DEPARTMENT OF ENERGY
FY 1999 PRESIDENT'S BUDGET REQUEST
OFFICE OF ENERGY RESEARCH

The FY 1999 budget request for the Office of Energy Research (ER) contains a $246 million increase above FY 1998. This increase will permit initiation of the Spallation Neutron Source (SNS), the first world class neutron source built by the United States in more than 30 years. The increase will also sustain the availability of the Department of Energy's (DOE) other unique scientific user facilities that serve the DOE missions as well as other national research needs. Within the proposed budget, ER will build on its existing programs to undertake increased efforts in areas of science that support efficient new technologies for the production and use of energy as well as the sequestration of carbon. The University and Science Education program will enable DOE to utilize the human and scientific assets of its National Laboratories to inspire and educate young scientists and engineers from the elementary grades through undergraduate school. These new efforts, along with the base ER program meet the mission and goals of the office within the Department of Energy.

Mission and Goals

The mission of the Office of Energy Research is to produce the scientific and technical knowledge needed to develop energy technology options, to understand the health and environmental implications of energy production and use, to maintain U.S. leadership in understanding the fundamental nature of energy and matter, to provide and operate the large-scale facilities required in natural sciences, to ensure a U.S. leadership position in the search for knowledge, and to support the availability of scientific talent for future generations.

The DOE Strategic Plan

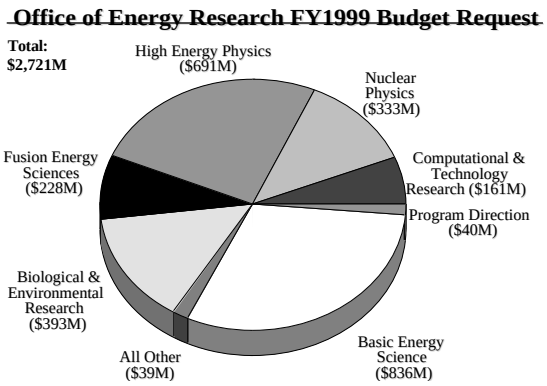


Figure 1

The ER budget is the Department of Energy's investment in basic science. ER directs the long-term, basic research programs that support the Department's mission for national energy needs, environmental management, and national security. ER's FY 1999 budget request, depicted in Figure 1 and Table 1, is structured to meet our mission consistent with DOE goals and strategies.

The Department of Energy is a science agency because its mission and goals require technologies and scientific knowledge far beyond that which is currently available. From safeguarding the nuclear stockpile to ensuring our Nation's energy supply for the next century, the DOE continues to challenge the frontiers of science and technology. The DOE Strategic Plan outlines the vision, goals and strategic objectives that will, through leadership in science and technology, help the DOE to meet those challenges. In keeping with the Government Performance and Results Act (GPRA), ER's FY 1999 budget request includes program specific goals, strategies, and measures that focus our research activities and ensure continuity with Departmental plans and national goals. These

measures and mechanisms will continue to be refined with use and as we benchmark our activities against the other federal science agencies and the best of the private sector.

ER's nationally and internationally recognized research programs support national laboratory, university, and industry based research in five key areas: High Energy and Nuclear Physics, Biological and Environmental Research, Basic Energy Sciences, Computational and Technology Research, and Fusion Energy Sciences. This support entails thousands of individual projects at hundreds of research facilities across the United States. As a result, the programs help to expand the Nation's human and intellectual resources, continuously replenishing the Nation's capabilities for scientific and technological innovation. In addition to this diverse research portfolio, ER plays a unique role in providing researchers, professors and students nationwide with access to the large-scale, state-of-the-art research equipment and scientific user facilities that are critical to their scientific work.

ER strives to be the premier basic research organization in the basic energy and natural sciences in order to contribute to a more secure energy future with a clean environment, a healthy citizenry, and a strong economy including the ability to meet future challenges. Consistent with the Department's Strategic Plan, ER's five strategic goals, listed in Figure 2, help us to realize that vision. These goals sustain our longstanding tradition of emphasizing scientific excellence in partnership with other organizations that are dedicated to advancing energy and supporting science. Achieving these goals will help to provide the Nation with the range of energy and policy options necessary for future prosperity.

For over 50 years, ER and its predecessor organizations, have demonstrated an unwavering commitment to the pursuit of cutting-edge scientific research. More recently, ER has committed to forging more

The Energy Research goals are:

- Enable the United States to uphold and enhance its world leadership in science, mathematics and engineering needed by all sectors of the Nation to enhance energy productivity and ensure reliable energy services while preserving human and environmental heath and safety.
- Obtain major new insights into the nature of energy and matter to better understand our natural world.
- Provide the best and most advanced scientific research facilities and infrastructure to advance science, improve existing energy options and create new energy choices.
- Ensure that ER programs are of the highest quality and are highly productive; that they strengthen and diversify the Nation's scientific work force; and that research and results are widely known, valued and trusted.
- Ensure that ER activities are protective of our workers, the public and the environment.

