U.S. Department of Energy

Office of Science

Transformational Science for Energy, Environment, and America's Competitiveness

FY 2008 Budget Request for the Office of Science

Presentation to Nuclear Science Advisory Committee

Dr. Raymond L. Orbach

Under Secretary for Science

March 8, 2007

www.science.doe.gov

U.S. Department of Energy

Office of Science

U.S. Department of Energy

Office of Science

The President's FY 2008 Request will enable scientific discoveries essential to solving our Nation's challenges

"It's in our vital interest to diversify America's energy supply – **the way forward is through technology**…

"America is on the verge of technological breakthroughs that will enable us to live our lives less dependent on oil. **And these technologies will help us be better stewards of the environment, and they will help us to confront the serious challenge of global climate change.**"

President George W. Bush
State of the Union Address
January 23, 2007

"**We must commit to doubling federal funding for basic research and development in the physical sciences….**"

Speaker Nancy Pelosi
U.S. House of Representatives
January 19, 2007

U.S. Department of Energy

Office of Science

The FY 2008 President's Budget Request for the Office of Science is an investment in America's future

The FY 2008 budget enables the Office of Science to deliver on its mission and ***enhance U.S. competitiveness*** *through…*

Transformational Science

Basic research for advanced scientific breakthroughs that will revolutionize our approach to the Nation's energy, environment, and national security challenges

National Scientific Facilities

World-leading research capabilities that maintain U.S. leadership in science and technological innovation

A Scientific Workforce for the Nation's Future

Supporting, training, and educating the Nation's current and future scientific & technical workforce: Ph.D.'s, post-docs, graduate students, and science educators

U.S. Department of Energy

Office of Science

Office of Science

FY 2008 Congressional Budget Request

(B/A in thousands)

	FY 2005 Approp.	FY 2006 Approp.	FY 2007 Request to Congress	FY 2007 vs. † FY 2006		FY 2008 Request to Congress	FY 2008 vs. FY 2007	
Basic Energy Sciences	1,083,616	1,110,148	1,420,980	+310,832	+28.0%	1,498,497	+77,517	+5.5%
Advanced Scientific Computing Research	226,180	228,382	318,654	+90,272	+39.5%	340,198	+21,544	+6.8%
Biological & Environmental Research								
BER Base Program	487,474	435,476	510,263	+74,787	+17.2%	531,897	+21,634	+4.2%
Congressionally-directed projects	79,123	128,601	——	-128,601	-100.0%	——	——	——
Total, Biological & Environmental Research	566,597	564,077	510,263	-53,814	-9.5%	531,897	+21,634	+4.2%
High Energy Physics	722,906	698,238	775,099	+76,861	+11.0% ††	782,238	+7,139	+0.9% ††
Nuclear Physics	394,549	357,756	454,060	+96,304	+26.9%	471,319	+17,259	+3.8%
Fusion Energy Sciences	266,947	280,683	318,950	+38,267	+13.6%	427,850	+108,900	+34.1%
Science Laboratories Infrastructure	37,498	41,684	50,888	+9,204	+22.1%	78,956	+28,068	+55.2%
Science Program Direction	154,031	159,118	170,877	+11,759	+7.4%	184,934	+14,057	+8.2%
Workforce Development for Teachers & Scientists	7,599	7,120	10,952	+3,832	+53.8%	11,000	+48	+0.4%
S&S	67,168	68,025	70,987	+2,962	+4.4%	70,987	——	——
Use of prior year balances	-5,062	——	——	——	——	——	——	——
SBIR/STTR (from SC programs)	77,842	81,160	——	-81,160	-100.0%	——	——	——
Subtotal, Science	3,599,871	3,596,391	4,101,710	+505,319	+14.1%	4,397,876	+296,166	+7.2%
SBIR/STTR (transferred from other DOE programs)	35,779	35,653	——	-35,653	-100.0%	——	——	——
Total, Science	3,635,650	3,632,044	4,101,710	+469,666	+12.9%	4,397,876	+296,166	+7.2%

† The FY 2008 President's Budget Request and the material presented here assume the requested level for FY 2007, as the timing of FY 2007 appropriations did not allow their inclusion.

