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Los Alamos National Laboratory Institutional Plan

FY2003–FY2008

'An Overview of Institutional and Joint Programs'

Los Alamos
NATIONAL LABORATORY

Edited by Charmian Schaller, Group IM-1

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Preface

The Los Alamos National Laboratory FY2003–FY2008 Institutional Plan is a document that provides detailed information on the Laboratory's current activities and a plan for work that will be done in the next five years.

The Institutional Plan is based on high-level, strategic planning documents developed for the Laboratory as a whole and for each of its six directorates.

Following is a brief summary of the sections in this document:

- The Director's Statement provides insight into the plans and philosophy of LANL Director John Browne.

- The Laboratory Overview explains the Laboratory's vision, mission, role in the nation and the world, values and goals, organization, and the responsibilities of each of its six directorates.

- The alignment grid shows how selected Laboratory activities in stockpile stewardship, threat reduction, energy research, environmental restoration and management, science, and technology relate to the goals of the Department of Energy and its National Nuclear Security Administration.

- "Mission-Strengthening Programs" outlines the goals, strategies, and recent achievements of four programs applied to assist the entire Laboratory.

- The section on "Directorates" describes in detail the goals, objectives, and recent successes of the six Laboratory directorates.

- The final section of the Institutional Plan provides detailed budget tables.

Director's Statement

The new threats of the 21st century—worldwide terrorism and the daunting possibility of the use of weapons of mass destruction—have given a new, more urgent, meaning to our national security mission. September 11 will live in our minds and our hearts as an event that will likely change forever the landscape of our world. The attacks on the World Trade Center and on the Pentagon ushered our nation into the first war of this century, this time a war against terrorism. Los Alamos National Laboratory (LANL, the Laboratory), initially created to help end World War II, will again play a special role in our nation's defense.

Our mission is directly linked to the urgent national security priorities of the Department of Energy (DOE) and the National Nuclear Security Administration (NNSA), and indeed, our country. We are strongly aligned with the new nuclear strategy set forth in the 2001 Nuclear Posture Review, which outlines a much broader strategy of assurance, deterrence, defense, and defeat that is based on a "New Triad" of nonnuclear and nuclear strike capabilities, a strong defense capability, and a responsive defense infrastructure (as well as command, control, and intelligence). The active support of this New Triad through a robust and responsive nuclear infrastructure within the national laboratories, working closely with the DOE/NNSA and the Department of Defense, will be vital. All of our major thrusts at the Laboratory—stockpile stewardship, threat reduction, homeland security, defense transformation, and energy and environmental security—support the underlying tenets of the New Triad.

We have had notable successes in our major thrust areas in the recent past. With respect to stockpile stewardship, we have made significant progress in manufacturing plutonium pits, in developing the experimental and simulation tools and methodologies that help us better understand weapons performance, and in enhancing certification methodology. This progress gives me confidence in our ability to meet present and future challenges to our stockpile.

Our threat-reduction activities have been refocused as a result of shifting national security priorities since September 11. The newly created Office of Homeland Security has been charged with protecting the United States from terrorist attack. We are strongly committed to supporting this effort, and we are participating with Lawrence Livermore and Sandia National Laboratories in efforts to defend the U.S. against nuclear, chemical, and biological terrorist attacks. We are making significant contributions to areas of information analysis and infrastructure protection; chemical, biological, radiological, and nuclear countermeasures; border and transportation security; and emergency preparedness and response.

With respect to ensuring an adequate energy supply and a safe environment, the Laboratory is heavily engaged in several areas of research and development—fuel cell technology, superconductivity, carbon management and sequestration, nuclear energy, and modeling and simulation of global climate change.

The Institutional Plan, our blueprint for the next five years, makes clear that our central responsibilities remain the same. We must develop and use scientific and technological expertise to find and improve ways to protect the nation and improve its quality of life. We must create and extend techniques to detect, deter, and defeat destructive efforts by our enemies.

Achieving and sustaining excellence in the execution of our critical mission responsibilities requires outstanding performance in both our programs and our operations. Integrated management is one of my primary strategies for accomplishing operational and programmatic excellence. It is my belief that to achieve our goal of being a unified, customer-focused Laboratory, we must integrate our science, our programs, and our business operations to focus on institutional rather than parochial issues. I have set 10 institutional objectives as our priorities for fiscal year 2003 (FY03) and beyond. Nine of these mirror the University of California (UC)/NNSA strategic performance objectives for FY03, and the tenth focuses on leadership. I am using our performance management system to establish and communicate our priorities for all Laboratory organizations. We are also in the process of implementing an integrated program planning, budgeting, and evaluation system to ensure strong links between our long-range planning, our budgeting, and our deliverables.

But to achieve excellence, we must focus on some additional strategies in the foreseeable future:

- **Developing a science-based predictive capability that integrates theory and modeling, computation and large-scale simulation, and high-precision experiments.** This capability is of enormous importance to our national security mission. We expect it to be a fundamental tool in helping us model complex phenomena in several key thrust areas—weapons, threat reduction, bioscience, energy, climate, and infrastructure. Fully developing this capability requires that we maintain strong interactions with other national laboratories, with universities, and with industry so that we can remain on the cutting edge of the most current scientific and technological advances being made anywhere.

- **Achieving a sustainable balance between work required to meet near-term deliverables and the science and engineering required to meet long-term program needs.** Delivering on our commitments to maintain the safety and reliability of the stockpile, including life-extension programs, remains one of our highest priorities. Long-term certification of nuclear weapons requires the very best science in modeling and simulation, dynamic material behavior, special nuclear materials and explosives, and experimentation. Therefore, our weapons activities must focus on ensuring a proper balance of work required to maintain the stockpile and the underlying science needed to certify stockpiled weapons and meet possible future nuclear weapons requirements—for this decade and beyond. The Laboratory-Directed Research and Development Program is a vital tool we have in directing our resources to support new, innovative ideas that might not yet have a direct programmatic focus but could hold the key to powerful scientific and technological solutions to mission-related problems.

- **Attracting and retaining a diverse and talented workforce.** We cannot accomplish our mission without outstanding people. We are concerned that a large number of employees and managers at the Laboratory are nearing retirement. It is critical that we effect the transfer of essential knowledge and prepare a new generation of people who will be qualified for our leadership positions. Our hiring of nearly 1,000 employees in FY02 has helped us begin to address this challenge.

- **Revitalizing our 50-year-old infrastructure.** We have developed a Ten-Year Comprehensive Site Plan that NNSA has approved as a guide for prioritizing maintenance and facility replacement at our site. With NNSA's support, we have begun to implement the plan with the completion of the Nicholas C. Metropolis Center for Modeling and Simulation and the Nonproliferation and International Security Center. In addition, I have chartered a strategic review of our existing facilities and infrastructure to determine where and how we might shrink our footprint for today's mission.

- **Focusing on outcomes, systems, and continuous improvement.** We fully support NNSA's efforts to streamline operational oversight, to encourage and support cooperation among its contractors, and to focus its efforts on strategic priorities and planning for the future. This approach should help us accomplish our mission and achieve programmatic success in a cost-effective and efficient manner and in a way that allows us to meet near-term requirements as well as evolving, long-term challenges.

Finally, an essential but often overlooked element of mission success is our core values. It is these values that guide and motivate everything we do. As custodians and stewards of the nation's nuclear stockpile, we bear an extraordinary responsibility to demonstrate integrity and adherence to a code of values that will engender the public's trust in our ability to carry out our mission successfully.

Our institutional values—trustworthiness, safety and security, excellence, teamwork, public service, and diversity—are critical to creating the Laboratory of the 21st century. As we become more sophisticated as an institution about how to communicate and realize these institutional values, I plan to develop a "scorecard" that will provide me with data about how well we are doing with respect to each one of these values. I will also engage our employees in helping to define our path forward.

Furthermore, I believe that it is the first value, trustworthiness—above all—that underlies our success as an institution. Our mission—ensuring the safety and reliability of the U.S. nuclear deterrent, reducing the global threat of weapons of mass destruction, and solving national problems in energy, environment, infrastructure, and health security—is of such moment that we cannot accomplish it without a fundamental belief on the part of the American public and on the part of our own employees that we are an institution to be trusted.

Our country faces ongoing and new challenges—global terrorism, evolution of nuclear deterrence with fewer deployed nuclear weapons, and certification of an aging stockpile without nuclear testing. Our Laboratory is committed to meeting these challenges to our nation's security. We will create an environment with a clear vision and mission, with institutional priorities, with operational and programmatic excellence, and with a set of values that we share and live. It is this environment that will ensure the success of our mission, today and in the future.

Los Alamos National Laboratory Overview

Los Alamos National Laboratory (LANL) is a multiprogram scientific laboratory broadly devoted to national and global security.

VISION

We serve the nation by developing and applying the best science and technology to make the world a better and safer place.

MISSION

The components of the Laboratory's core mission are

- to ensure the safety and reliability of the U.S. nuclear weapons stockpile;
- to develop technical means for reducing the global threat of weapons of mass destruction or terrorism (including biological, chemical, nuclear, and cyber weapons); and
- to solve national problems in energy, environment, infrastructure, and health security, utilizing the investment in people and facilities developed for the first two mission components.

