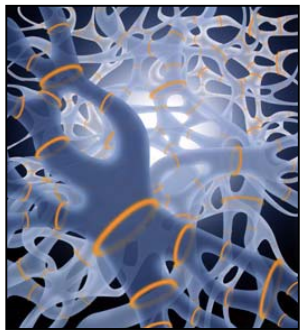
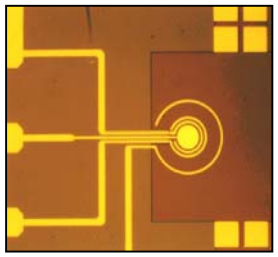
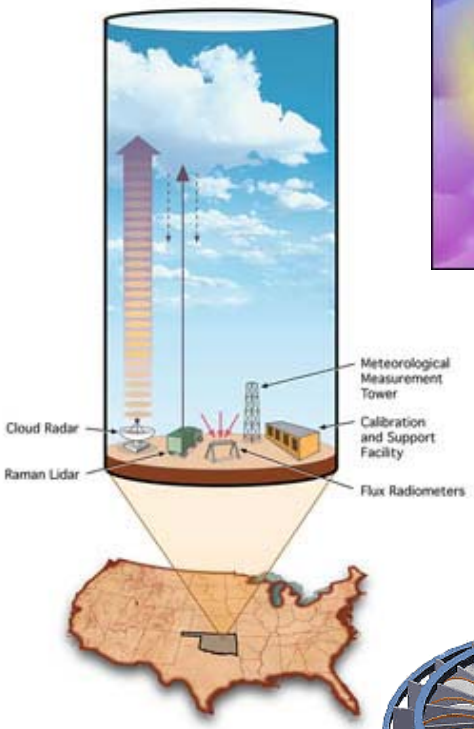
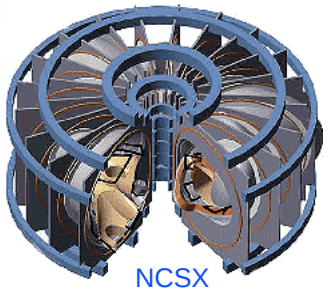
Ensuring Our Nation's Energy Security









Overview of the FY 2003 Budget Request for the Office of Science

Fusion Energy Sciences Advisory Committee

February 27, 2002

Dr. James Decker
Acting Director
Office of Science

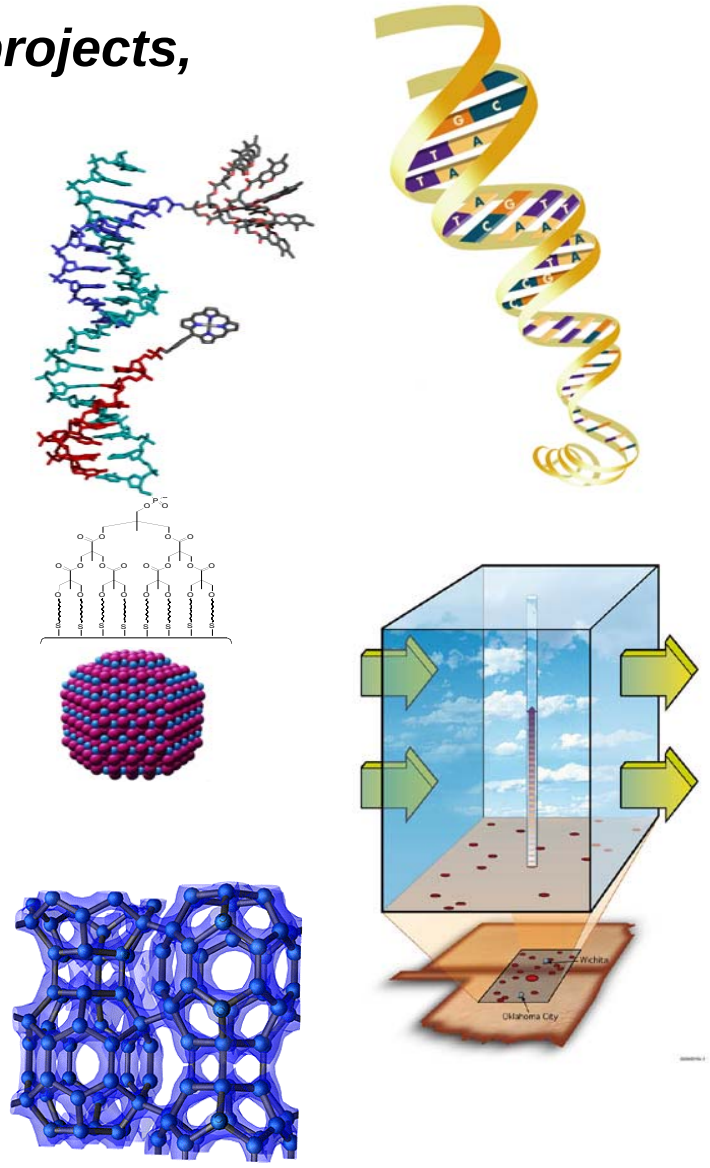
The DOE FY 2003 Budget
(in millions of dollars)