Figure 2

effective partnerships that leverage our research investments and connect us more closely with other federal science programs and the direct beneficiaries of our research. ER is fostering new kinds of partnerships among its national laboratory, university and industry based researchers to maximize the effectiveness and impact of research activities. In partnership with the Department's applied programs, ER is also working to bridge the gap between basic research and application to ensure the continued relevance of our research portfolio and maximize the return on the taxpayers' investment. These partnerships include: joint planning of long-term research; joint solicitations and funding of

targeted research efforts; and annual integration workshops that bring together program managers from across DOE.

Strategies

- *Ensure excellence in research.* ER emphasizes initiation of proposals by investigators and selects the best using peer review. Scientific advisory committees use the scientific and technological communities to help identify the most important areas of research to support and the most efficient methods of support. ER program managers measure research quality within scientific areas through periodic evaluations using external technical experts. For excellence in the future, we reach out to improve the quality of and access to science, mathematics, and engineering education.

- *Support science with a purpose.* Throughout 1998, ER will conduct a series of planning activities designed to ensure the continued relevance of our research program to DOE missions and national needs. These activities will result in selected roadmaps to guide our research program and enhance connectivity between the Department's basic and applied research efforts.

- *Coordinate research on complex national problems important to DOE missions*. ER programs coordinate and fund multidisciplinary research at universities and the national laboratories on complex national problems requiring a long investment horizon to find satisfactory solutions. Joint programs and partnerships are ongoing in such areas as environmental management, human genome, and global climate. In FY 1999 ER will expand partnerships and coordination.

- *Provide major scientific facilities.* ER supports large, sophisticated research facilities that are too expensive for a single institution, or group of institutions, to build in support of the Department's and the Nation's science and technology goals. These facilities are selected and designed to meet the highest priority research goals of the scientific community. ER is dedicated to optimizing the utilization, safety and scientific value of existing facilities while ensuring forefront capability.

DNA Sequencing - *high throughput sequencing facility*

- *Continuously improve the quality of administrative processes.* Increase ER effectiveness and productivity by improving program management practices using performance based contracts with our laboratories, strategic plans, goals, measures and metrics to focus and track our research programs. Quality improvements include leveraging resources through partnerships.

Success stories

ER has achieved great success in advancing science, DOE missions, and the welfare of the Nation. Each year, ER research and investigators have been recognized by national and international scientific societies, magazines, and prizes. For example, Paul Boyer, supported by ER and its predecessor organizations for over 30 years, was awarded the 1997 Noble Prize in Chemistry for his work on "elucidation of the enzymatic mechanism underlying the synthesis of adenosine triphosphate" (ATP). ATP is frequently called the "energy currency" of the cell because the energy cycle of all biological organisms involves this central molecule.

Each year *Science* Magazine lists the top ten significant developments in scientific research. The 1997 list included three topics strongly supported by ER programs - synchrotrons, fullerenes and genomes. Richard Smalley's Noble Prize winning discovery of fullerenes continues to generate exciting science at the nano- (one billionth of a meter) scale, such as Lawrence Berkeley National Laboratory's nanotubes. Microbial genome research, that builds on our capabilities and contributes to our mission, has contributed to "what once seemed a pie-in-the-sky goal--analyzing whole genomes". Third generation synchrotron radiation sources, the Advanced Photon Source and the Advanced Light Source were called out for enabling breakthroughs in the structure of materials.

The Advanced Photon Source (APS) completed its first year of operation in 1997. The floor of the APS was filled with experiments many of which could not have been conducted anywhere else. Results are beginning to flow out of those experiments in many fields including: materials science and condensed matter physics, biological sciences, plant and environmental sciences, and geosciences. For example, a new structural determination and biochemical analysis of the human fragile histidine triad (FHIT) protein was performed at the APS during its first year of operation. This protein derives from a fragile site of human chromosome 3 that is commonly disrupted in association with cancer development. The unique capabilities of the APS are advancing our understanding of this tumor suppressor protein and a great many other scientific mysteries.

ER's advanced materials research is also contributing to human health. A new sensor (figure 3) has been invented that makes it possible to instantly and inexpensively detect a wide range of biological toxins and common disease-causing organisms such as cholera and the botulism toxins, similar to those recently discovered in fruit and fast food hamburgers, that are responsible for hundreds of American deaths each year. Existing tests require a 24 hour culture, but with development, the new sensors could be placed on packaging for instant and simple identification of contaminated foods and materials.