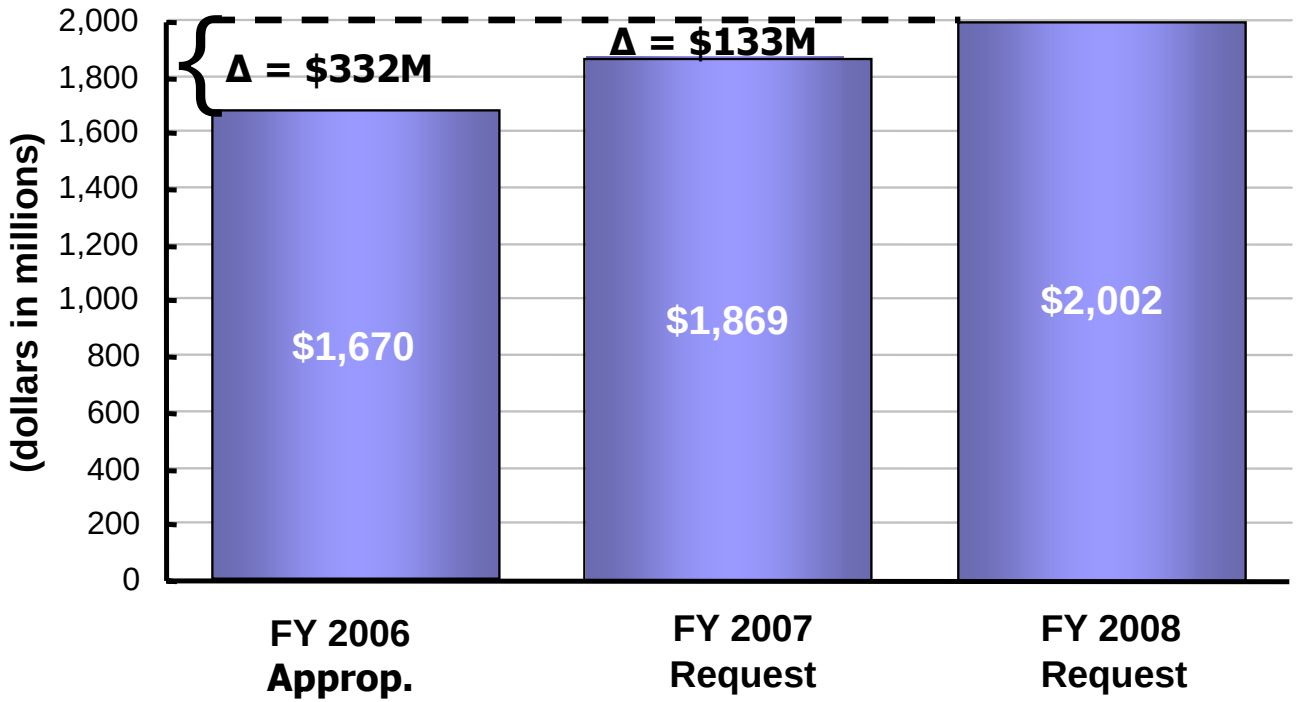
†† A portion of Stanford Linear Acceleration Center linac operations transfers from High Energy Physics to Basic Energy Sciences in FY 2007 and FY 2008. Excluding the linac operations funding, the remainder of the High Energy Physics budget increases by 12.6% in the FY 2007 request and a further 3.7% in FY 2008.

U.S. Department of Energy

Office of Science

The President's FY 2008 request supports transformational research for enhanced **U.S. competitiveness**

Office of Science Core Research Funding*—a 7.1% increase over the FY 2007 Request