Organization	FY 2002 Appropriation	FY 2003 Request	Difference
National Nuclear Security Administration	7,605	8,039	+ 433 (6%)
Environment	7,228	7,397	+ 169 (2%)
Science	3,288	3, 293	+ 5 (0%)
Energy	2,457	2,2379	- 78 (-3%)
Other	757	809	+ 52 (7%)
Total	21,335	21,917	+ 582 (3%)

Emphasis of the FY 2003 Budget

Setting aside SNS and the one-time FY2002 projects, there is a 5% increase for Science.

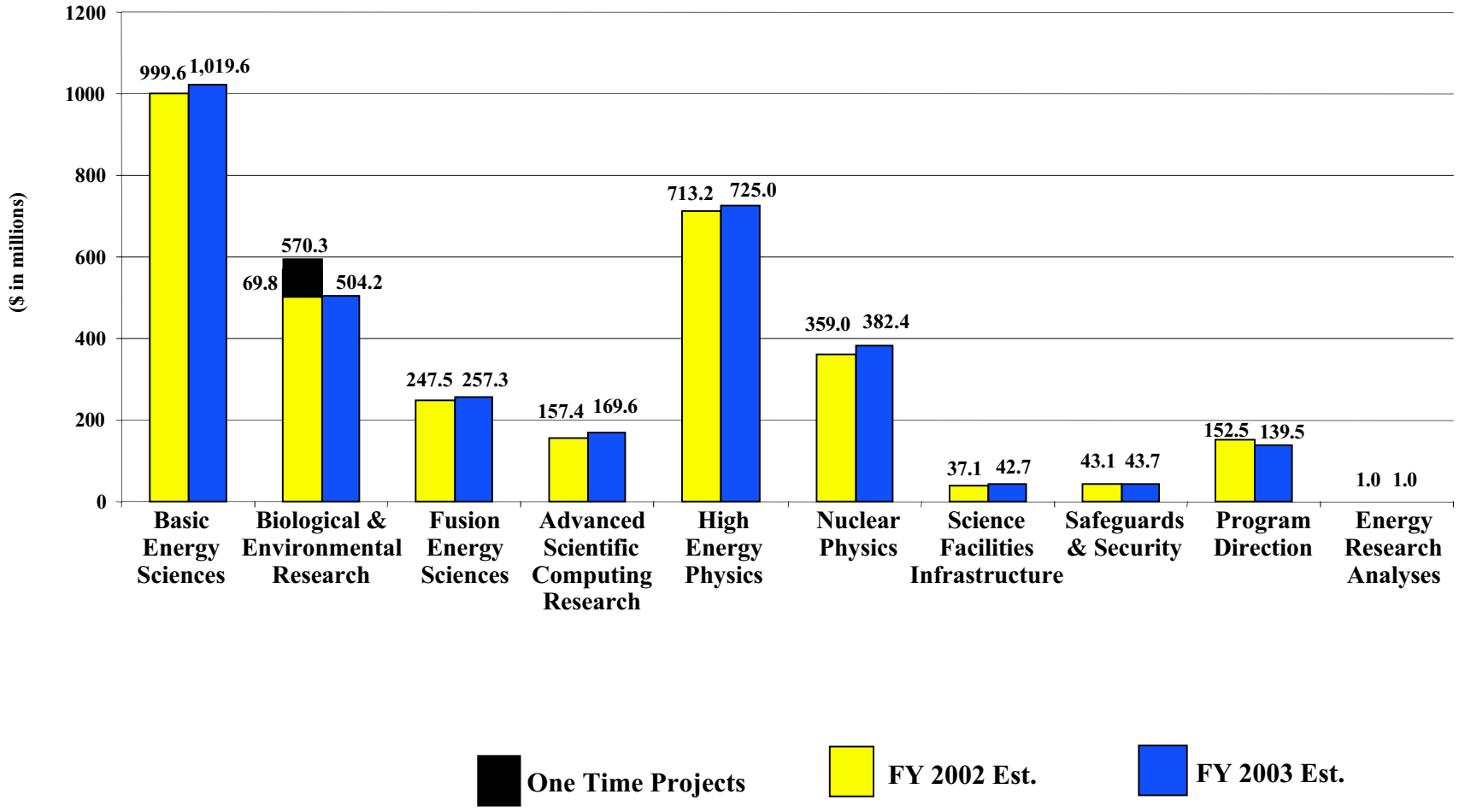
- ***Science Thrust Areas:***
  - Nanoscale Science, Engineering, and Technology ($133M, +$48M)
  - Genomes to Life ($45M, +$20M)
  - Climate Change Research Initiative ($3M, +$3M)
  - Scientific Discovery Through Advanced Computing (SciDac) ($62M, +$5M)
- ***More Operating Time and New Instrumentation at User Facilities ($1,246M, +$40M)***
- ***Improved Infrastructure ($43M, +6M)***