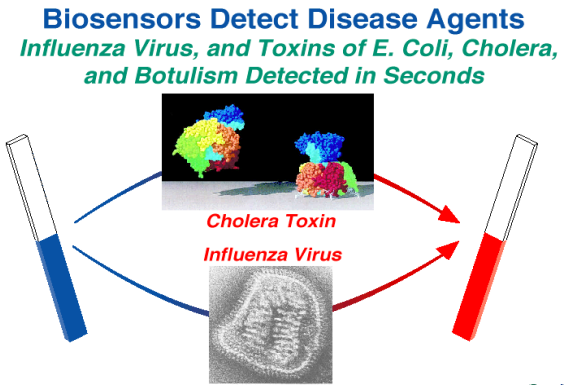


Figure 3

In 1997, the *Wall Street Journal* recognized another ER material- aerogel films. A breakthrough in the processing of ceramic aerogel films overcame a 60 year barrier to large scale production and utilization of this material. Aerogels have a foam-like structure with exceptional lightness and transparency, and make ideal insulating materials for double-pained windows and other applications.

Research from the 1997 field experiments of the Atmospheric Radiation Measurement Project included atmospheric measurements in the arctic region near Point Barrow, Alaska taken in collaboration with the National Science Foundation. This coordinated research will help to improve current climate models and will contribute to our understanding of global climate change.

The William R. Wiley Environmental Molecular Sciences Laboratory (EMSL), a unique scientific user facility for molecular-level research in environmental and life sciences, was officially dedicated at Pacific Northwest National Laboratory in FY 1997. In addition to its potential for breakthrough research in environmental sciences and remediation technologies, EMSL has advanced the concept of "virtual and remote" laboratory research.

Building on some of the successes mentioned last year, ER research has taken the Noble prize winning buckyballs, which continue to open up new areas of chemistry, and has created "buckybowls" and other fullerene structures for the development of new materials. In addition, last years sequencing of the Archea *Methanococcus Jannaschii* - a third branch of life - enables scientists to develop procedures for manipulating the genes involved in Methane (natural gas) production. This advances our understanding of the nature and properties of these organisms and holds the potential for bioproduction of methane as a renewable energy source.

Research at ER's high energy physics laboratories has resulted in the most precise measurements ever made of key particles and interactions supporting the Standard Model including: the Top Quark, W Boson, and Weak Mixing Angle. Full operation of the superconducting accelerator at the Thomas Jefferson National Accelerator Facility is accumulating data and research results that further our understanding of the sub-atomic world.

DOE and NSF have completed negotiations with the European Physics Lab CERN regarding contributions to the Large Hadron Collider (LHC) accelerator and detectors as part of the U.S. participation in the LHC program. Participation will provide U.S scientists with continued access to the forefront high energy physics facilities in the next decade.

Initiatives for FY 1999

The initiatives that the Office of Energy Research will undertake in FY 1999 are listed in figure 4 and described below.

The Spallation Neutron Source - The U.S. currently lags far behind both Europe and Japan in neutron research capability and planned foreign neutron sources threaten to further increase their lead. The importance of neutron science for fundamental discoveries and technological development has been enumerated in all of the major materials science studies over the past two decades, including the National Research Council's 1984 study "Major Facilities for Materials Research and Related Disciplines" (the Seitz-Eastman Report).

The unique information that neutrons provide about the hundreds of materials that we use every day affects us all. For example, chemical companies use neutrons to make better fibers, plastics, and catalysts; drug companies use neutrons to design drugs with higher potency and fewer side effects; and research on magnetism has led to higher strength magnets for more efficient electric generators and motors and to improve magnetic materials for magnetic recording tapes and computer hard drives.

ER is addressing the current situation in two ways: first by effecting modest upgrades of existing reactor and spallation neutron sources within the Basic Energy Sciences program; and second by planning the next-generation, pulsed Spallation Neutron Source (SNS) that will meet the future neutron scattering needs of the United States research community.

The SNS will provide about 1 megawatt power or around six times that currently available worldwide. The new facility will serve over 1,000 users per year and provide expanded capabilities for research

FY 1999 Initiatives

- The Spallation Neutron Source
- Climate Change Technology Initiative
- Scientific Facilities Utilization
- The Next Generation Internet
- University Science Education

Figure 4

in physical, chemical, materials, biological, and medical sciences. On August 19, 1996, the Secretary of Energy reviewed and approved the Justification of Mission Need for the SNS. Conceptual design work and R&D began in FY 1996 and was completed in June of 1997, taking into account the recommendations of the scientific community.

