Hall A, Hall B, and Hall C, respectively, at the Continuous Electron Beam Accelerator Facility. The actual targets will be established in the FY 2010 Budget Request.	Accelerator is shut down for installation of the 12 GeV energy upgrade so there is no running. Zero events in each hall.
Weighted average number (within 30% of baseline estimate) of millions of proton collision events sampled by the PHENIX (127,000) and recorded by the STAR (158) detectors, respectively during the polarized proton run at the Relativistic Heavy Ion Collider.	Weighted average number (within 30% of baseline estimate) of millions of proton collision events sampled by the PHENIX and recorded by the STAR detectors, respectively, at the Relativistic Heavy Ion Collider. The actual targets will be established in the FY 2008 Budget Request.	Weighted average number (within 30% of baseline estimate) of millions of proton collision events sampled by the PHENIX and recorded by the STAR detectors, respectively, at the Relativistic Heavy Ion Collider. The actual targets will be established in the FY 2009 Budget Request.	Weighted average number (within 30% of baseline estimate) of millions of proton collision events sampled by the PHENIX and recorded by the STAR detectors, respectively, at the Relativistic Heavy Ion Collider. The actual targets will be established in the FY 2010 Budget Request.	Weighted average number (within 30% of baseline estimate) of millions of proton collision events sampled by the PHENIX and recorded by the STAR detectors, respectively, at the Relativistic Heavy Ion Collider. The actual targets will be established in the FY 2011 Budget Request.
Heavy Ion Nuclear Physics				
Weighted average number (within 30% of baseline estimate) of millions of events sampled by the PHENIX (30,000) and recorded by the STAR (100) detectors, respectively during the heavy ion run at the Relativistic Heavy Ion Collider.	Weighted average number (within 30% of baseline estimate) of millions of events sampled by the PHENIX and recorded by the STAR detectors, respectively, at the Relativistic Heavy Ion Collider. The actual targets will be established in the FY 2008 Budget Request.	Weighted average number (within 30% of baseline estimate) of millions of events sampled by the PHENIX and recorded by the STAR detectors, respectively, at the Relativistic Heavy Ion Collider. The actual targets will be established in the FY 2009 Budget Request.	Weighted average number (within 30% of baseline estimate) of millions of events sampled by the PHENIX and recorded by the STAR detectors, respectively, at the Relativistic Heavy Ion Collider. The actual targets will be established in the FY 2010 Budget Request.	Weighted average number (within 30% of baseline estimate) of millions of events sampled by the PHENIX and recorded by the STAR detectors, respectively, at the Relativistic Heavy Ion Collider. The actual targets will be established in the FY 2011 Budget Request.

Office of Science 5-Year Budget Plan

FY 2007–FY 2011

FY 2007 Targets	FY 2008 Targets	FY 2009 Targets	FY 2010 Targets	FY 2011 Targets
Low Energy Nuclear Physics				
Weighted average number (within 20% of baseline estimate) of billions of events recorded by experiments at the Argonne Tandem Linac Accelerator System (22) and Holifield Radioactive Ion Beam (1.8) facilities, respectively.	Weighted average number (within 20% of baseline estimate) of billions of events recorded by experiments at the Argonne Tandem Linac Accelerator System and Holifield Radioactive Ion Beam facilities, respectively. The actual targets will be established in the FY 2008 Budget Request.	Weighted average number (within 20% of baseline estimate) of billions of events recorded by experiments at the Argonne Tandem Linac Accelerator System and Holifield Radioactive Ion Beam facilities, respectively. The actual targets will be established in the FY 2009 Budget Request.	Weighted average number (within 20% of baseline estimate) of billions of events recorded by experiments at the Argonne Tandem Linac Accelerator System and Holifield Radioactive Ion Beam facilities, respectively. The actual targets will be established in the FY 2010 Budget Request.	Weighted average number (within 20% of baseline estimate) of billions of events recorded by experiments at the Argonne Tandem Linac Accelerator System and Holifield Radioactive Ion Beam facilities, respectively. The actual targets will be established in the FY 2011 Budget Request.

Fusion Energy Sciences (FES)

	B/A (dollars in thousands)					
	FY 2006 Approp.	FY 2007 Request	FY 2008	FY 2009	FY 2010	FY 2011
User Facility Operations	62,726	65,767	67,276	82,791	86,215	86,056
ITER Total Estimated Cost (TEC)[1]	15,866	37,000	149,500	208,500	208,500	180,785
Research	209,052	216,183	210,224	202,709	206,285	217,159
Total, FES	287,644	318,950	427,000	494,000	501,000	484,000

Priorities:

User Facility Operations

- DIII-D and C-Mod, the FES program's major tokamak facilities, continue to operate for 12 weeks and 15 weeks respectively, the level planned in FY 2007. At this level of operations, U.S. scientists are able to carry out about one-third to one-half of the experimental proposals that are submitted to the facilities, with the best proposals selected through peer review.
- The National Spherical Torus Experiment (NSTX) is the current alternate concept facility at the Princeton Plasma Physics Laboratory, with fabrication of the National Compact Stellarator Experiment (NCSX) completed in FY 2009 to investigate the unique physics of compact stellarators. The NSTX continues operations at the FY 2007 level of 12 weeks until NCSX comes on line. Once NCSX is fully operational, NCSX and NSTX alternate operating 24 weeks every other year. Each facility will be serviced and modified, as appropriate, during the periods when the other facility is in operation. This plan for alternate periods of operations and upgrades permits the most cost-effective use of shared components and subsystems as well as the joint team of scientists, engineers, and technicians.