OFFICE OF SCIENCE
FY 2003 PRESIDENT'S BUDGET REQUEST
(B/A in thousands)

	FY 2001 Comparable Approp.	FY 2002 Comparable Approp.	FY 2003 President's Request
SCIENCE			
Basic Energy Sciences	973,768	999,605	1,019,600
Advanced Scientific Computing Research	161,296	157,400	169,625
Biological and Environmental Research	514,064	570,300	504,215
High Energy Physics	695,927	713,170	724,990
Nuclear Physics	351,794	359,035	382,370
Fusion Energy Sciences	241,957	247,480	257,310
Energy Research Analyses	950	995	1,020
Science Laboratories Infrastructure	26,887	37,130	42,735
Science Program Direction	139,861	152,475	139,479
Small Business Inn. Research and Technology Transfer	93,069	-	-
Subtotal	3,199,573	3,237,590	3,241,344
Safeguards and Security	39,081	47,609	48,127
Reimbursable Work	(4,648)	(4,460)	(4,383)
Total Safeguards and Security	34,433	43,149	43,744
Total Science	3,234,006	3,280,739	3,285,088

SC FY2003 Budget Request by Program



Fusion Energy Sciences

Science and Enabling R&D ($179M, +$5M)

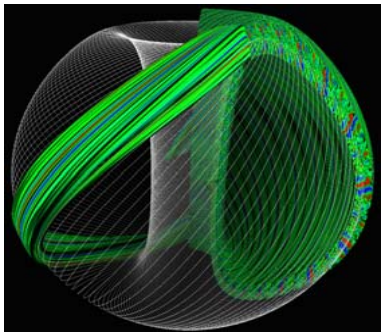
- Innovation in fusion energy, plasma science and related technologies are part of the Administration's National Energy Policy.
- Explore innovative approaches to confining, heating, and fueling plasmas.

Facilities ($68M, -$6M)

- Significantly increase operating time on three national fusion facilities to resolve issues in energy transport and plasma stability, using a variety of heating techniques.

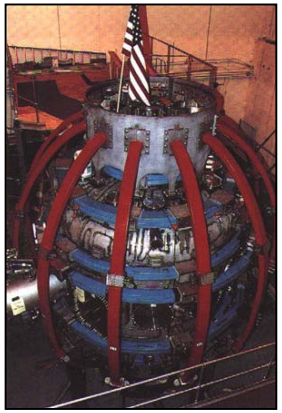
Fabrication, Engineering & Design ($11M, +$11M)

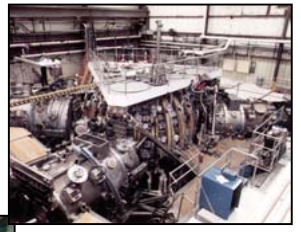
- Expand concept innovation with fabrication of the new National Compact Stellarator Experiment (NCSX) at the Princeton Plasma Physics Laboratory
  - –TEC ~ $69M, Operation 2007