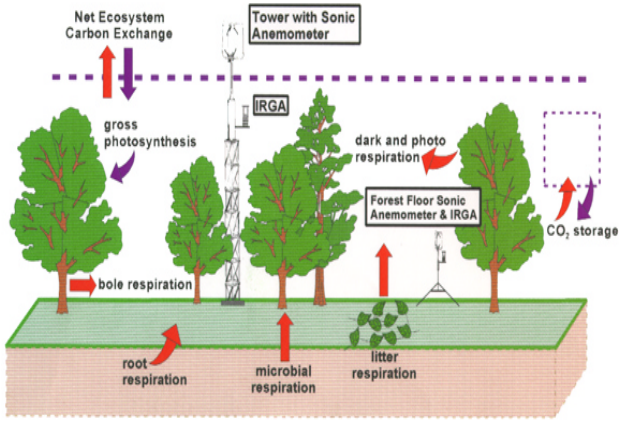
The SNS Total Project Cost (over 7 year schedule) is $1,333 million. In August of 1997, ER's Division of Construction Management reviewed the Design with a team of 60 experts and concluded that the design was credible and the costs reasonable. The DOE Independent Cost Estimate done by Burns and Roe, validated the cost to within (less than) 1%. On December 23, 1997, the Secretary reviewed and approved the SNS Baselines.

The SNS project is an excellent example of an interlaboratory effort that uses the DOE laboratories as a system. Under DOE leadership, Oak Ridge National Laboratory is responsible for the project with participation from Lawrence Berkeley National Laboratory, Los Alamos National Laboratory, Brookhaven National Laboratory, and Argonne National Laboratory. The laboratories have been working together most effectively and critical R&D is proceeding smoothly.

The Environmental Impact Statement (EIS) for the SNS began with the Notice of Intent published on July 25, 1997. Public scoping meetings have been held at Oak Ridge, Argonne, Los Alamos, and Brookhaven. There were no issues affecting the EIS at any of these meetings. The final EIS is expected in July of 1998. The Project Execution Plan has been prepared and MOU's among all of the parties have been drafted. A workshop on industrial applications is scheduled for March 3-4 of 1998.

We are organizing our management, in the labs, the field offices, and headquarters, to be ready for prompt initiation of the project in FY 1999. Key lab management positions have been filled and development of the Cost and Schedule Control System is proceeding as planned. A Steering Committee has been formed, consisting of distinguished members of the neutron science community, to provide input on instrumentation and user needs.

Climate Change Technology Initiative - Energy drives our economy but also challenges environmental stewardship locally, regionally and globally. About 85% of manmade greenhouse gas emissions are associated with energy production and use. To control or reduce these emissions we must rethink our use of carbon based fuels. New technologies for efficient conversion, sequestration, or use of renewable fuels will be key. The foundation for both technology and policy innovation is new knowledge. Building on existing programs and capabilities, DOE is proposing a significant increase in energy-related science and technology programs.



ER contributions to the Department initiative will include research directed at the themes of: science for efficient technologies; low-carbon science; and sequestration science. The new research efforts in carbon management, as well as existing activities, will be closely related to DOE's technology programs and will provide the knowledge base for the development of advanced technologies to reduce carbon dioxide emissions. Many activities will impact the Office of Energy Efficiency

and Renewable Energy by providing technology options for increasing efficiency and reducing energy consumption. The basic research program will also provide the knowledge base needed to increase the use of renewable resources and alternate energy sources. Other aspects of the research program impact the Office of Fossil Energy by providing a foundation for effective and safe underground sequestration, new materials, a better understanding of combustion, and improved catalysts.

The ER part of the Climate Change Technology Initiative will provide the science base for new technologies that will lead to a reduced atmospheric concentration of greenhouse gases. For example: fundamental materials science will be used to develop low-friction, lightweight, and nano-scale materials that improve energy efficiency; biomimetic (biological-mimicking) chemistry, biochemistry, and molecular genetic analysis will promote low- and non-carbon emitting energy sources; catalysis research will be used to advance energy efficient chemical processes; and the natural sequestration processes of ecological systems will be explored for possible enhancements. These topics and our integration approach flow naturally from the recommendations of the "11 Lab Study", that incorporated findings from the ER workshops reports entitled *Carbon Management: Fundamental Research Needs Assessment*, and the President's Committee of Advisors on Science and Technology (PCAST) report on Energy R&D entitled *Federal Energy Research and Development for the Challenges of the Twenty-First Century*.

This initiative will study areas of carbon cycle management, including areas jointly identified and implemented by the BER and BES programs. In addition to solicitations for individual research projects, proposal notifications will be developed jointly with the DOE energy technology programs with the possibility of establishing multi-disciplinary centers at universities and National Laboratories and enhanced use of major scientific user facilities and scientific computation, modeling and simulation in support of Climate Change Technology.