LANL'S ROLE IN THE NATION AND THE WORLD

LANL is a multiprogram scientific laboratory of the National Nuclear Security Administration (NNSA), a semiautonomous entity within the U.S. Department of Energy (DOE). The Laboratory is managed and operated for the NNSA by the University of California (UC). Our staff, a diverse collection of outstanding professionals, is integrated into multidisciplinary teams and targeted at finding solutions to problems of national importance.

The Laboratory is committed to supporting the NNSA, its principal customer, by being a unified and customer-focused laboratory with a record of outstanding performance in all areas. This commitment is LANL's "strategic business plan."

LANL's core mission is nuclear stockpile stewardship. Certification responsibility for a substantial majority of the nation's active nuclear weapons stockpile is the primary mandate. Complementary to nuclear stewardship is LANL's mission to detect, monitor, and defeat nuclear, biological, chemical, and cyber threats. Ancillary strategic scientific research is conducted in the areas of environment, energy, and health security. Basic, cutting-edge science is the foundation on which all programmatic endeavors at LANL are built. The Laboratory

conducts the long-range research and personnel development needed to maintain its ability to perform its core mission. Customers for LANL's research and development activities include not only the NNSA, but also other DOE offices (notably the Office of Science), as well as other federal agencies and departments.

Inseparable from its commitment to excellence in science and technology is LANL's commitment to completing all endeavors in a safe, secure, and cost-effective manner. We value diversity in all its aspects and believe that the most creative solutions can be reached only when people with a broad range of ideas and backgrounds are participants.

SIX ZEROS, SIX FOCUS AREAS, AND 10 INSTITUTIONAL GOALS

This plan is a living document, and it changes in response to the needs of our customers and the world situation. Laboratory Director John Browne has identified and given top priority to "six zeros," six thematic focus areas, and 10 specific institutional goals.

Six Zeros

The six zeros state our goals in safety, security, environmental protection, and human relations. They are as follows:

- Zero injuries and illnesses ON the job;
- Zero Safeguards and Security incidents;
- Zero injuries and illnesses OFF the job;
- Zero environmental incidents;
- Zero ethics incidents; and
- Zero people-mistreatment incidents.

Focus Areas

The focus areas guide how we do our business. They are listed below.

- **Values.** Our values are central to our ability to succeed. Trustworthiness is an overarching value and an enabler of the other values that we care about: safety and security, excellence, teamwork, public service, and a commitment to diversity.
- **People.** High among our strategic priorities are recruitment and retention of an outstanding workforce of scientists, engineers, and other staff members with many required skills. The demographics of our workforce require the efficient generational transfer of knowledge in many areas close to our core mission. This fact implies both

vigorous entry-level hiring and the engagement of those of our retirees who continue to work part time. Training of our workforce, especially our outstanding technicians, is a key priority.

- **Science and Engineering.** We are committed to enabling our scientists and engineers to be at their creative and productive best. Recruiting and retention efforts, mentoring, and skills revitalization and renewal are some of our means. We commit to providing opportunities and support to early-career scientists and engineers; to improving facilities and equipment; and to reducing administrative burden, overhead costs, and bureaucracy.

- **Customers and Stakeholders.** We will deliver on commitments to our stakeholders, both our program commitments to our customers and our commitment to being a good neighbor to the surrounding communities. One strong focus is continuous improvement in communications with all stakeholders. Another focus is pursuit of a program of continuous improvement in project management.

- **Costs.** We are not satisfied with our current costs of doing business. Our focus will be on decreasing facilities costs, simplifying complex business systems and practices, and reducing hidden costs. We plan to review and analyze our expenditures for organizational support and to examine discretionary spending decisions. We will maintain strong institutional oversight of our general and administrative overhead spending.

- **Integrated Management.** The laboratory has made enormous progress in safety by implementing Integrated Safety Management (ISM), a way of doing business that puts together responsibility, accountability, and empowerment in the unbroken "safety chain" that extends from the Laboratory Director, through line management, to each individual employee. We commit to bringing other—eventually all—aspects of our business into the same chain of integrated management. Safeguards and security, including cybersecurity and the operation of nuclear facilities, is the first such focus. We are committed to engaging our entire workforce in integrated management through training and an increased sense of empowerment at all levels.

Institutional Objectives

Nine of the Laboratory's objectives are based on the UC/NNSA performance objectives for 2002 to 2003. In addition, the Director has included an objective related to leadership. The 10 objectives are as follows:

Objective #1: Develop and implement a common UC design-laboratory certification strategy.

Strategies:

- Develop an integrated, scientifically based, quantitative certification methodology that has been externally reviewed for use in future warhead certification and in support of the Annual Certification Process.

- Demonstrate application of a common assessment methodology using Quantification of Margins and Uncertainty in major warhead assessments.

- Demonstrate progress toward quantifying margins and reducing uncertainties in evaluations of primary and secondary performance.

Objective #2: Develop with NNSA and implement long-term, balanced, integrated stewardship.

Strategies:

- Support the needs of warhead assessment and certification by coordinated programs of targeted small- and large-scale experiments and mining of archival underground-testing data to improve predictive capability.

- Demonstrate advances in radiography technology and develop joint options and recommendations for future x-ray and proton radiographic capability that support the quantitative certification methodology.

- Demonstrate Advanced Simulation and Computing simulation and modeling capabilities that support the ongoing needs of stockpile assessment and certification.

- Improve and apply tools and models for prediction of systems and/or component lifetimes.

- Develop and implement a collaborative and complementary program of experiments at High Energy Density facilities that supports the quantitative certification methodology.

- Develop an integrated program for plutonium capabilities of LANL and Lawrence Livermore National Laboratory (LLNL) to support the overall NNSA strategic requirements.

Objective #3: Develop with NNSA and implement near-term, balanced, weapons program plans.

Strategies:

- As part of the Annual Certification Process, complete the annual assessments of the continued safety, reliability, and performance of all warhead types in the stockpile, determining whether nuclear testing is required for resolution of any issues and supporting DOE as required during interagency and community coordination of the Annual Certification Process.

- Provide technical support to production complex operations including the Integrated Weapons Activity Plan (IWAP).

- Deliver on W88 Pit Manufacturing and Certification Project major milestones.

- Deliver on the major milestones for the Life-Extension Programs for the W76, the B61-7/11, and the W80-2/3 in accordance with the Phase 6.X process.

- Conduct stockpile surveillance and assessment activities, including investigation and subsequent resolution of significant findings (on a priority basis) and resolution of issues identified in technical assessment reports.

- Support directive schedule requirements.

Objective #4: Develop and implement a sound nonproliferation/counterterrorism program basis.

Strategies:

- Sustain and expand intelligence and counterintelligence programs and analysis and analytical data systems for detecting and thwarting proliferation and terrorism.

- Sustain and expand international cooperative programs to reduce the threat of nuclear proliferation.

- Develop and expand complex systems modeling to enhance prediction and identification of threats, prioritization and integration of counterterrorism efforts, and effectiveness of response systems for terror events.

- Develop and transition technologies for large-scale deployment for civilian preparedness against terrorist biological attacks, chemical attacks, and other kinds of attacks.

- Develop and demonstrate nuclear detection and monitoring technologies; provide technologies and expertise to enhance protection of nuclear materials inside, at, and outside U.S. borders; and maintain the capability to deploy a nuclear emergency response team for protecting U.S. assets from radiological and nuclear threats.

- Develop global situational awareness with the defense and intelligence communities and enable the necessary technical underpinnings to monitor and track facilities, people, and situations worldwide in real time.

Objective #5: Enhance and nurture a strong science base in support of NNSA strategic objectives.

Strategies:

- Develop and implement an integrated and balanced strategy for investing Laboratory-Directed Research and Development, programmatic, and institutional resources to ensure the long-term vitality of the Laboratory science and technology base to support the NNSA mission and emerging national needs.

- Nurture and maintain the Laboratory's signature capabilities including unique experimental facilities and competencies in support of Laboratory and external users and sponsors.

- Strategically pursue and successfully execute a portfolio of non-NNSA-sponsored research that builds on unique Laboratory capabilities and enhances the Laboratory's competencies to meet current and future national security needs.

- Foster active participation in the broad scientific community and leverage unique Laboratory expertise and capabilities to develop strategic collaborations with other national laboratories, industry, and academia.

Objective #6: Achieve successful completion of projects and development of user facilities.

Strategies:

- Execute significant construction projects as identified and agreed to by the DOE Site Office—within budget, scope, and schedule.

- Develop with NNSA and implement a National Hydrotest Plan that addresses mutual utilization of hydrotest facilities and includes discussion of containment and materials availability.

- Develop and implement with NNSA and other appropriate DOE programs plans to support optimal use of scientific, research, and test facilities and capabilities (e.g., the National Ignition Facility, the Dual-Axis Radiographic Hydrotest Facility, terascale computing facilities, and the Los Alamos Neutron Science Center).