Magnetic Fusion Energy Simulation

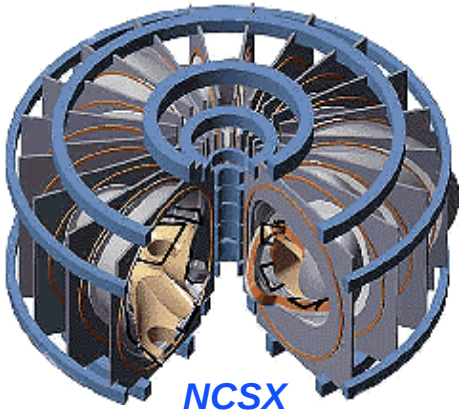
National Spherical Torus Experiment





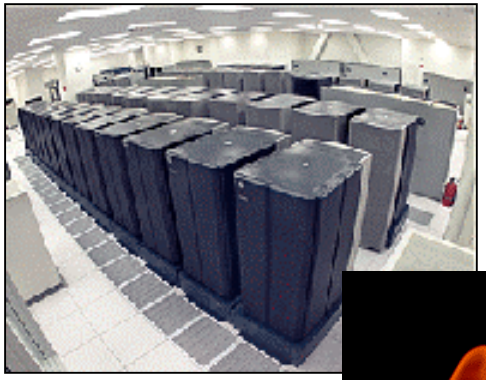
DIII-D

Alcator C- MOD

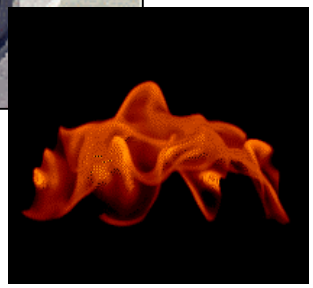


NCSX

Advanced Scientific Computing Research



NERSC IBM SP RS/6000—"Seaborg"



modeling turbulent combustion

ESNet

Mathematical, Information, and Computational Sciences ($167M, +$13M)

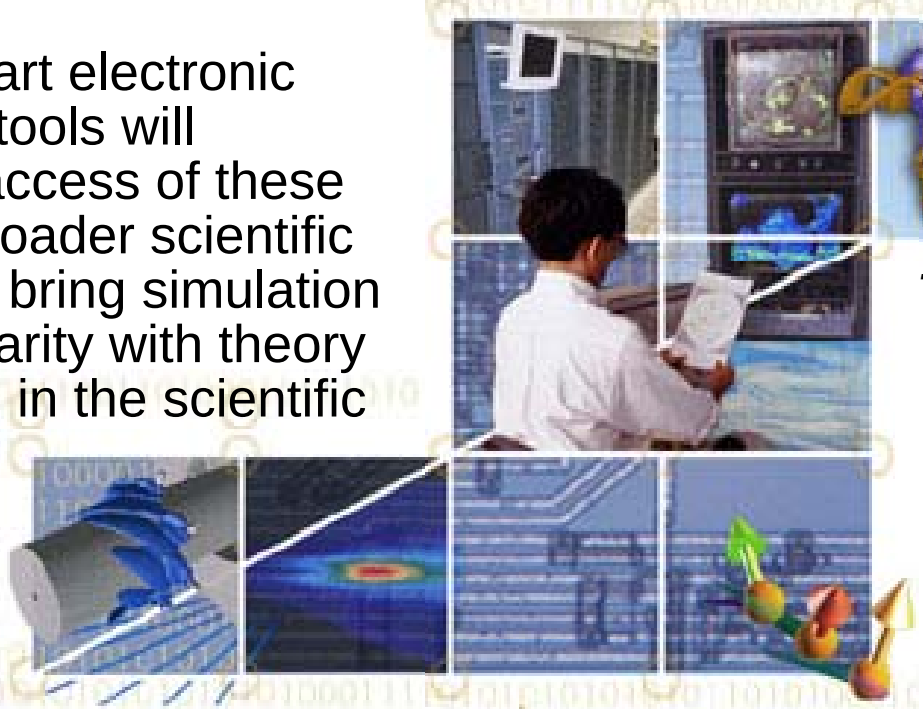
- ***Supports operation of supercomputer and network facilities available to researchers 24-7-365:***
  - National Energy Research Scientific Computing Center (NERSC),
  - Advanced Computing Research Testbeds, and
  - Energy Sciences Network (ESNet).
- ***Scientific Computing Research Investments:***
  - Applied Mathematics,
  - Computer Science, and
  - Advanced Computing Software Tools.
- ***High Performance Networking, Middleware and Collaboratory Research Investments:***
  - Networking,
  - Collaboratory Tools, and
  - National Collaboratory Pilot Projects.