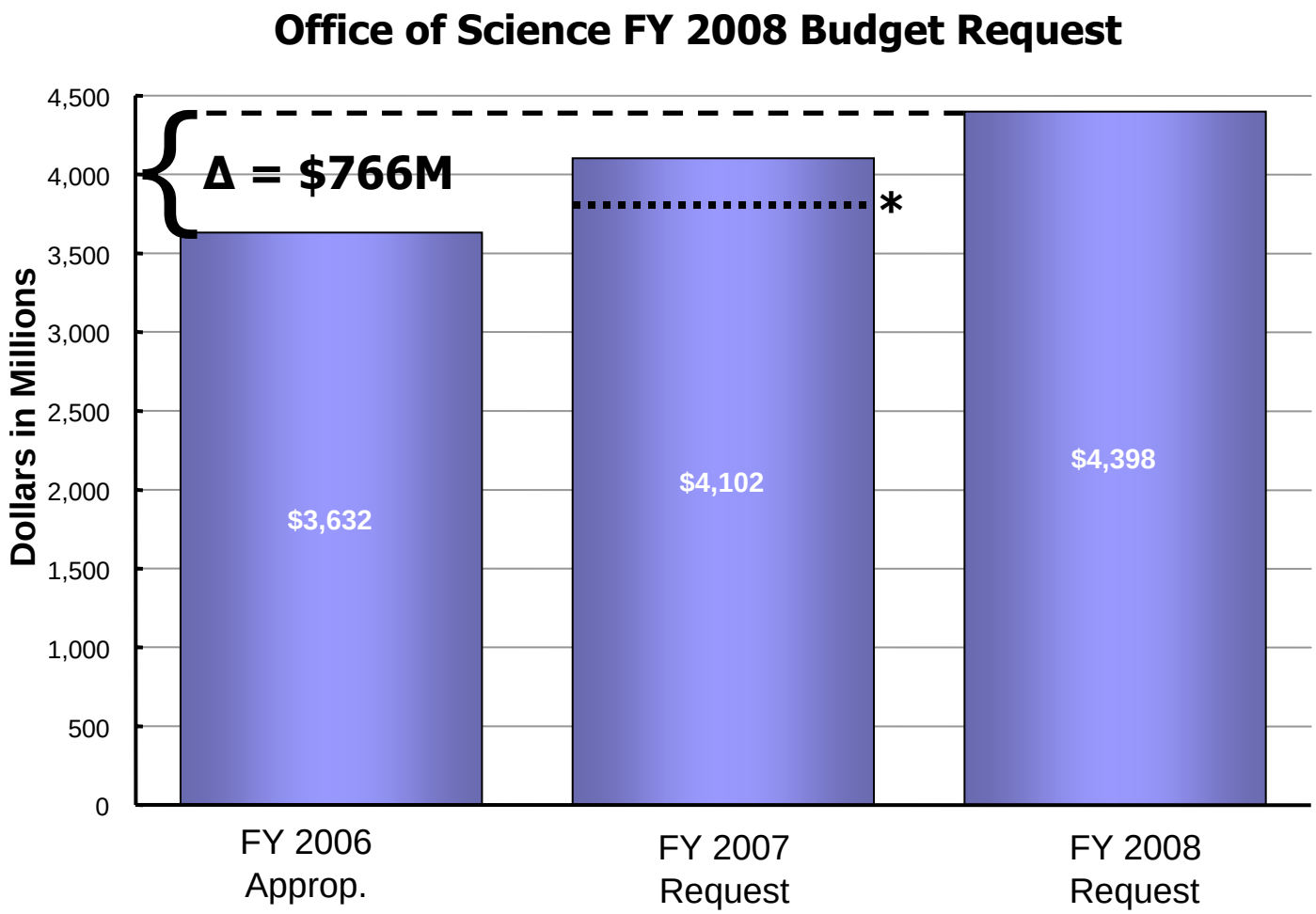
The FY 2008 request is a 19.8% increase over the FY 2006 appropriated level.

* Excludes facility operations, capital projects, and supporting programs such as program direction

U.S. Department of Energy

Office of Science

The President's FY2008 request supports transformational research for enhanced **U.S. competitiveness**

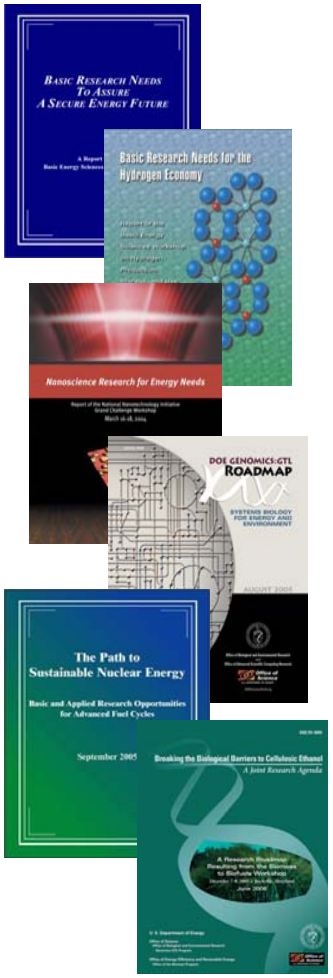


*** On January 31, 2007, the U.S. House of Representatives passed an appropriations level of $3,796 million for FY 2007.**

U.S. Department of Energy

Office of Science

Workshops help identify scientific research opportunities for future investment in support mission need and national initiatives