Objective #7: Maintain an effective and efficient operations basis in support of mission objectives.

Strategies:

- Meet facility short- and long-term needs necessary to support mission requirements; ensure that critical facilities, including nuclear facilities, meet operational needs for programmatic work requirements by minimizing unplanned system outages and downtime; and achieve the objectives in the approved FY03 Ten-Year Comprehensive Site Plan.

- Achieve continual improvement in ISM by developing and implementing simplified facility safety basis and related operational requirements for nonnuclear facilities based on benchmarking of best practices and by assuring consistent application of ISM principles across all organization levels and across all Laboratory facilities.

- Comply with 10 CFR 830 subpart B for the operations of the Laboratory's category 2 and 3 nuclear facilities by completing the required Documented Safety Analysis and Technical Safety Requirements according to the Master Schedule.

- Complete the NNSA-approved action plans and UC-approved project plans for implementing Integrated Safeguards and Security Management (ISSM), and, after that, achieve continuous improvements by providing consistency throughout the Laboratory.

- Develop with NNSA a long-term plan to reduce inventories of surplus and excess special nuclear materials and onsite waste.

- Develop and execute an Environmental Management Program consistent with regulatory and mission requirements.

Objective #8: Utilize UC strengths to recruit, retain, and develop the workforce basis.

Strategies:

- Provide skills necessary to enhance the science base by implementing integrated recruiting and retention strategies to meet the Laboratory's long-range skills requirements.

- Implement leadership and management development programs aligned with workforce planning and diversity objectives.

Objective #9: Sustain effective community initiatives.

Strategies:

- Leveraging the UC expertise and mission in science education, establish and maintain science education outreach programs with the joint goals of community outreach and substantive contribution to science education.

- Support community and tribal initiatives that leverage community and corporate UC resources in order to foster economic development and corporate citizenship, including educational activities, regional procurement, and workforce development.

Objective #10: Model institutional leadership and demonstrate leadership accountability.

Strategies:

- Demonstrate integrated management of formality of operations by using LANL management systems (no shadows).

- Plan strategically and systematically.

- Improve communications (at all levels) using various mechanisms to focus on vision, values, and expectations for results and behavior.

- Delegate effectively, making authorities and responsibilities clear and always establishing a single owner.

- Follow through on commitments.

- Engage in executive development activities and model leadership attributes.

Directorates, Crosscutting Activities, and Supporting Plans

In addition to Director John Browne, LANL has at its executive level: a principal deputy director and chief operating officer; a deputy director for science and technology; and a deputy director for national security.

LANL's programmatic activities are organized into four directorates, each headed by an associate laboratory director (Strategic Research, Threat Reduction, Weapons Engineering and Manufacturing, and Weapons Physics). In addition, two more associate laboratory directors oversee vital support activities (Administration and Operations). The sections below summarize

the responsibilities of each of the six directorates. Each is also responsible for maintaining a Supporting Plan that elaborates on its activities.

Administration

The Administration Directorate supports the Laboratory by ensuring that all business, personnel, outreach, and related matters operate effectively and efficiently and in accordance with contractual requirements.

The Administration Directorate includes four divisions and six offices. The divisions are Business Operations (BUS), Communications and External Relations (CER), Human Resources (HR), and Information Management (IM). The offices are Audits and Assessments (AA), Diversity (DVO), Equal Opportunity (OEO), Laboratory Counsel (LC), the Ombuds Program (Ombuds), and Quality Improvement (QIO).

The organizations in Administration have key human-resources responsibilities—planning, training, recruiting, and retaining an outstanding and diverse workforce. They design and implement the business systems and practices that play a key role in determining and reducing costs at the Laboratory. They serve as the Laboratory's administrative link to industry; to federal, state, tribal, and local governments; and to the community at large. They assist in complaint resolution, problem solving, and communication through the Ombuds Program Office, and they focus and promote the Laboratory's interest in diversity and equal opportunity. They also design and facilitate system improvements aimed toward implementation of integrated management.

Operations

The Operations Directorate manages activities and projects that support physical infrastructure, enable scientific and technical achievement, and affect the quality of life and long-term health and direction of the Laboratory.

The Operations Directorate includes six divisions and two offices: the Facility and Waste Operations Division (FWO); the Health, Safety, and Radiation Protection Division (HSR); the Performance Surety Division (PS); the Project Management Division (PM); the Risk Reduction and Environmental Stewardship Division (RRES); the Security Division (S); the Internal Security Office (ISEC); and the Infrastructure, Facilities, and Construction Office (IFC).

The Operations Directorate has a leading role in implementing ISM and ISSM programs. As a result, the directorate is a key player in introducing improvements in the LANL safety and security culture. The directorate is also responsible for managing, developing, planning, and executing construction and infrastructure projects; for managing and maintaining the Laboratory's facilities, utilities, and grounds in a manner that minimizes risk to the employees, the public, and the environment; and for ensuring sound environmental stewardship.

This directorate will play a major role in facility modernization.

Strategic Research

The Strategic Research Directorate creates and develops science and technology essential to the Laboratory's mission.

The directorate provides critical capabilities in support of the programs of the Weapons Physics, Weapons Engineering and Manufacturing, and Threat Reduction Directorates. In addition, the work of Strategic Research involves environmental and energy security issues.

Underpinning the directorate's mission is a broad program of high-quality, basic research that adds to the national and international scientific knowledge base. Strategic Research is often the Laboratory's "front door" in interactions with other national laboratories, universities, industries, and units of government.

Strategic Research has five divisions: the Chemistry Division (C), the Earth and Environmental Science Division (EES), the Industrial Business Development Division (IBD), the Materials Science and Technology Division (MST), and the Theoretical Division (T). The directorate operates a number of "user facilities" including the National High Magnetic Field Laboratory, the National Flow Cytometry Resource, and the Stable Isotope Resource. The directorate also has one program office—Energy and Sustainable Systems (ESS).

Threat Reduction

The focus of the Threat Reduction Directorate is to develop and implement programs to reduce threats to U.S. security. The primary focus is on detection, assessment, control, and neutralization of nuclear, chemical, and biological weapons of mass destruction and their components.

Work in Threat Reduction focuses on five major program areas: cooperative programs with Russia and the former Soviet Union states; nonproliferation programs, including the development of sensors and detection systems; counterproliferation and counterterrorism programs, including homeland defense; defense science and technology development; and the development of technologies for critical infrastructure protection.

Technical divisions within the directorate are the Nonproliferation and International Security Division (NIS), the Decision Applications Division (D), and the Biosciences Division (B). In addition, the directorate has seven program offices: Biothreat Reduction, the Center for Space Science Exploration, Department of Defense Programs, International Technology, Nonproliferation Programs, Nuclear Materials Management, and Research and Development.

Weapons Engineering and Manufacturing

The Weapons Engineering and Manufacturing Directorate ensures the safety and reliability of the U.S. nuclear weapons stockpile by reestablishing the nation's capability to manufacture weapon components and by applying the best engineering, design, development, and diagnostic tools available to the maintenance and refurbishment of the stockpile.

Among the directorate's prime responsibilities are pit manufacturing, certification, and surveillance; nuclear materials surveillance, management, safeguards, and security; actinide chemistry research and development; nuclear fuels and power source technologies; preservation and advancement of warhead and subsystem design capability; and enhancement of the U.S. ability to manufacture and process specific weapon components and materials.

The two technical divisions within this directorate are Engineering Sciences (ESA) and Nuclear Materials Technology (NMT).

Weapons Physics

The primary focus of the Weapons Physics Directorate is nuclear stockpile stewardship. The goal of the national Stockpile Stewardship Program is to maintain the safety, security, and reliability of the U.S. nuclear stockpile for the indefinite future without the necessity of conducting nuclear tests. In the absence of nuclear testing, the Weapons Physics Directorate makes use of a science-based approach supported by the broad range of science and technology capabilities at the Laboratory to ensure confidence in the stockpile.

LANL has the responsibility of regularly certifying (or not certifying) five weapons systems within the nuclear weapons stockpile: the B61, W76, W78, W80, and W88.

Work in the Weapons Physics Directorate focuses primarily on four major areas: the experimental program, the Accelerated Strategic Computing Initiative, Stockpile Life-Extension Programs, and the neutron and proton programs at the Los Alamos Neutron Science Center, a world-class facility serving both security and civilian users.

The six technical divisions within Weapons Physics are Computing, Communications, and Networking (CCN); Computer and Computational Sciences (CCS); Dynamic Experimentation (DX); LANSCE; Physics (P); and the Applied Physics Division (X).

Alignment of Selected Los Alamos National Laboratory Activities with the Goals of Sponsoring Organizations

Los Alamos National Laboratory (LANL) has a large number of programs, funded by many different agencies and institutions. It is vital that the scientific and technical activities undertaken at the Laboratory align with the goals of major sponsors.

The tables that follow show how a few important Laboratory programs and activities (selected from among many at the Laboratory) align with key goals of the National Nuclear Security Administration (NNSA) and the remainder of the Department of Energy (DOE), particularly the Office of Science.