Scientific Facilities Utilization - To meet the demand for operating time and to improve research capabilities at existing facilities, the Science Facilities Initiative began in Fiscal Year 1996. In FY 1999, this initiative will enable ER to sustain or increase the utilization of 23 scientific user facilities nationwide.

The user community is extremely pleased with the results of the Science Facilities Initiative as seen in many letters and customer surveys. However, the full impact of the Initiative has not yet been realized since new beamlines and instrumentation are not yet fully operational. Many of the instrument funding commitments are spread over multiple years and continued support in FY 1999 is important to the success of this Initiative.

This FY 1999 budget request continues to strongly support the Scientific Facilities Utilization initiative in the following programs: Basic Energy Sciences, High Energy Physics, Nuclear Physics and Biological and Environmental Research. Each year, over 15,000 university, industry, and government sponsored scientists conduct cutting edge experiments at these large and small user facilities that include particle accelerators, neutron sources, synchrotron light source, and smaller facilities.

The Next Generation Internet - Key to the solution of large complex multidisciplinary problems is the ability to maintain strong communications and collaborations between researchers in remote locations. As the complexity of the problem grows, it increases the need to communicate and transmit massive amounts of data. DOE's science and technology intensive mission demands increasingly complex

collaborations that include distributed computing, national collaboratories, and remote access to facilities. As a result, DOE's projected data transmission requirements of about a thousand-trillion bytes per year (peta bytes/year) will critically stress existing internet capabilities.

The Next Generation Internet (NGI) program was developed to address the existing and projected challenges to Internet capabilities. DOE's science and technology activities and their reliance on internet technology makes success of the NGI initiative critical to the success of DOE's mission. ER participation in the NGI initiative will advance the DOE mission and the interagency initiative will benefit from more than 24 years of DOE experience as a user and developer of advanced networks.

DOE currently utilizes advanced networks to provide thousands of remote users nationwide with access to its large, unique computer facilities. In addition, DOE uses the internet to link researchers in universities, laboratories, and industry who are working to solve the multidisciplinary problems that underpin the DOE mission. These problems include computing the effects of greenhouse gases on global warming, designing the next generation of clean diesel engines, and guaranteeing the safety of the nuclear stockpile.

The proposed DOE NGI program for FY 1999 has the following three components. First, a core program of networking and advanced applications R&D that builds on the Department's successful networking R&D, DOE 2000's national collaboratory tools and pilot projects, and ESnet interconnections with other networks. Second, strategic enhancements that include work on very high speed optical networks, operating systems improvements that take full advantage of advanced networks, and an "OC-12" high speed link (622mb/s) ESnet infrastructure linking several DOE labs. The third element is the DOE University Applications Consortia which represents a significant change in the way in which we partner with universities. Under the new approach, we will solicit proposals from consortia of researchers, labs and network providers to build flexible networked application testbeds that provide an integrated network view to the applications scientists.

ER's NGI initiative builds on DOE's expertise in integrating advanced technologies into mission-critical applications as well as ESnet's demonstrated effectiveness in providing services that cross administrative and network boundaries.

University and Science Education -The ER programs support university faculty, graduate students and post-docs in specific areas as part of their ongoing research efforts. ER also operates its unique research facilities for the peer reviewed use of university scientists. The scientific and technical challenges of the DOE missions demand the availability of an adequate and diverse supply of excellent scientists, engineers, and technicians. Therefore, the Department, also uses the resources of its national laboratories to provide hands-on research opportunities to undergraduate students and faculty, and to K-12 teachers to contribute to the national effort to improve math and science education.

In line with this educational philosophy ER's FY 1999 budget includes a modest request to support University and Science Education (USE) programs aimed at maintaining a diversity of students in the science pipeline from small colleges and universities and minority serving institutions across the country. The Department has requested $15 million to reestablish this effort and provide a focus for DOE corporate investments in the next generation of scientists and engineers in support of DOE missions. The proposed USE program will support activities that utilize DOE resources in partnership with other agencies thereby ensuring against duplication of efforts. By opening its laboratories to

students and teachers, providing them with hands-on research opportunities, utilizing and advancing the Internet and other technical tools, DOE fills an important gap in math and science education across the Nation.