Laboratory Technology Research ($3M, +$0M)

Scientific Discovery Through Advanced Computation (SciDAC)

- SciDAC brings the power of tera-scale computing and information technologies to several scientific areas -- breakthroughs through simulation.
- SciDAC is building community simulation models through collaborations among application scientists, mathematicians and computer scientists -- research tools for plasma physics, climate prediction, combustion, etc.

•State-of-the-art electronic collaboration tools will facilitate the access of these tools to the broader scientific community to bring simulation to a level of parity with theory & observation in the scientific enterprise.



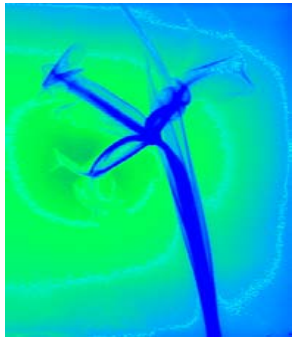
Topical Computing (TC)

- FY03 increases will reconfigure some resources at existing facilities around TC concept.
- These facilities will support applications communities to develop the operational model.
- Full-scale TC facilities will be proposed in FY-04.

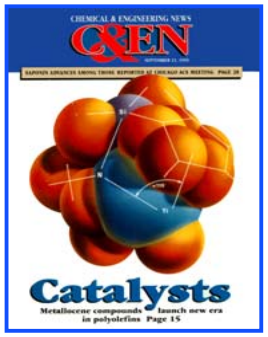
terascale computing

Hardware Infrastructure — Software Infrastructure — Collaboratories and DataGrids

Basic Energy Sciences

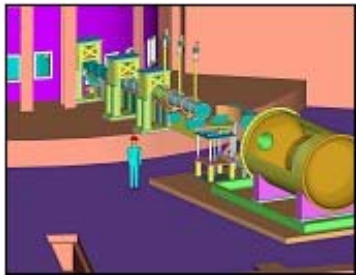


Neutron image of an iris behind granite blocks



Advanced Photon Source

Artists conception of a neutron scattering instrument



Research ($488M, +$37M)

- Science at the nanoscale: increased research in condensed matter physics and materials synthesis and processing.
- X-ray and neutron scattering: research and new instrumentation at the major user facilities.
- Other core research programs: heavy-element chemistry, separations and analysis, materials chemistry, photochemistry, combustion, and catalysis.

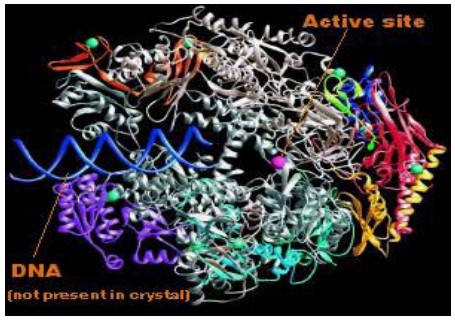
Facilities ($279M, +$10M)

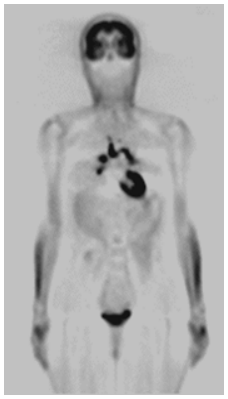
- New and upgraded instrumentation.
- Continued high level of service at major user facilities.