Table 1, below, shows how LANL scientific and technical programs align with the first three goals of the February 2002 NNSA Strategic Plan.

Table 1. NNSA Goals and Strategies and Related Laboratory Activities

Goal 1: Maintain and enhance the safety, security, and reliability of the nation's nuclear weapons stockpile to counter the threats of the 21st century.	
Strategy: Conduct a program of warhead evaluation, maintenance, refurbishment, and production, planned in partnership with the Department of Defense.	• Conducting assessment and certification of the safety and reliability of the stockpiled weapons. For six consecutive years, LANL Director John Browne has been able to certify that the five Los Alamos–designed weapons in the U.S. nuclear stockpile—the B61 family, W76, W78, W80, and W88—remain safe and reliable, and that a nuclear test is not required to resolve any current issues. • Working to reestablish the nation's capability to manufacture plutonium pits while supporting NNSA's plan to reestablish industrial-scale pit production at a new, specially constructed facility in the longer term. • Building the first War-Reserve (WR)-certifiable W88 pit (the prototype for reestablished manufacturing capability) by April 2003. Thirteen development pits had been completed by June 12, 2002. • Maintaining the capability to resume underground nuclear testing (in accordance with the presidential directive and the Nuclear Posture Review) through a coordinated experimental and test readiness program. • Collaborating with Nevada Test Site on subcritical, nonyield, underground tests. • Meeting all annual weapons maintenance and refurbishment schedules developed jointly by DoD and DOE. • Refurbishing, modifying, and replacing weapons and weapons components through the Stockpile Life-Extension Program. LANL has begun engineering development for the Navy's W76 warhead and will proceed toward production, development, and certification of the first production unit in 2007. A major refurbishment of this warhead is planned

Goal 1: Maintain and enhance the safety, security, and reliability of the nation's nuclear weapons stockpile to counter the threats of the 21st century.	
Strategy (Continued): Conduct a program of warhead evaluation, maintenance, refurbishment, and production ….	with the goal of extending its lifetime to 2042. LANL also has finalized plans with NNSA, Pantex, and Y-12 to begin refurbishing canned subassemblies of the B61 Mod 7 and 11 in 2006. And, in support of the Livermore National Laboratory W80 Life-Extension Program, LANL is developing the Acorn gas transfer system with Sandia National Laboratories-California Site. LANL and Sandia have completed the W80 Baseline program. • Maintaining the boosting system for the W76 Mk 4 warhead, the targets for the neutron generators, and WR detonators and detonation systems. • Supplying the Kansas City Plant with WR-quality small-cap inserts as the exclusive manufacturer of beryllium parts.
Strategy: Develop science, design, engineering, testing, and manufacturing capabilities needed for long-term stewardship of the stockpile.	• Providing scientific understanding of the nuclear weapons to sustain our ability to certify the nuclear weapon stockpile without underground nuclear testing. • Designing, conducting, and analyzing experiments to test and validate models and to support weapons assessments. Experiments include the following: o subcritical experiments at Nevada Test Site, o hydrodynamic testing to study the implosion of mock-up nuclear weapons primaries, o pulsed-power and laser-driven experiments and simulations in the area of high-energy-density physics, o high-explosives science and engineering experiments. • Developing and applying advanced experimental tools and techniques, such as proton radiography. Proton radiography is already an operational tool at the Los Alamos Neutron Science Center—LANSCE—and has already provided data that have influenced stockpile decisions. The availability of this tool supports and strengthens LANSCE as LANL's flagship user research facility. • Using LANSCE, the National Ignition Facility, and the Atlas Pulsed-Power Machine to study weapons physics and materials and to provide experimental data to validate understanding. • Developing neutron resonance spectroscopy as a key technology for new materials modeling. • Using Advanced Strategic Computing Initiative (ASCI)-class computing systems such as Blue Mountain and the Q machine to conduct complex calculations necessary for assessment and certification. LANL continued to make rapid advances in the ability to simulate nuclear explosions faster and with greatly increased detail. During the past year, LANL completed the first three-dimensional simulation of a full nuclear weapon system explosion using the LLNL 12 teraops White computer. This calculation

Goal 1: Maintain and enhance the safety, security, and reliability of the nation's nuclear weapons stockpile to counter the threats of the 21st century.	
Strategy (Continued): Develop science, design, engineering, testing, and manufacturing capabilities needed for long-term stewardship of the stockpile.	represents the first time that we have been able to compute a fully coupled primary and secondary explosion to analyze weapon performance. It represents a breakthrough for the program. In addition, the Strategic Computing Complex, a 300,000-square-foot facility that will house the Q machine, was recently completed at LANL, on time and under budget. • Completing the second axis of the Dual-Axis Radiographic Hydrotest Facility (DARHT) by the end of 2002, commissioning the second axis in 2003, and having the full two-axis capability available in 2004. • Developing enhanced surveillance capabilities for predicting and detecting weapons aging problems. On average, LANL conducts about 500 surveillance tests per year on weapons drawn from all stockpiled systems. The Laboratory expects to conduct 650 surveillance tests in FY2003. • Developing technologies such as Neutron Tube Target Loading and Accelerator Production of Tritium to replace the decaying tritium in nuclear weapons. • Maintaining nuclear-weapons design expertise through the study of advanced concepts that could meet changing weapons requirements in the future. LANL is evaluating robust earth-penetrating weapons and has a small study group looking at past research and development efforts that could be developed to meet changing national needs for nuclear deterrence. • Supporting space and terrestrial missions through heat source and generator design, testing, evaluation, production, and recycling. (The Laboratory is the only DOE facility capable of handling large amounts of plutonium-238 heat source material.)

Goal 2: Detect, prevent, and reverse the proliferation of weapons of mass destruction while promoting nuclear safety worldwide.	
Strategy: Enhance the capability to detect weapons of mass destruction, including nuclear, chemical, and biological systems, and terrorist threats.	• Developing technologies and methodologies for detecting, tracking, measuring, and monitoring nuclear materials and waste in support of domestic and international safeguards. • Improving U.S. proliferation-detection efforts through the development of remote-detection technology, including the development of low-cost satellites and computational tools for detecting and identifying distinctive signatures of potential nuclear weapons research and development efforts. • Providing technology development and on-call expertise in support of the Nuclear Emergency Support Team and the Accident Response Group. • Operating the Data Processing and Analysis Center for the Multispectral Thermal Imager to provide images to government and civilian agencies for nonproliferation and environmental applications.

Goal 2: Detect, prevent, and reverse the proliferation of weapons of mass destruction while promoting nuclear safety worldwide.	
Strategy (Continued): Enhance the capability to detect weapons of mass destruction….	• Developing technologies to model the spread of biological or chemical agents after they have been released. Through the development of technology for the detection, identification, and defeat of pathogens, we will reduce the threat to the public health from pathogenic organisms.
Strategy: Prevent and reverse proliferation of weapons of mass destruction.	• Adhering to the approved DOE/DoD schedule for the safe and secure dismantlement of weapons that have been removed from the U.S. nuclear weapon stockpile. • Developing technologies and detection systems to verify compliance with the Nuclear Nonproliferation Treaty and the Comprehensive Test Ban Treaty while supporting future strategic nuclear arms reduction treaties. • Using LANL's bioscience base (developed through pioneering work on sequencing the human genome) to play a key role in analyzing the DNA of biothreats. LANL was able to determine that certain anthrax samples from U.S. mail attacks came from the common Ames strain—a determination that helped with efforts to respond to and treat victims. In addition, LANL and Livermore deployed a biological-agent detection system at the Salt Lake City Olympics.
Strategy: Protect or eliminate weapons and weapons-usable nuclear material and/or infrastructure, and redirect excess foreign weapons expertise to civilian enterprises.	• Providing technical leadership and expertise to meet U.S. policy objectives for downsizing and converting the Russian nuclear cities. • Leading the DOE Materials Protection, Control, and Accounting (MPC&A) program that is significantly upgrading the security of nuclear materials in the Former Soviet Union. • Developing technologies that support international customs agents and law enforcement officials in combating smuggling of nuclear weapons and materials.
Strategy: Reduce the risk of accidents in nuclear fuel cycle facilities worldwide.	• Providing technical expertise and review of the International Science and Technology Center proposals related to nuclear safety. • Sharing technologies to help the International Atomic Energy Agency and other governments control nuclear materials. • Participating in international nuclear safety conferences. • Supporting the Nuclear Emergency Search Team, which, for more than 25 years, has provided expertise and special equipment for addressing threats of stolen or improvised nuclear devices.

Goal 3: Provide the Navy with safe, militarily effective nuclear propulsion plants and ensure their continued safe and reliable operation.	
Strategy: Ensure the safety, performance, reliability, and service life of operating reactors.	None
Strategy: Develop new technologies, methods, and materials to support reactor plant design for the next-generation reactors for submarines and aircraft carriers.	None
Strategy: Maintain outstanding environmental performance.	None

Energy- and environment-related scientific and technical programs at the Laboratory align with two important goals in the September 2000 DOE Strategic Plan (the most recent DOE plan available). Table 2, below, shows how selected key efforts fit into the DOE's planning.