Major Program Activities for FY 1999

Basic Energy Sciences - In support of DOE's missions in energy and the environment, the Basic Energy Sciences (BES) program will continue to be one of the Nation's foremost sponsors of fundamental research in materials sciences, chemical sciences, geosciences, plant and microbial sciences, and engineering sciences. BES will also continue to provide premier national scientific user facilities to researchers from academia, industry, government and other laboratories

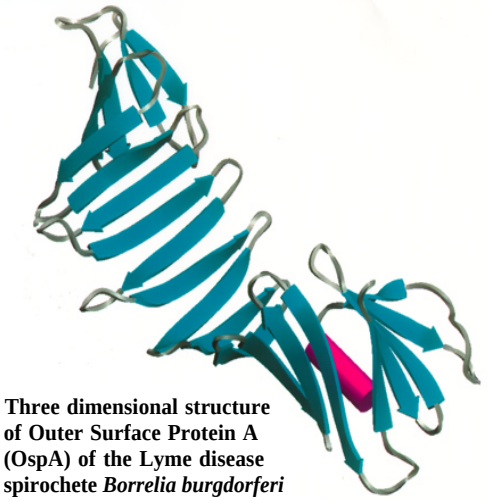
To maintain a strong U.S. position in the field of neutron science, the BES program will continue to support selected enhancements of existing reactor and spallation neutron sources and will proceed with the construction of the Spallation Neutron Source (SNS).

Other neutron science enhancements include the fabrication of instrumentation for the short-pulse spallation source at the Manuel Lujan Jr. Neutron Scattering Center at the Los Alamos Neutron Science Center and scheduled maintenance of the ORNL High Flux Isotope Reactor, including replacement of the beryllium reflector and improvements to the beam tubes and monochromators that will significantly increase thermal neutron flux to the instruments.

Within the base research effort, a program in Complex and Collective Phenomena will be initiated to support work at the frontiers of basic research. This new effort will help to bridge the gap between an atomic level understanding (reductionist view) and a continuum mechanics understanding (classical view) of complex and collective phenomena. In addition, a Partnership for Academic-Industrial Research (PAIR) program will be initiated to encourage and facilitate research partnerships between academic researchers, their students, and industrial researchers.

In addition, BES partners with all appropriate DOE technology offices to ensure awareness and application of research results. BES programs are influenced by the needs of the technology offices resulting in a great many joint activities. For example, in November, 1997, more than 30 program staff from the Office of Energy Research (ER) -- primarily from BES -- and from EE Offices of Utility Technologies and Transportation Technologies met to discuss programs in biomass, wind energy, photovoltaics, hydrogen, and solar photoconversion. Follow on meetings between program managers in both offices are ongoing for identification of research needs and gaps to further define priority research opportunities for both offices.

Biological and Environmental Research - The Biological and Environmental Research (BER) program supports basic research and facilities that contribute to a healthy citizenry, environmental cleanup, and our understanding of the global environment through programs in the life sciences, environmental processes and remediation, medical applications and measurement sciences.



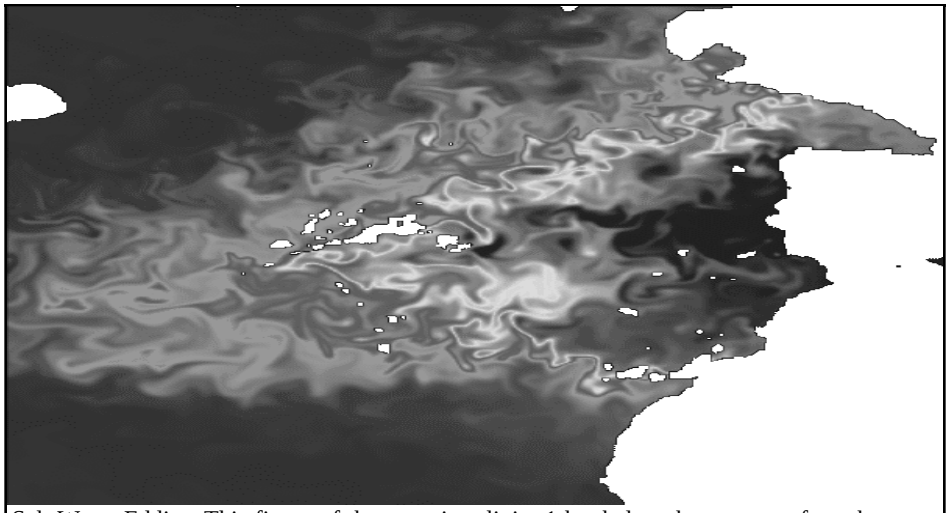
Three dimensional structure of Outer Surface Protein A (OspA) of the Lyme disease spirochete *Borrelia burgdorferi*

BER will contribute to a healthy citizenry by emphasizing high-throughput DNA sequencing methods for the human genome program. The new Joint Genome Institute, which integrates the activities of the human genome centers at Los Alamos, Lawrence Livermore, and Lawrence Berkeley National Laboratories, will enable ER to accomplish about one third of the U.S effort to sequence all 3 billion base sequences of the human genome by the year 2005. In addition, BER will pursue structural biology and innovative imaging methodologies for medical diagnosis and treatment. BER's low dose rate exposure activity provides the scientific basis for understanding exposures and risks to humans, associated with low level radiation and chemical exposures. This information is critical to the accuracy of risk assessment for low exposure levels.