ITER

- DOE will continue to participate as a full partner in the ITER project, a Presidential priority and the critical next step on the path to fusion energy. The ITER mission is to demonstrate the scientific and technological feasibility of fusion in a facility that for the first time will be able to produce a sustained, burning plasma much like that needed in a full scale fusion power plant. The cost of ITER is shared among the seven partners that have agreed to construct, operate, deactivate, and decommission the facility: China, the European Union, India, Japan, Korea, Russia, and the United States. This multilateral approach provides critical science to each partner at a fraction of the cost that each would have to pay if it undertook the project unilaterally. The European Union is hosting ITER in Cadarache, France, and pays roughly 45% of the project costs. The remaining 55% of the

[1] ITER Other Project Cost funding is included within the Research line. Inclusion of ITER Other Project Costs with the Total Estimated Cost results in an ITER Total Project Cost funding level of $19,315,000 in FY 2006, $60,000,000 in FY 2007, $160,000,000 in FY 2008, $214,500,000 in FY 2009, $210,000,000 in FY 2010, and $181,285,000 in FY 2011.

project costs is shared equally among the six remaining partners. During the five years covered by this plan, the U.S. makes "in kind" contributions of equipment, personnel, and cash, including contingency, to the project. The U.S. is implementing its contributions through a Major Item of Equipment project called U.S. Contributions to ITER. After the international project team is assembled at the Cadarache site and the construction schedule is established, the U.S. project will establish its cost and schedule baseline, at Critical Decision 2. This milestone is tentatively planned for September 2007.

Research

- Research on all major fusion facilities includes support for the ITER project, and on joint experiments with the large tokamaks abroad on burning plasma studies.
- Two additional SciDAC projects are competitively selected in FY 2007. One focuses on developing the software tools for remote collaboration on foreign fusion facilities, and the other on laying the ground work for developing an integrated capability for simulating the behavior of fusion plasmas. These two projects and the other ongoing SciDAC work will continue throughout the five year period.
- Research continues on the development of the fundamental understanding of the plasma science necessary to explore innovative, improved pathways to plasma confinement.
- Research on High Energy Density Physics focuses on heavy ion beam science and fast ignition, with research also on plasma jets.
- Research support continues for development of enabling technologies to enhance plasma performance on both current and planned domestic machines as well as for international collaborations.
- The other non-ITER elements of the research program are maintained at roughly the FY 2007 level of effort.

Fusion Energy Sciences

Performance Targets

FY 2007 Targets	FY 2008 Targets	FY 2009 Targets	FY 2010 Targets	FY 2011 Targets
Program Goal 05.24.00.00 (World-Class Scientific Research Capacity)				
Science				
Conduct experiments on major fusion facilities leading toward the predictive capability for burning plasmas and configuration optimization. – In FY 2007, FES will measure and identify magnetic modes on NSTX that are driven by energetic ions traveling faster than the speed of magnetic perturbations (Alfvén speed); such modes are expected in burning plasmas such as ITER.	Conduct scheduled experiments on fusion facilities.	Conduct scheduled experiments on fusion facilities.	Conduct scheduled experiments on fusion facilities.	Conduct scheduled experiments on fusion facilities.
Increase resolution in simulations of plasma phenomena—optimizing confinement and predicting the behavior of burning plasmas require improved simulations of edge and core plasma phenomena, as the characteristics of the edge can strongly affect core confinement. – In FY 2007, improve the simulation resolution of linear stability properties of Toroidal Alfvén Eigenmodes driven by energetic particles and neutral beams in ITER by increasing the number of toroidal modes used to 15.	Increase resolution in simulations of plasma phenomena—optimizing confinement and predicting the behavior of burning plasmas require improved simulations of edge and core plasma phenomena.	Increase resolution in simulations of plasma phenomena—optimizing confinement and predicting the behavior of burning plasmas require improved simulations of edge and core plasma phenomena.	Increase resolution in simulations of plasma phenomena—optimizing confinement and predicting the behavior of burning plasmas require improved simulations of edge and core plasma phenomena.	Increase resolution in simulations of plasma phenomena—optimizing confinement and predicting the behavior of burning plasmas require improved simulations of edge and core plasma phenomena.
Facility Operations				
Average achieved operational time of major national fusion facilities as a percentage of total planned operational time is greater than 90%.	Average achieved operational time of major national fusion facilities as a percentage of total planned operational time is greater than 90%.	Average achieved operational time of major national fusion facilities as a percentage of total planned operational time is greater than 90%.	Average achieved operational time of major national fusion facilities as a percentage of total planned operational time is greater than 90%.	Average achieved operational time of major national fusion facilities as a percentage of total planned operational time is greater than 90%.
Cost-weighted mean percent variance from established cost and schedule baselines for major construction, upgrade, or equipment procurement projects kept to less than 10%.	Cost-weighted mean percent variance from established cost and schedule baselines for major construction, upgrade, or equipment procurement projects kept to less than 10%.	Cost-weighted mean percent variance from established cost and schedule baselines for major construction, upgrade, or equipment procurement projects kept to less than 10%.	Cost-weighted mean percent variance from established cost and schedule baselines for major construction, upgrade, or equipment procurement projects kept to less than 10%.	Cost-weighted mean percent variance from established cost and schedule baselines for major construction, upgrade, or equipment procurement projects kept to less than 10%.