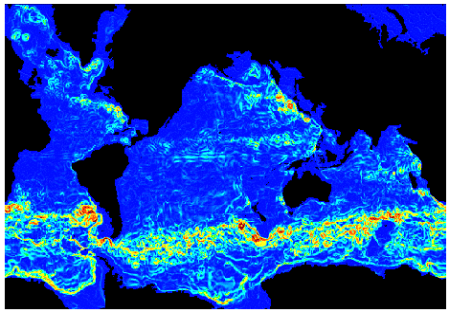
Construction, Engineering & Design

- Construction of the Spallation Neutron Source is fully funded. ($211M, -$66M)
- Nanoscale Science Research Centers (NSRC): continue engineering & design at ORNL, LBNL, SNL/LANL. (PED $11M, +$8M)
- Begin construction of the NSRC at ORNL. ($24M, +$24M)
- The Linac Coherent Light Source at SLAC begins

Biological & Environmental Research







Research

- Genomes to Life will enable revolutionary advances in energy supply, greenhouse gas mitigation, and environmental cleanup. ($37M, +$15M)
  - Bioterrorism detection/defeat. ($3M, +$1M)
- The Human Genome Program will provide high quality complete sequence of Chromosomes 5, 16, and 19. ($90M, +$2M)
- Climate Change Research underpins the President's initiative. Research and observations will improve climate models and understanding of the global carbon cycle. ($126M, +$6M)
  - Climate Change Research Initiative. ($3M, $3M)
- The Environmental Management Science Program is transferred from the Office of Environmental Management. ($30M, -$7M)
- Boron Neutron Capture Therapy. ($5M, -$5M)

Nanoscale Science Research Centers (NSRCs)

Facilities for fabrication, assembly, and characterization of objects at the nanoscale

- NSRCs are highly collaborative, multidisciplinary research centers and user facilities for the the fabrication and study of materials at the nanoscale.
- Project Engineering and Design funding ($11M) is provided for three NSRCs at Oak Ridge National Laboratory (ORNL), Lawrence Berkeley National Laboratory (LBNL), and Sandia National Laboratory (SNL)/Los Alamos National Laboratory (LANL)
  - *Equipment and capabilities of the NSRCs are being determined based on input from the scientific user community. NSRCs at ORNL and SNL/LANL held widely advertised and heavily attended workshops (200-300 attendees) in 2001. A workshop for the NSRC at LBNL is scheduled for spring 2002.*
- Construction funding is provided for the Center for Nanophase Materials Sciences (CNMS) at ORNL ($24M). The facility will be collocated with the Spallation Neutron Source on Chestnut Hill at ORNL.

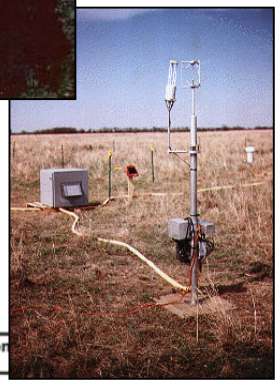
"Wet" and "dry" materials synthesis and characterization labs; high-resolution scanning probe microscopes adjacent to Nanofabrication Research Laboratory; office space for staff and visitors

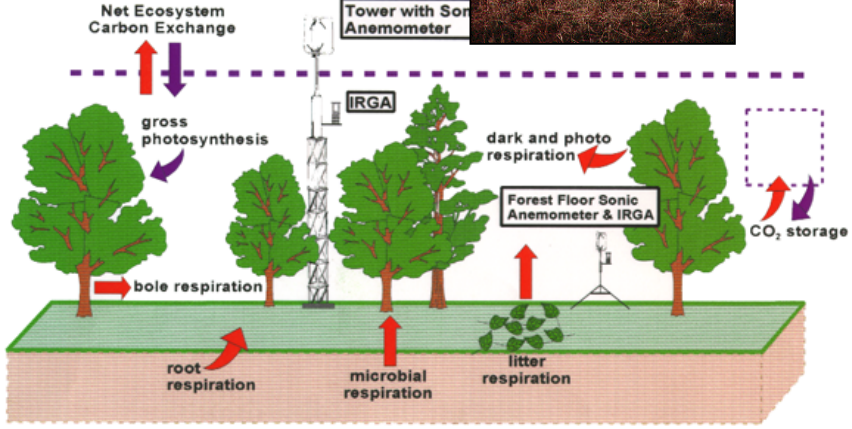
Nanofabrication Research Laboratory containing clean and environmentally controlled rooms; electron microscopes; nanoscale patterning (e-beam writer /lithography); facilities for manipulation and integration of soft and hard materials