In support of DOE's environmental mission, the William R. Wiley Environmental Molecular Sciences Laboratory (EMSL), will provide a unique scientific resource for research in environmental remediation that will underpin safe, cost-effective environmental remediation methods and technologies. The Natural and Accelerated Bioremediation Research (NABIR) program will conduct basic research in bioremediation, complementing ongoing efforts in pollution prevention.

BER will strengthen collaborations with the Office of Environmental Management and the Office of Energy Efficiency and Renewable Energy through joint planning and funding of research. For example, in partnership with the Office of Environmental Management, BER performs fundamental research that addresses problems in environmental management, remediation, and restoration that are intractable without new, fundamental scientific information and technologies.

Computational and Technology Research - The Computational and Technology Research (CTR) program conducts a forefront integrated



Salt Water Eddies: This figure of the oceanic salinity 1 km below the ocean surface shows eddies forming in very salty water flowing out of the Mediterranean Sea, in a simulation made with the Los Alamos Parallel Ocean Program. The LANL CM-5 was used to carry out the highest resolution simulation ever made of the north Atlantic Ocean: 11 km (1/10=B0) at the equator down to 3 km (at 73=B0) N on a Mercator grid. Forty levels ranging from 10m at the surface to 250m at great depth were used in the vertical with realistic bottom topography and coastlines. The solid white area shows the coastlines topography at 1 km depth.

effort in high performance computing and communications, information infrastructure, applied mathematical sciences, advanced energy projects and technology research.

Through high performance computing, communications, and networking CTR extends the availability and utility of our laboratories and user facilities. The DOE 2000 program and the new capabilities for NGI will enable scientists nationwide to work together on problems as easily as if they were at the same Laboratory or facility.

Program emphasis in FY 1999 supports these national "collaboratories", advanced computational testing, simulation, and high performance computing and networking facilities in support of all of the Energy

Research programs, CTR will emphasize national collaboratory technologies, advanced computational testing, simulation, and high performance computing and networking facilities.

The Laboratory Technology Research and Advanced Energy Projects programs will bridge basic research and technology development to the point that industry can utilize and exploit the innovations originally developed for DOE energy applications.

Fusion Energy Sciences - The three goals of the Fusion Energy Science (FES) program are to advance plasma science, develop fusion science and concept innovation, and pursue fusion energy as an international collaboration.The FES mission is to advance the knowledge base needed to make fusion an economically and environmentally attractive power source for the future.

The FES program provides national stewardship for the fundamental discipline of plasma science, contributing to many scientific and technical goals, ranging from industrial processing to national security. The new NSF/DOE Joint Partnership in Plasma Science and Engineering has resulted in more than 15 new awards in basic plasma science and engineering.

Fundamental discovery and analysis have led to remarkable new insights regarding transport barriers that reduce the loss of energy from magnetically confined plasma. Experiments on the DIII-D and Alcator C-Mod tokamaks will be carried out in combination with continuing theoretical development to extend the range in time and space where energy losses are dramatically reduced. Collaborative experiments with our major international partners will also attempt to scale these results to energy producing plasmas.

Preparations will begin for a second national proof-of-principle experiment using facilities and infrastructure available at PPPL. This would include national working groups selecting a candidate physics concept from ongoing smaller experiments and beginning pre-conceptual design.

Following the completion of the six year Engineering Design Activities (EDA) Agreement supporting the International Thermonuclear Experimental Reactor (ITER), the United States will restructure its participation into a more limited and focused, post-EDA role. In this post-EDA period, possible sites will be explored by our international partners to bring regulatory concerns into the design process, and a broad range of lower cost options will be jointly developed to increase the likelihood of proceeding to construction with an ITER design. The U.S. fusion technology program, previously focused solely on ITER project requirements, will be restructured to focus on domestic program needs and, where possible in a dual purpose sense, ITER needs as well. Both the technology and science programs will be seeking to accomplish their aims through broader coordinated use of both domestic and international facilities.

An important new facility, the National Spherical Torus (NSTX) will begin operations in FY 1999. This proof-of-principle level facility will investigate the physics of the promising spherical torus concept. Located at Princeton Plasma Physics Laboratory, this experiment will be operated as a national collaboratory with expected participation from 10-15 institutions.

The FES program will increase emphasis on alternative concepts. Through the Innovative Concepts Initiative three new university scale experiments and one theoretical study began in FY 1998.

High Energy Physics - The High Energy Physics (HEP) program is a major component of the Department's basic research program. It is directed at understanding the nature of energy and matter at the most fundamental level. An integral component of this effort is the construction and operation of state-of-the-art research facilities.