Table 2. The Alignment of Selected LANL Activities with DOE Goals and Objectives on Energy and Environment

Energy Resources Strategic Goal: Promote the development and deployment of energy systems and practices that will provide current and future generations with energy that is clean, efficient, reasonably-priced, and reliable.	
Objective ER1 Promote reliable, affordable, clean, and diverse domestic fuel supplies.	• Developing the Fuel Cells for Transportation Applications Program. • Pursuing Alkane Functionalization Catalysis. • Developing the Natural Gas and Oil Technology Partnership. • Continuing to pursue magnetized target fusion as a new entry in fusion energy research. • Advancing the utilization of coal in an environmentally responsible manner through the Zero Emission Coal Alliance.
Objective ER2 Promote reliable, affordable, and clean transformation of fuel supplies into electricity and related products.	• Conducting research and developing energy-related products at the Superconductivity Technology Center. • Improving power-conversion technologies through computational modeling and by developing fuel cells, catalysts, and high-temperature superconductivity materials.
Objective ER3 Increase the efficiency and productivity of energy use, while limiting environmental impacts.	• Continuing the work of the Multiphase Fluid Dynamics Research Consortium. • Maintaining an Environmental Stewardship Office that works with Laboratory programs to reduce waste and improve efficiency.

Energy Resources Strategic Goal: Promote the development and deployment of energy systems and practices that will provide current and future generations with energy that is clean, efficient, reasonably-priced, and reliable.	
Objective ER3 (Continued)	• Supporting research to advance the scientific and technical knowledge and skills needed to develop and use new and existing energy resources in an economically viable and environmentally sound manner. • Developing zero-emission energy technologies through research on separations, collection, fixation, sequestration, and utilization technologies for carbon dioxide, leading efforts in carbon-management research. • Applying technology to promote efficient fossil fuel production, including improved porous-flow modeling and rock-mass imaging.
Objective ER4 Inform public policy makers, energy industries, and the general public by providing reliable energy information and analysis.	• Conducting the Fuel Cell Education Project.
Objective ER5 Cooperate globally on international energy issues.	• Working on critical infrastructure protection. • Modeling complex infrastructure systems using the Accelerated Strategic Computing Initiative (ASCI). • Developing scientific tools: (1) to understand, quantify, and predict the environmental consequences of energy-related activities and to facilitate improvements in the quality of environments adversely impacted by energy-related activities; and (2) to understand, quantify, and predict the rate, magnitude, and potential environmental and socioeconomic consequences resulting from human-induced changes in the global climate system associated with energy-related greenhouse gases.

Environmental Quality Strategic Goal: Aggressively clean up the environmental legacy of nuclear weapons and civilian nuclear research and development programs at the Department's remaining sites, safely manage nuclear materials and spent nuclear fuel, and permanently dispose of the Nation's radioactive wastes.	
Objective EQ1 Safely and expeditiously clean up sites across the country where DOE conducted nuclear weapons research, production, and testing, or where DOE conducted nuclear energy and basic science research. After completion of cleanup, continue stewardship activities to ensure that human health and the environment are protected.	• Maintaining an active Environmental Restoration program that has developed plans and schedules to complete its mission by 2013. • Continuing to improve subcontracting efforts to ensure that the lowest-possible-cost cleanup of sites occurs. • Continuing to work toward making available to the community highly valuable land in close proximity to Los Alamos and White Rock. • Working with neighboring communities to identify and clean up sites. • Using Laboratory science and technology to work with sites such as Hanford and Rocky Flats to develop a safe, environmentally responsible path forward for dealing with their Cold War legacy waste.

Environmental Quality Strategic Goal: Aggressively clean up the environmental legacy of nuclear weapons and civilian nuclear research and development programs at the Department's remaining sites, safely manage nuclear materials and spent nuclear fuel, and permanently dispose of the Nation's radioactive wastes.	
Objective EQ2 Complete the characterization of the Yucca Mountain site and, assuming it is determined suitable as a repository and the President and Congress approve, obtain requisite licenses, construct and, in FY2010, begin acceptance of spent nuclear fuel and high-level radioactive wastes at the repository.	• Providing essential scientific support to the Yucca Mountain Project.
Objective EQ3 Manage the material and facility legacies associated with the Department's uranium enrichment and civilian nuclear power development activities.	• Maintaining and continually upgrading hazardous and radioactive solid and radioactive liquid waste treatment and disposal facilities. • Exceeding all of the Secretary of Energy pollution prevention goals. • Working with the surrounding region to implement effective waste minimization. • Assessing technology options for the transmutation of spent nuclear fuel and waste through the Advanced Accelerator Applications Project. • Streamlining facilities and operations certified by DOE to characterize and ship transuranic waste to the Waste Isolation Pilot Plant.

A number of significant science and technology programs exist at the Laboratory. They support the goals of LANL's Weapons Physics, Weapons Engineering and Manufacturing, and Threat Reduction Directorates while also furthering the goal of increasing mankind's scientific knowledge. Many such science and technology programs are funded by the DOE Office of Science (OS) and align with OS Strategic Objectives. Table 3, below, shows how selected programs funded by OS align with OS planning. In addition, the table includes some scientific activities at the Laboratory that are funded through other sources but align well with OS objectives. In the activities cell associated with each objective below, the activities shown first are funded by OS. Activities listed after a row of stars in any cell have other funding sources.

Table 3. Office of Science Strategic Objectives and Selected Laboratory Activities that Align with These Objectives

Goals: The goal of the Nuclear Physics program is to foster fundamental research in nuclear physics that will provide new insights and advance our knowledge on the nature of matter and energy and will develop the scientific knowledge, technologies, and trained manpower that are needed to underpin the DOE's missions for nuclear-related national security, energy, and environmental quality. The goal of the High Energy Physics program is to understand the universe at a fundamental level by investigating the elementary particles that are the basic constituents of matter and the forces between them, thereby underpinning and advancing DOE missions and objectives through the development of key cutting-edge technologies and trained manpower that provide unique support to these missions.	
SC-1 and 2 (Nuclear Physics and High Energy Physics): To deliver the scientific knowledge and discoveries to understand the most fundamental, subatomic building blocks of matter and the forces between them; to extend the frontiers of nuclear physics and the accompanying leading-edge tools that contribute to many other fields of science, testing conventional and new theories on the dynamic forces that govern the formation and behavior of nuclei, and theories of the process by which quarks and gluons coalesce to form nucleons and ultimately, nuclei, the basis for all elements; and to serve with distinction as the principal steward of U.S. nuclear physics, providing the premier research facilities for university and national laboratory scientists, the technological advances, and the vital human capital that support DOE missions in energy, defense, and environmental quality. **(Continued on the next page.)**	• Supporting the Relativistic Heavy-Ion Collider at Brookhaven National Laboratory through assistance in the collaboration and the physics program of the Pioneering High Energy Nuclear Interaction Experiment (PHENIX) detector. Los Alamos National Laboratory (LANL) has the lead role in building the tracking system for the two-armed muon detector. LANL is also responsible for constructing the multiplicity vertex detector. • Assisting with the MiniBooNE collaboration based at Fermilab. The collaboration, linking 14 universities and laboratories, will use recycled photomultiplier tubes from the recently completed Liquid Scintillator Neutrino Detector (LSND) at LANL. The LSND reported a few cases in which the antiparticle of a neutrino had presumably transformed into a different type of antineutrino. The first neutrino beam created by Fermilab's accelerators will traverse the detector in the spring. Confirmation of the LSND result would indicate the existence of an additional kind of neutrino beyond the three known flavors, requiring physicists to rewrite a large part of the theoretical framework called the Standard Model. • Supporting the Sudbury Neutrino Observatory collaboration, which produced an important breakthrough in understanding of neutrinos last year—a breakthrough that has significance for the final evolution of the universe. LANL is assisting with work involving Sudbury's ^{3}He neutral-current detectors, calibration, and analysis. • Pursuing a program of fundamental nuclear physics research using neutrons produced at the Los Alamos Neutron Science Center (LANSCE), the best source in the world for both pulsed cold and ultracold neutrons. LANL has initiated three major Office of Science efforts with pulsed cold and ultracold neutrons. One of the experiments would employ a pulsed cold neutron beam to measure the gamma-ray asymmetry from the capture of polarized neutrons on hydrogen. In the second major effort, a measurement of the asymmetry of electrons emitted from polarized neutron decay—the A-coefficient—would use ultracold neutrons from a new source now being developed. The third effort is a search for the electric dipole moment of the neutron, using a

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And to deliver the scientific knowledge and discoveries to unlock nature's most fundamental and persistent secrets—the essence of matter and energy, the origin of mass, and the nature of the powerful forces that govern the universe; to extend the frontiers of high energy physics with experimental measurements and collaborations that challenge conventional theories (and advance new ones) on the complex and mysterious interactions between matter, energy, time, and space and that press the limits of design in particle accelerators with resulting benefits to many fields of science; to serve with distinction as the principal steward of U.S. high energy physics, providing the advanced research facilities for researchers at universities and national laboratories, to provide the technological innovation and the support for vital human capital that support DOE missions in energy, defense, and environmental quality.

sample of ultracold neutrons trapped inside a volume of superfluid helium-4. Current nuclear physics research at LANSCE also includes the following:

- Conducting an experiment (to be done at the LANSCE Spallation Neutron Source using cold polarized neutrons) that will attempt to answer long-standing questions concerning the weak interaction of nucleons. (The pulsed cold-neutron beam line is being constructed, and data collection is scheduled to begin in the summer of 2003.)
- Designing and building a full-scale ultracold neutron source at LANSCE. (A density of 300 UCN/cm^3 will allow very precise measurements of neutron decay asymmetries, and hence of the weak coupling constants, pushing the limits of understanding of the fundamental forces of nature.)