Climate Change Research Initiative

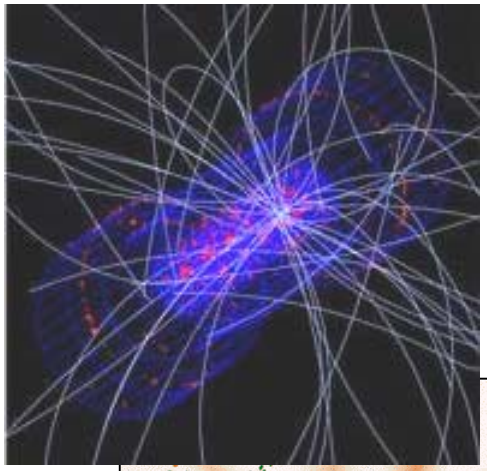
CCRI is a multi-agency activity to address specific high priority climate change uncertainties. In FY 2003 we will:

- Expand AmeriFlux facilities to quantify regional- and continental-scale carbon sinks and enable flux measurements in locations that correspond with planned campaigns to estimate regional carbon fluxes.
- Expand measurements at existing AmeriFlux facilities to independently verify estimates of net carbon exchange.
- Enhance user facilities for carbon cycle research.
- Expected outcomes include:
  - Quantification of the location and magnitude of the North American carbon sink and identification of environmental factors affecting the sink.
  - Information on how to enhance carbon sequestration in terrestrial ecosystems through purposeful management.

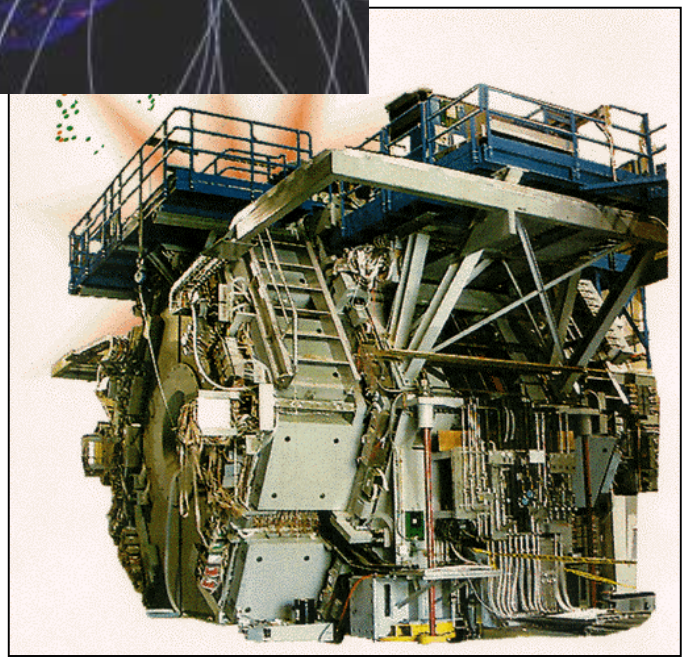




High Energy Physics



Collision event from CDF at Fermilab



B-Factory Detector at SLAC

Research & Technology ($258M, +$14M)

- Emphasize the window of opportunity for answering two key questions about matter and energy:
  - The origin of mass - the Higgs Boson?
  - The absence of antimatter in the Universe – Charge-Parity Violation?
- Increase support for university scientists collaborating on high-priority experiments

Facilities ($446M, -$11M)

- Enhance capabilities for Tevatron Run II at Fermilab.
- Increase operating time and capability upgrades for the B-Factory at SLAC.

Construction ($20M, +$9M)

- Neutrinos at the Main Injector (NuMI)

Nuclear Physics

Highest Priority Given to Enhancing User Facility Operations

Low Energy Nuclear Physics ($66M, +$4M)

- Structure of nuclei, nuclear reaction mechanisms, and fundamental symmetries – including neutrino oscillations.