The foremost high energy physics research facility of the next decade will be the Large Hadron Collider (LHC) at Europe's CERN facility. DOE and NSF have completed negotiations with CERN regarding contributions for the LHC accelerator and detectors as part of the U.S. participation in the LHC program.This will ensure access for U.S. scientists to the frontier of high energy physics. Participation will primarily involve U.S. design and fabrication of accelerator and detector subsystems supported by DOE and NSF. In FY 1999, HEP will support R&D, design and the start of component and subsystem fabrication for US-LHC participation.

The HEP program has two construction projects in the FY 1999 budget, Neutrinos at the Main Injector (NuMI) and the Wilson Hall Safety Improvement Project, both at Fermilab. The NuMI project provides new facilities at Fermilab and at the Soudan Underground Laboratory in Minnesota to search for neutrino oscillations. The Wilson Hall Safety Improvement Project provides urgently needed rehabilitation of the building.

The Fermilab Main Injector Project is proceeding well and is within planned cost and schedule profiles. All relevant milestones have been met. The final data collection from the Fermilab 800 GeV external fixed-target program, will be completed in FY 1999. The prime focus of the Fermilab program will next turn to Tevatron research with the higher luminosity of the Main Injector.

At the end of FY 1998, construction of the SLAC B-factory Project will be complete. Commissioning will be completed in FY 1999 and physics, using the BaBar detector, will begin. During the 3rd quarter of FY 1999, the Alternating Gradient Synchrotron, at Brookhaven National Laboratory (BNL), will be transferred to the Nuclear Physics program for use as the injector for the new Relativistic Heavy Ion Collider (RHIC) facility.

Nuclear Physics - The Nuclear Physics (NP) program complements the HEP program in the study of the nature of energy and matter. NP research investigates the structure and interactions of atomic nuclei to advance our understanding of the fundamental forces and particles of nature as manifested in extended nuclear matter.

FY 1999 is a transition year for the Nuclear Physics program. RHIC construction will be completed in the third quarter of FY 1999, the research program will be initiated in the fourth quarter, with full operation beginning in FY 2000. The Thomas Jefferson National Accelerator Facility will continue to improve performance and expand experimental capabilities. The new joint US/Canadian Sudbury Neutrino Observatory (SNO) will be completed in FY 1999 and will begin to investigate the solar burning process. The new Radioactive Ion Beam (RIB) facility at Oak Ridge National Laboratory will focus on improving performance, developing new beams to address the needs of the experimental program, and carrying out high-priority experiments with the developed beams.

Other - The Technical Information Management (TIM) Program will advance electronic availability and utility of DOE information. The Energy Research Analyses (ERA) program will continue to evaluate the quality and impact of ER programs and provide analysis of key issues

for planning and performance evaluation. The Multiprogam Energy Laboratories - Facilities Support (MEL-FS) program will provide line item construction funding to support the general purpose infrastructure of the five ER multiprogram labs.

Program Direction - There continues to be constraints on our program direction budget and FTE ceiling. Despite strong support for our programs by the Administration and the Congress, and despite one of the lowest federal ratios of people per million dollars managed, ER is managing its staffing levels consistent with the Department's Strategic Alignment Initiative.

We have completed a detailed activity-based analysis to identify the most time-consuming and costly functions that we perform and those activities that did not add value to our work products. As a result of a customer survey, the activity-based analysis, and management prioritization, we have begun a number of process improvement and re-engineering activities, including a major effort to improve how we communicate, store, and disseminate program information.

These efforts were recognized in the 1997 Department of Energy quality award. In addition, ER was recognized for performing our major functions (budgeting, planning, managing programs, and internal operations) with good input from customers and stakeholders and using a variety of avenues to obtain that input. ER was also recognized for our focus on excellent science, including our review processes that verify performance to high standards.

Recent events at Brookhaven National Laboratory have led to a reevaluation of the manner in which infrastructure, Environment, Safety and Health and general laboratory management are addressed and funded within DOE and the Office of Energy Research. ER is providing leadership, corporate focus and integration for the operations; infrastructure; environment, safety and health; and construction management activities at its laboratories using the principles of integrated safety management.

Closing

The significant increase in the FY 1999 budget for the Office of Energy Research recognizes the critical role that fundamental knowledge plays in achieving the mission of the Department as well as for the general advance of the Nation's economy and the welfare of its citizens. The SNS, the Scientific Facility Utilization, and Next Generation Internet initiatives will build upon and sustain the Department's role in the development and operation of large, unique scientific instruments and facilities. The Climate Change Technology Initiative will provide fundamental knowledge for a long term portfolio of clean, efficient energy technologies. On behalf of the administration and the Department, I am pleased to present this budget for the Energy Research programs and welcome the challenge to deliver the required results.

Martha A. Krebs
Director
Office of Energy Research