- Supporting the Los Alamos Accelerator Code Group (LAACG) and serving as a member of the Department of Energy SciDAC initiative entitled "Advanced Computing for 21st Century Accelerator Science and Technology." These two projects cover a full spectrum of accelerator simulation software that runs on platforms ranging from personal computers to massively parallel supercomputers. The goal of the LAACG is to provide software and services to members of the accelerator community who use and/or develop software for the design and analysis of particle accelerators, beam transport systems, and components of these systems. There are more than 1,000 registered users of LAACG's codes. The SciDAC accelerator-modeling project is a national effort with the primary goal of establishing a comprehensive simulation environment to attack the most challenging problems in accelerator science and technology. One such effort, IMPACT, was developed by LANL and now represents the state of the art in large-scale beam dynamics codes.

- Conducting research at the Milagro Observatory, which uses 723 photomultiplier tubes in two layers and 8 m of water to monitor the entire overhead sky at energies above 100 GeV, studying transient and variable sources of very-high-energy gamma rays, and discovering new gamma ray sources. Milagro was built in an existing, man-made, 6-million-gallon pond of water at Fenton Hill, a former geothermal project site. It is currently being upgraded with the addition of approximately 170 water tanks surrounding the reservoir. In the past year, Milagro has proven its ability to detect cosmic sources with observations of the Crab Nebula and the active galaxy Mrk421. In addition, it has performed the most sensitive survey of the northern hemisphere in the TeV energy range and searched for bursts of TeV gamma rays from the northern sky over time scales from 100 microseconds to two hours.

- Helping to elucidate the properties of quantum chromodynamics using perturbative and nonperturbative (lattice quantum chromodynamics) techniques. LANL has provided new insights into physics beyond the Standard Model by investigating supersymmetry, extra dimensions, gravity,

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SC-1 and 2 (Continued)	and strings. LANL's work on nonequilibrium field theory is a prototype for extracting the hydrodynamic limit of field theory and for studying scattering processes far from equilibrium in hot dense plasmas.

Goal: The Biological and Environmental Research program supports advancing environmental and biomedical knowledge that promotes national security … through competitive and peer-reviewed research at national laboratories, universities, and private institutions. In addition, BER develops and delivers the knowledge needed to support the President's National Energy Plan, provides the science base in support of the Energy Policy Act of 1992, and works cooperatively with DOE's national security programs to develop tools to combat terrorism.	
SC-3 (Biological and Environmental Research): To deliver the scientific knowledge and technology discoveries in biological and environmental research that underpin DOE's missions in science, energy, environmental quality, and national security; to extend the frontiers of biological and environmental research and discover the fundamental operating principles of biological systems through research in structural biology, genomics, and functional genomics; to explain the role of greenhouse gases in climate and environmental change; to enable, through basic research, novel biotechnology solutions for energy, environmental cleanup, and biothreat defense; and to provide innovative diagnostic and treatment technologies for human health. BER will also plan, construct, and operate major scientific user facilities to serve researchers at universities, national laboratories, and industrial laboratories.	• Carrying out production finishing for the Human Genome Project and the Microbial Genome Project. The LANL Center for Human Genome Studies is responsible for coordinating and conducting the finishing of human chromosome 16. • Conducting research (in partnership with LANSCE and Brookhaven National Laboratory) using the Protein Crystallography Station. The Protein Crystallography Station, located at LANSCE, is now fully commissioned, and a number of experiments have been carried out on biological crystals and fibers, demonstrating the potential of the facility. • Supporting the Oak Ridge National Laboratory Center for Structural Molecular Biology by providing software that will expand the user base of the small-angle neutron scattering instrument currently under construction. A combined neutron scattering-computational study has been completed on an important model enzyme, the cAMP-dependent protein kinase, and a software application for modeling solution scattering data has been completed and tested. • Developing an extendable diagnostic platform to guide management of infectious disease. The early target is an inexpensive system that could be used to diagnose tuberculosis in Third World countries. • Developing a new version of the LANL Parallel Ocean Program. The new version, which utilizes a hybrid programming model, is almost completed. Further testing and optimization is needed on a range of available supercomputers. • Working on a calculation that allows close examination of the behavior of ocean currents and provides a basis for improving simulations. The work involves global 1/10-degree simulation with 1.8×10^8 ocean grid points and requires approximately 10^6 timesteps per decade of simulated time—a grand-challenge-scale computation. • Developing the dynamical core of the sea ice (CICE) model. The incremental remapping scheme deals with the heat and salt content of multiple layers of ice, the ice thickness distribution, and the thickness of snow on top of the ice.

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SC-3 (Continued)	• Operating observational systems at sites in the Tropical Western Pacific (TWP) for the DOE Atmospheric Reduction Measurement (ARM) Program. These sites complement others on the North Slope of Alaska and in Oklahoma in ARM's strategy of obtaining long-term observations of cloud behavior in a variety of climatically important regimes. The ARM sites are expected to have National User Facility status in the next year. The TWP network recently added a third observing system, located near Darwin, Australia. • Serving as one of the leaders of the Water Cycle Pilot Project, a multilaboratory investigation of the water cycle at the Whitewater subbasin near Towanda, Kansas. The study is coupling hydrologic modeling, measurement, and analyses for an improved understanding of the water budget at the basin scale. LANL's role is to provide simulations of the atmosphere and hydrology of the Whitewater River and compare the simulation results with observations, radar estimated precipitation, and other models. ********** • Combating bioterrorism with an optical biosensor. This sensor, which has the capacity for rapid detection of toxins and pathogens, is convenient enough for use by emergency first responders and has exchangeable sensor elements for reuse. • Applying Joint Genome Institute sequencing capabilities to developing pathogen "signatures"—sequences in the genomes of pathogens that can be used as identifying markers—and understanding the biology of biothreat organisms. These signatures are critical to intelligence, law enforcement, and public health needs for pathogen detection, forensics, and attribution. • Maintaining the capability to understand the various strains of anthrax (natural and man-made), and maintaining a comprehensive anthrax database for use by health officials. This knowledge base was applied in determining the source of anthrax in critical cases involving letters mailed to sites in Florida, New York, and Washington, D.C., in 2001-2002. • Providing the capacity for early warning of airborne biological incidents for large assemblies and high-visibility meetings. LANL provided such capacity for the Salt Lake City Winter Olympics through the Biological Aerosol Sentry Information System. • Developing approaches for characterizing microbial communities in soil that bypass the need to culture the organisms. Allied to this work is a project focused on the effects of climate change on the composition of microbial communities in the soil. • Improving terrestrial carbon measurement, management, and sequestration and reducing costs by integrating advanced measurement and assessment technology (through efforts of the Applied Terrestrial Sequestration Partnership). One advanced measurement technique being used and improved as part of this effort is laser-induced breakdown spectroscopy.

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SC-3 (Continued)	• Working toward development of technologies to recycle spent nuclear fuel, transmute nuclear wastes, and generate electricity in fast spectrum systems (the Advanced Nuclear Fuel Cycle thrust in the Strategic Research Directorate). • Developing viable options for sequestering CO_2 produced by fossil fuels. One of the Laboratory's major accomplishments in this area is development of mineral carbonation, a process in which a pressurized CO_2 stream reacts with magnesium or calcium silicate mineral deposits to form geologically stable mineral carbonates. The resulting mineral end products are benign and offer permanent fixation of CO_2. • Using Laser-Induced Breakdown Spectroscopy to collect data about carbon in soils, giving scientists a better understanding of terrestrial processes that could influence global warming. • Launching a national research, development, and demonstration program on the relationships between water and energy. • Conducting research through the Atmospheric Science Program (ASP) that has value both to science and to Homeland Defense preparedness. One current focus in ASP is the study of processes in the atmosphere that effect vertical transport and mixing, particularly those in stable conditions and in complex terrain.