Medium Energy Nuclear Physics ($124M, +$6M)

- Nature's fundamental building blocks – quarks & gluons – how they bind together to form the protons & neutrons of atomic nuclei.
  - Continuous Electron Beam Accelerator Facility at TJNAF

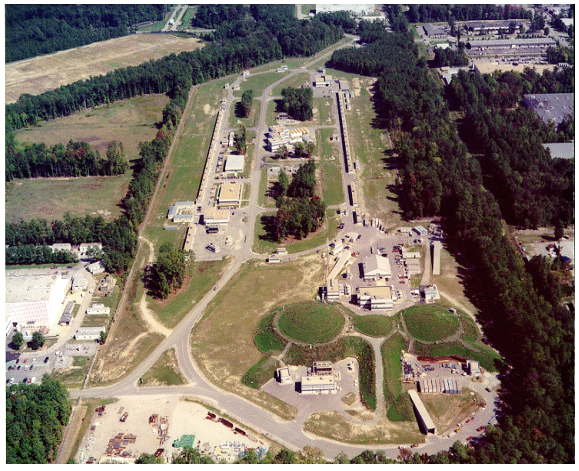
Heavy Ion Nuclear Physics ($168M, +$12M)

- Properties of nuclear matter over range of conditions created in nucleus-nucleus collisions.
- Attempt to synthesize an extreme form of matter that only existed for a fraction of a second at the Big Bang – the Quark-Gluon Plasma.
  - Relativistic Heavy Ion Collider at Brookhaven

Nuclear Theory ($24M, +$2M)

- Characteristics of atomic nuclei and nuclear matter and the fundamental forces involved.

Relativistic Heavy Ion Collider (RHIC)



Thomas Jefferson National Accelerator Facility (TJNAF)

Infrastructure

- Challenge: aging facilities at ten science laboratories.
- The FY 2003 budget increases funding for critical infrastructure improvements and supports removal of excess facilities.
  - Line Item Construction ($33M, +$10M)
  - Payment in Lieu of Taxes ($1M, +$0M)
  - Oak Ridge Landlord ($5M, +$1M)
  - Excess Facilities Disposition ($5M, -$5M)
- These vital funds position DOE to provide world class science in the 21st century, while reducing the costly footprint of worn-out or obsolete buildings/utility systems.

The growing importance of
management to Science's programs:

The President's Management Agenda

Jack Marburger, AAAS, Feb. 15, 2002

“ . . . The President’s budget makes much of management, and proposes many measures that are not particularly designed to save money so much as to optimize its impact . . . the growth in opportunity requires better decision making.

I support these science management initiatives. . . ”

- The President's Management Agenda of August 2001 and the FY 2003 Budget Request place priority on budgeting and managing all Federal programs for results.

- The Administration is focusing on improving the performance of all R&D programs.

- For DOE, preparation of the FY 2004 budget will base investment decisions on transparent investment criteria.

  The Administration is using the DOE Energy programs as a pilot to develop investment criteria for applied R&D programs.

  The Administration also recognizes that the goals and methods of basic research are different from those for applied R&D, and is working to define an appropriate set of criteria.

How is SC Measuring Up?

Program	***Assessment***	***Explanation***
National Nuclear Security Administration—Naval Reactors	***Effective***	Outputs are identifiable and make key contributions to national security. Delivery schedules are consistently met. Contracts have positive and negative incentives, and include performance requirements
National Nuclear Security Administration—Weapons Activities	***Moderately effective***	Certifies safety and reliability of nuclear weapons stockpile and maintains a high-quality scientific capability. However, it needs to improve its long-range planning and resource allocation process and better link stockpile requirements to available resources.
Defense Environmental Restoration and Environmental Management	***Ineffective***	Many sites are behind schedule for cleanup. Completion costs are escalating. "Compliance agreements," signed before the breadth of problems was known, make it difficult to effectively manage the program.
Office of Science	***Effective***	Supports world-class basic research. Effectively operates a large suite of scientific user facilities.
Fossil Energy R&D	***Ineffective***	Broad mission, lack of investment criteria and unmeasurable performance goals allow for funding of virtually any project. This leads to corporate subsidies. Program has contributed little to improving the prospects for new energy technology.
Nuclear Energy, Science and Technology	***Ineffective***	Resists competitive, peer-reviewed research awards. Resource allocation does not support priorities identified by external experts

Source: The Budget Request for Fiscal Year 2003, U.S. Department of Energy: Status Report on Selected Programs:

BESAC is issuing a report on performance measurement.

It can help SC integrate the SC budget with performance measures.

It is informing the discussion at the Workshop on Investment Criteria for Basic Research, Feb. 27, 2001, sponsored by the Committee on Science, Engineering and Public Policy (COSEPUP) of the National Academy of Sciences.

It can inform future management reviews.