Basic Research Needs to Assure a Secure Energy Future

BES Workshop, October 21-25, 2002

The foundational workshop that set the model for focused workshops that follow

Workshops	Research Supported	Initiative
Basic Research Needs for the Hydrogen Economy **BES Workshop, May 13-15, 2003**	**Hydrogen (BES, BER)** FY06=$45.0M; FY07=$70.0M; FY08=$74.5M	Hydrogen Initiative/ Advanced Energy Initiative
Nanoscience Research for Energy Needs **BES and the National Nanotechnology Initiative, March 16-18, 2004**	**Nanoscience (BES, ASCR, BER)** FY06=$204.9M; FY07=$256.9M; FY08=$285.6M	Nanotechnology Initiative/ Competitiveness
Breaking the Biological Barriers to Cellulosic Ethanol, BER and EERE, December 7-9, 2005	**Biomass/Biofuels (BER, BES)** FY06=$22.9M; FY07=$62.5M; FY08=$112.9M	Advanced Energy Initiative/ DOE Mission Need

Recent & Future Workshops:

DOE Cybersecurity R&D Challenges for Open Science, **ASCR January 24-26, 2007**

Basic Research Needs for Electrical Energy Storage, **BES April 2-5, 2007**

Systematic Errors in Climate and Numerical Weather Prediction, **DOE/BER/LLNL partnership with the international World Climate Research Programme, February 12-14, 2007**

U.S. Department of Energy

Office of Science

Research capabilities and tools to drive U.S. competitiveness

Advanced systems biology research on microbes and plants – driving scientific breakthroughs necessary for the development of cost-effective methods for biofuels and bioenergy production.

- **Three Bioenergy Research Centers** are supported in FY 2008 ($75.0M)

Next generation tools – for assembly and characterization of matter and materials enabling transformational science for energy applications and U.S. competitiveness.

- **National Synchrotron Light Source-II (NSLS-II)** – a light source facility with the world's finest capabilities for x-ray imaging, capable of nanometer resolution – continued support for R&D and project engineering and design (PED) ($65.0M)
- **Linac Coherent Light Source (LCLS)** – an x-ray free electron laser that will allow examinations of chemical reactions in real time at the single molecule level – construction and instrumentation development continues ($76.9M)
- **Spallation Neutron Source (SNS)** – the world's forefront neutron scattering facility, by an order of magnitude was completed and began operations in 2006 – full operations continue & additional experimental capabilities continue to be added ($188.6M)

Providing unmatched capabilities for research at the nanoscale –

- **DOE Nanoscience Research Centers** – all 5 nanoscience centers will be operating in FY 2008 ($100.5M)

U.S. Department of Energy

Office of Science

World-leading research and resources for U.S. science

Advanced computational science – extending the frontiers of science.

- **National Energy Research Scientific Computing Center (NERSC)** – continues to provide cutting-edge supercomputing resources at 100-150 teraflop capacity ($54.8M)
- **Leadership Computing** – on the road to petascale capabilities, the ORNL Leadership Computing Facility (LCF) will reach 1 petaflop computing capability by the end of FY 2008 ($77.0M); the ANL LFC IBM Blue Gene P will provide between 250-500 teraflops ($28.0M)

Theoretical and experimental high energy physics – studying the elementary constituents of matter and energy and interactions at the heart of physics to understand how our universe works at its most fundamental level.

- **Tevatron / Large Hadron Collider / B-Factory** – continuing to reach milestones in the search to understand the fundamental forces of nature – full operations of the Tevatron, the world's most powerful particle collider and B-factory ($334.0M)
  - **Neutrino Physics** – full operation of the neutrino oscillation experiment and start of fabrication of a next generation detector to provide a platform for a world-leading neutrino program in the U.S.
- **Accelerator R&D** – ILC R&D ($60M) and superconducting radiofrequency (RF) technology R&D ($23.5M) – to enable the most compelling science opportunities in the coming decade

U.S. Department of Energy

Office of Science

Powerful tools and capabilities will accelerate U.S. scientific discovery and innovation

Fusion science and an international fusion experiment – to demonstrate the scientific and technological feasibility of fusion power.

- **ITER** – U.S. procurement, fabrication, and delivery of medium- and high-technology components and U.S. share of the common costs at the ITER site are supported ($160.0M)

Supporting fundamental research on understanding of nuclear matter – advancing our knowledge on the nature of matter and energy; maintaining U.S. leadership in nuclear physics research central to the development of technologies for nuclear energy, nuclear medicine, and national security.