Goal: The goal of the Basic Energy Sciences program—a multipurpose, scientific research effort—is to foster and support fundamental research in materials sciences and engineering, chemical sciences, biosciences, and geosciences in order to expand the scientific foundation for new and improved energy technologies and for understanding and mitigating the environmental impacts of energy use.	
SC-4 (Basic Energy Sciences): To deliver the scientific knowledge and discoveries in the basic energy sciences that underpin DOE missions in energy, national security, and environmental quality; **(Continued on the next page.)**	• Doing cutting-edge neutron-scattering research at the Lujan Center user facility at LANSCE. Following are a few recent highlights: The Short-Pulse Spallation Source—SPSS—Enhancement Project culminated in the commissioning of three new instruments on the Lujan Center experimental floor, all of which were prepared for the user program in 2002. PHAROS (Phased Rotor Spectrometer), the inelastic neutron-scattering spectrometer designed to measure lattice excitations in materials, was rebuilt and made operational by the end of 2001 after a five-year hiatus. Asterix, also commissioned in 2001 at the Lujan Center, provides a polarized neutron beam for studies of magnetic materials using reflectometry and diffraction and includes application of high magnetic fields. And, as a commissioning challenge, measurements were made at SMARTS (the Scalable Multithreaded Asynchronous Runtime System) on a tungsten-carbine cobalt cermet sample at temperatures and stresses not possible anywhere else. • Supporting the National Nanotechnology Initiative by improving understanding of materials and material interactions at the nanoscale. LANL is working in partnership with Sandia National Laboratories to create and operate the Center for Integrated Nanotechnologies.

Goal: The goal of the Basic Energy Sciences program—a multipurpose, scientific research effort—is to foster and support fundamental research in materials sciences and engineering, chemical sciences, biosciences, and geosciences in order to expand the scientific foundation for new and improved energy technologies and for understanding and mitigating the environmental impacts of energy use.

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To advance the frontiers and the scientific interrelationships among materials sciences, chemical sciences, biosciences, and geosciences in order to expand the scientific foundations for safe, secure, and efficient systems of energy supply and utilization and for understanding and mitigating the adverse environmental impacts of energy use; to plan, construct, and operate synchrotron radiation light sources, neutron scattering facilities, and other scientific user facilities to serve researchers at universities, national and federal laboratories, and industrial laboratories; and to maintain the vital human capital required for the success of the science programs and DOE missions.

- Doing research in catalysis and chemical transformations and studying heavy-element chemistry.
- Researching nonaqueous actinide chemistry. LANL investigations of actinide diazoalkane complexes provided new insight into the importance of valence 5f-orbitals in chemical bonding.
- Studying a new family of unconventional superconductors—CeMIn5 and Ce2MIn8 (M=Co, Ir, Rh). Their generalized pressure-composition-temperature phase diagrams reveal the important role of antiferromagnetic quantum fluctuations in influencing the ground state properties of these materials. Further, unambiguous evidence for a first-order superconducting transition in CeCoIn5's magnetic field-temperature phase diagram, long-sought theoretically but only rarely observed experimentally, was revealed, in part, using the resources of the National High Magnetic Field Laboratory (NHMFL). This research also led to the discovery of 18K-superconductivity in PuCoGa5, the first-known plutonium-based superconductor.

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- Maintaining user facilities such as the Manuel Lujan Jr. Neutron Scattering Center at LANSCE, the National High Magnetic Field Laboratory, the High-Performance Computing Center, and the Electron Microscopy Facility.
- Constructing a 100 MeV proton beam facility at LANSCE to enable expansion of the production of medical isotopes.
- Using a neutron spectrometer (designed and built at LANL and flown aboard NASA's Mars Odyssey) to determine that Mars has enough water to sustain human exploratory missions.
- Participating in the Multispectral Thermal Imager project.
- Continuing research into high-temperature superconductivity (HTS). The Superconductivity Technology Center coordinates a multidisciplinary program for research, development, and technology transfer in HTS. Projects (conducted with industry) include development of superconducting tapes, current controllers, generators, power transmission cables, and magnetic separators.
- Conducting fuel cell and hydrogen energy research that could lead to clean, efficient powering of devices from laptop computers to automobiles. One example: conducting research under the Freedom Car Initiative, a program that focuses on developing enabling technologies that will help to produce a new kind of car—perhaps powered by fuel cells—without sacrificing mobility, choice, or affordability.
- Developing competency in the science of predicting the behavior, responses, and uncertainties of complex systems and networks. LANL has assembled the components of a core expertise in the integration of theory, modeling, simulation, and visualization.

Goal: The goal of the Advanced Scientific Computing Research program is to foster and support fundamental research in advanced scientific computing—applied mathematics, computer science, and networking—and to provide the high-performance computational and networking tools that enable DOE to succeed in its science energy, environmental quality, and national security missions….	
SC-5 (Advanced Scientific Computing Research): To deliver scientific knowledge and discoveries in strategic areas of applied mathematics, computer science, and network and collaboratory research; to bridge the gap between advanced research in applied mathematics and computer science, and computational science research in the physical, chemical, biological, and environmental sciences; to operate world class high performance computing and network facilities; and to maintain the vital human capital required for the success of the science programs and DOE missions. These objectives underpin DOE's missions in science, energy, environmental quality, and national security.	• Engaging in an integrated, commodity-based approach to large-scale data visualization, leveraging the commodity system and graphics hardware markets. A project to develop terascale comparative visualization and analysis will allow scientists to focus on differences among the outputs of simulations. An open-source parallel visualization tool, Paraview, has been released. A high-performance volume rendering tool, TRex, has been deployed. • Developing and working with high-performance TCP (transmission control protocol) flow-optimization protocols that can adjust transmission rates for web-based teleconferencing and other multimedia applications. A method for "dynamically right-sizing" TCP window sizes during a file transmission has shown an order-of-magnitude improvement in overall performance. Smart-routing technology is being developed to enable the detection and containment of nonadaptive and malicious network traffic. A project is under way to detect steganography—the existence of messages embedded within other unrelated data—and to eliminate it. • Developing new algorithms, better analysis tools, and software techniques to use effectively the inherent power of the current and future generations of scalable parallel supercomputers. • Taking a broad-based approach to modeling problems that arise in subsurface flow and ocean modeling to provide practical computational models for these complex systems. ********** • Using supercomputers to simulate complex national infrastructure in fields including transportation, energy, health, and communications, and applying the knowledge gained to avert or ease the effects of natural and man-made disasters. • Using supercomputers to "mine" huge sets of information to increase knowledge and allow the modeling of phenomena in important fields ranging from global warming to terrorist activity. • Promoting Genetic Imagery Exploitation, a software system for rapidly evolving image-processing algorithms. This system has value for the detection of production of weapons of mass destruction. • Providing support for government and industry decision makers through the National Infrastructure Simulation and Analysis Center. • Using new, superfast computers to model and study tsunamis.

Goal: The goal of the Fusion Energy Sciences program is to advance plasma science, fusion science, and fusion technology—the knowledge base needed for an economically and environmentally attractive fusion energy source.	
SC-6 (Fusion Energy Sciences): To deliver knowledge and discoveries in plasma science, fusion energy sciences and fusion technology, providing the knowledge base needed for an economically and environmentally attractive fusion energy source; to extend the frontiers of the fundamental science of plasmas, exploring their complex and dynamic properties that are likely to lead to their application in other areas of science and in industry, with potential applications as diverse as plasma processing of electronic materials and cleanup of hazardous waste.	• Conducting preliminary experiments—including work on a double-shell target and research on laser-plasma interactions in a single hot spot—designed to support the design of the National Ignition Facility at Lawrence Livermore National Laboratory. • Leading a multi-institutional research team to develop and characterize a magnetized plasma target under compression by an imploding liner. The experimental activities and theoretical modeling require development of the target plasma and a liner-driver to implode and compress the target plasma. In the first phase of research, a high density, deuterium compact Field Reversed Configuration target plasma was designed and constructed. • Serving as a team member on the National Spherical Tokamak Experiment (NSTX) at the Princeton Plasma Physics Laboratory. LANL provides diagnostic and plasma expertise in the form of personnel involvement and specialized imaging systems for physics experiments on NSTX. LANL has fielded a fast visible digital video imaging system, which has become a valuable diagnostic for device operations and experiment execution. With this system, LANL is also involved in the study of edge turbulence using a new diagnostic set called "Gas Puff Imaging." • Conducting a theory program that develops and applies analytic and computational models describing the equilibrium, stability, and nonlinear evolution of toroidally confined plasmas for the magnetic fusion energy program.

Laboratory business and operations activities align with two of the February 2002 NNSA goals and the five DOE 2000 corporate management objectives. There is considerable overlap. Table 4, immediately below, addresses the NNSA goals and selected Laboratory activities aligned with them.