- **Continuous Electron Beam Accelerator Facility (CEBAF) Upgrade** – maintains status as the world's most powerful "microscope" for studying the quark structure of matter – R&D and project engineering and design (PED) for an upgrade to double beam energy supported ($14.5M)
- **Relativistic Heavy Ion Collider (RHIC)** – continuing studies of the internal quark-gluon structure of nucleons and the properties of hot, dense nuclear matter ($162.2M)
- **Rare Isotope Beams** – continuing R&D to develop advanced rare isotope beam capabilities and initiating a solicitation for design of a next generation U.S. facility for nuclear structure and astrophysics – R&D ($4.0M)

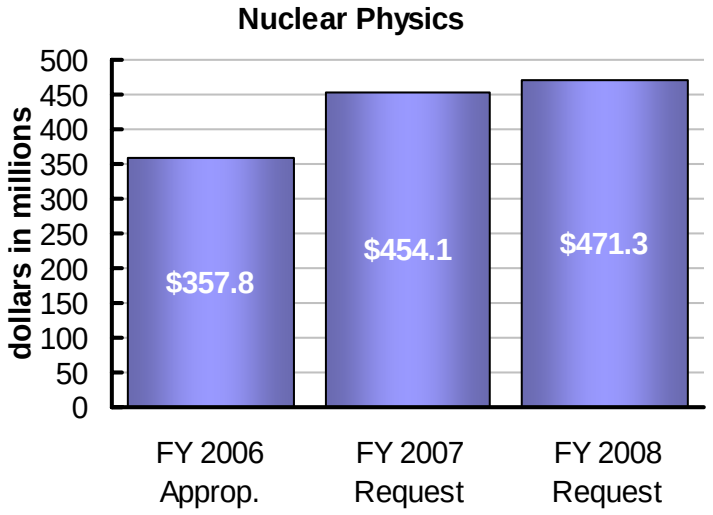
U.S. Department of Energy

Office of Science

Nuclear Physics (NP)

(FY 2008=$471.3)

- **Core research programs**. University and laboratory researchers will extract new results from studies of hot, dense nuclear matter, the quark structure of matter, nuclear structure & astrophysics, fundamental interactions, and neutrinos. Support is provided for the program's six university centers of excellence. (FY2006=$122.5M; FY2007=$143.3M; **FY2008=$147.6M**)
- **Facility Operations.** The program's four National User Facilities (RHIC, CEBAF, ATLAS and HRIBF) are operated at near optimum levels. The Electron Beam Ion Source (EBIS) being fabricated at RHIC will lead to more cost-effective operations and new research capabilities. (FY2006=$206.2M; FY2007=$256.3M; **FY2008=$258.8M**)
- **Advanced Instrumentation.** Detector upgrades at RHIC and for the heavy-ion program at LHC, the GRETINA detector for nuclear structure studies, a double-beta decay experiment (CUORE) to measure the neutrino mass, and a detector and beamline at the SNS for measurements of fundamental neutron properties. (FY2006=$8.4M; FY2007=$14.5M; **FY2008=$19.2M**)
- **12 GeV CEBAF Upgrade Project.** Project Engineering Design (PED) and R&D proceeds for the upgrade of the beam energy and research capabilities of CEBAF. (FY2006=$4.4M; FY2007=$9.5M; **FY2008=$14.5M**)
- **Accelerator R&D.** Accelerator R&D, including superconducting radio-frequency developments at TJNAF, electron cooling at RHIC and R&D for rare isotope beam capabilities are supported. (FY2006=$6.8M; FY2007=$7.6M; **FY2008=$7.6M**)
- **Stewardship Responsibilities.** Laboratory infrastructure, Small Business Innovative Research (SBIR), Scientific Technology Transfer Research (STTR), etc. (FY 2006=$9.2M; FY2007=$22.7M; FY 2008=$23.6M)



U.S. Department of Energy

Office of Science

Science for environmental solutions & investment in our Nation's scientific talent

Science and technology solutions to long-term environmental challenges –

- **Climate Change Science Research** - understanding the principal uncertainties of the causes and effects of climate change, including abrupt climate change, understanding the global carbon cycle and supporting basic research for biological sequestration of carbon ($129.6M)
- **Geosciences** – basic research underpinning the Nation's strategy for understanding and mitigating terrestrial impacts of energy technologies - understanding subsurface chemistry; new approaches to understanding subsurface physical properties of fluids, rocks and minerals, and how to determine them from the surface ($23.9M)
- **Environmental Remediation Sciences** – extending the frontiers of methods for environmental remediation - developing innovative molecular tools for investigating and monitoring environmental processes ($97.4M)

Preparing effective teacher scientists and inspiring America's youth –

- **DOE Academies Creating Teacher Scientists (ACTS)** – Hands-on experience at DOE's labs allows K-14 teachers to make connections between the science and technology principles they teach and become educational leaders ($5.6M)
- **National Science Bowl for High School and Middle School Students** – Providing prestigious academic events to challenge and inspire the Nation's youth to excel in math and science ($1.3M)

U.S. Department of Energy

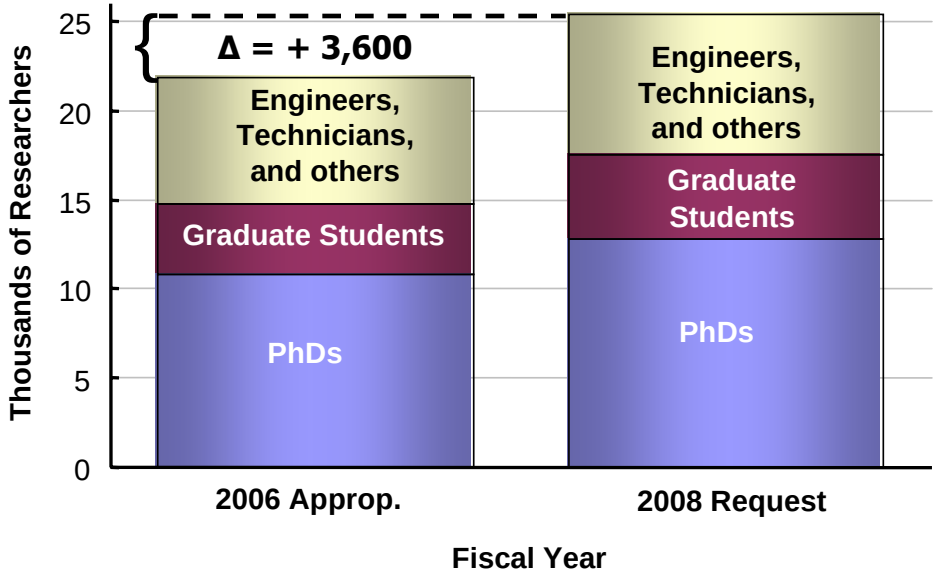
Office of Science

"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."

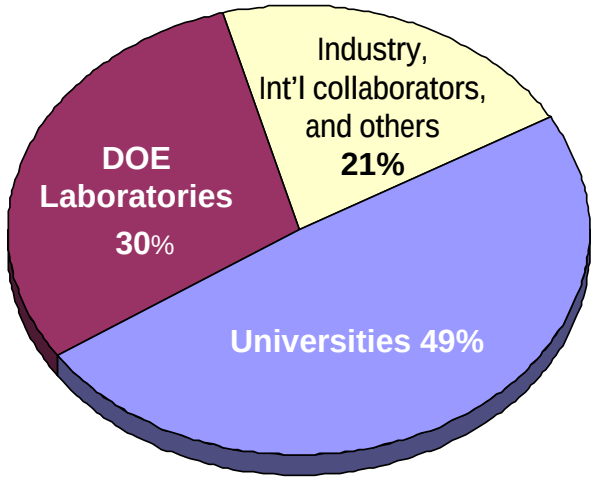
President George W. Bush,
State of the Union Address 2006

- SC supports (FY 2008) the research of about 25,500 Ph.D.'s, Postdoctoral Research Associates, and Graduate Students
- Half of over 21,500 users of the SC's scientific facilities in FY 2008 will come from universities

Scientific Workforce Supported by SC



SC National User Facilities—User Affiliations



U.S. Department of Energy

Office of Science

Keeping America at the Forefront of Science & Innovation

Our Nation's current and future energy, environmental, health, and security challenges can be addressed through scientific and technological innovation and a skilled workforce.

The Department of Energy has played an important role in training America's scientists and engineers for more than 50 years, making historic contributions to U.S. scientific preeminence.

Our large-scale scientific facilities and research capabilities lead the world, enabling remarkable discoveries that drive our economy and excite our youth to pursue science and engineering.

The FY 2008 President's request for the Office of Science will help ensure continued U.S. leadership in the physical sciences and prepare the scientific workforce we will need in the 21st century to address our Nation's challenges.