Table 4. NNSA Business and Operations Goals and Strategies and Some Related Laboratory Activities

Goal 4: Ensure the vitality and readiness of the NNSA's nuclear security enterprise.	
Strategy: Attract and retain the best laboratory and production workforce.	• Ensuring the availability of a well-trained, highly motivated workforce that has the critical skills necessary to meet stockpile stewardship requirements by training new weapons scientists and engineers through formal programs such as the Theoretical Institute for Thermonuclear and Nuclear Studies and the Joint Nuclear Explosive Training Facility. • Developing recruiting, redeployment, and development strategies, tools, and programs for management to use in filling projected gaps between the current workforce and workforce needs and requirements through the efforts of the Human Resources Division; Science and Technology Base Division groups such as University of California Directed Research and Development; and technical divisions. Among strategies to address this need are efforts to enhance the critical-skills pipeline by establishing strong, early relationships with talented students in key areas; working with technical organizations to hire entry-level technical staff members from

Goal 4: Ensure the vitality and readiness of the NNSA's nuclear security enterprise.	
Strategy (Continued): Attract and retain the best laboratory and production workforce.	universities; working with Lawrence Livermore National Laboratory to establish joint recruiting efforts; and focusing on long-term Laboratory needs in replenishing the aging workforce in critical areas. Related efforts include providing total compensation strategies to support retention of the laboratory workforce; and optimizing the performance and flexibility of the current workforce through employee training and development and improved management and leadership.
Strategy: Provide state-of-the-art facilities and infrastructure supported by advanced scientific and technical tools to meet operational and mission requirements.	• Ensuring that physical infrastructure and facilities— including the Dual-Axis Radiographic Hydrotest (DARHT) facility—are operational, safe, secure, and compliant and that a well-defined state of readiness is sustained at all critical facilities through the Readiness in Technical Base and Facilities Program. One key facility, the Strategic Computing Complex, has been completed on time and under budget and now houses the first units of the Q Machine, a computing tool designed to run at 30 teraops.
Strategy: Protect classified information and assets.	• Upholding security as a Laboratory priority through Integrated Safeguards and Security Management (ISSM), and striving for zero safeguards and security incidents. • Assessing U.S. infrastructure vulnerabilities through high-class computer modeling and simulation capabilities such as TRANSIMS, ELECTRIMS, EPISIMS, and the Urban Security Project.

Goal 5: Create a well-managed, responsive, and accountable organization.	
Strategy: Deploy new business practices to create an integrated nuclear security enterprise.	• Implementing and coordinating with NNSA the Planning, Programming, Budgeting, and Execution System (PPBES) to develop five-year financial and program plans. • Developing the Enterprise Project, which uses new computer technology to integrate human resources, facilities, financial, project management, and other administrative activities and information. The laboratory has hired IBM Corporation as the subcontractor/integrator for the Enterprise Project.

The relevant goals from the September 2000 DOE Strategic Plan and the aligned Laboratory activities are shown in the next table.

Table 5. DOE Goals and Objectives on Business and Operations and Related Laboratory Activities

Corporate Management Strategic Goal: Demonstrate excellence in the Department's environment, safety, and health practices and management systems that support our world-class programs.	
Objective CM1 Ensure the safety and health of the DOE workforce and members of the public, and the protection of the environment in all Departmental activities.	• Performing all work safely and in an environmentally responsible manner by implementation of Integrated Safety Management (ISM) throughout the Laboratory. • Conducting regular assessments through the Audits and Assessments (A&A) Office that evaluate the Laboratory's performance in areas such as environment and safety.

Corporate Management Strategic Goal: Demonstrate excellence in the Department's environment, safety, and health practices and management systems that support our world-class programs.	
Objective CM1 (Continued)	• Overseeing the contractual relationship between the Department of Energy (DOE) and the University of California (UC). UC and the Laboratory are accountable to DOE for complying with all contractual requirements, including those in the functional areas of environmental restoration, waste management, and environment, safety and health. • Preserving the sustainability of both the region and the world through the selection of strong leadership and the provision of adequate resources for the newly organized Risk Reduction and Environmental Stewardship Division. • Assisting science and technology operations in conducting their work in a manner that protects the worker, the public, and the environment through Environment, Safety, and Health Division policy. • Managing, maintaining, and operating Laboratory waste facilities in a safe and efficient manner through the Facility and Waste Operations Division.
Objective CM2 Manage human resources and diversity initiatives and implement practices to improve the delivery of products and services.	• Implementing and assessing human resources activities to ensure compliance with the UC-DOE contract. • Incorporating diversity into the workplace to enhance organizational decision-making, effectiveness, responsiveness, and productivity. • Ensuring a positive work environment; providing essential support for employees; maintaining a means for employees to resolve office problems; promoting nondiscrimination; increasing representation of minorities, women, veterans, and disabled individuals; enhancing equal opportunity; and improving performance through Employee Relations, Human Resources, the Ombuds Program Office, Equal Opportunity Office, and Quality Improvement Office (QIO) activities.
Objective CM3 Manage financial resources and physical assets to ensure public confidence.	• Conducting audits, assessments, and evaluations (through the work of A&A) to assure that Laboratory management and business practices are continually improved to be more cost-effective. • Providing leadership, resolving business issues, and fulfilling customer needs while reducing the cost of doing business through the Business Operations Division. • Establishing user-friendly channels through the Industrial Business Development Division for collaboration between the Laboratory and external partners for the benefit of the nation. • Achieving a unified, customer-focused culture and improving scientific, programmatic, and operational excellence through QIO. • Providing appropriate news releases and information to the media through the work of Public Affairs; providing solid, factual, in-depth information to scientists through the work of LA Science; providing an outstanding archive (with appropriate protection of classified material) through the work of the J. Robert Oppenheimer Study Center; and increasing public knowledge and understanding of the Laboratory and its work through the Government Relations Office and the Bradbury Science Museum.

Corporate Management Strategic Goal: Demonstrate excellence in the Department's environment, safety, and health practices and management systems that support our world-class programs.	
Objective CM4 Manage information technology systems and infrastructure to improve the Department's efficiency and effectiveness.	• Storing, linking, making accessible, presenting, protecting, and maintaining Laboratory information with maximum accuracy, excellence, efficiency, and creativity, using web-based and other computing tools through the activities of such organizations as the Information Management Group, the Computing, Communications and Networking Group, the J. Robert Oppenheimer Study Center, and the Security and Safeguards Division. • Providing institutional guidance for efficient, effective site and infrastructure planning, land use, and contract management through the Project Management Division. • Developing, managing, and maintaining facilities, utilities, and grounds in the safest, most efficient way possible through the activities of the Facility and Waste Operations Division.
Objective CM5 Use appropriate oversight systems to promote the efficient, effective, and economical operation of the Department of Energy.	• Conducting business in an efficient and cost-effective manner through the Business Operations Division by providing leadership, resolving business issues, and fulfilling customer needs. • Assessing Laboratory operations and business practices to make them more cost-effective through A&A Office activities. • Using Contract Administration and Performance Management techniques to make sure that all work done at the Laboratory reflects LANL's goals of excellence, timely completion, and cost-effectiveness. • Creating a worker-based, total safety culture through continued implementation of ISM. • Ensuring appropriate protection of Laboratory information, work, people, and equipment through the activities of the Safeguards and Security Division, Integrated Safeguards and Security Management, Cybersecurity, and Internal Security (Counterintelligence) programs. • Striving for constant improvement of all Laboratory products through the activities of QIO.

Mission-Strengthening Programs

The Industrial Business Development Division

The Industrial Business Development (IBD) Division within the Strategic Research Directorate (SR) serves as the conduit for the transfer of Laboratory technologies to external sectors to enhance technological innovation and economic competitiveness in the region and in the nation. In support of the Laboratory's technology transfer mission, IBD matches Laboratory scientific and technical expertise, intellectual property, and facilities with research, development, and commercialization endeavors outside the Laboratory. Working closely with the Laboratory's technical divisions and program offices, IBD focuses its technology-transfer efforts in three major areas: industrial partnerships, strategic partnerships, and technology commercialization.

Industrial Partnerships

The IBD Industrial Partnerships Office (IBD-IP) manages the Laboratory's intellectual property, provides business development expertise, and negotiates and executes licenses and partnership agreements between the Laboratory's technical divisions and industry, academia, and other research institutions.

Patents and Copyrights

The Laboratory's ability to use the results of its own scientific research and to meet its technology-transfer mission effectively depends on the protection of its intellectual property. This intellectual property includes the inventions, discoveries, software, drawings, and technical know-how of the Laboratory's staff. IBD-IP works with inventors/authors and the Laboratory Counsel to identify, legally protect, and manage the Laboratory's intellectual property through patents and copyrights.

Goals: IBD-IP's goals are (1) to review, update, and refine processes for management of the Laboratory's intellectual property in furtherance of the development of science and technology; and (2) to provide guidance and training for the technical staff regarding intellectual property processes, options, and consequences in their decisions to publish, patent, or copyright.

Achievements

- In FY2001, 137 copyright disclosures were submitted; 20 U.S. copyrights were asserted; 127 invention disclosures were submitted; 110 U.S. patent applications were filed; and 40 U.S. patents were issued.

Licenses

The Laboratory licenses its patented and copyrighted intellectual property to companies for commercial development and application. Through its licensing program, the Laboratory is able to create a vital link with the private sector. This process leads to innovative and effective solutions to problems that affect both industry and the Laboratory. IBD-IP negotiates, executes, and administers the Laboratory's commercial, noncommercial, and government-use licenses.

Goals: IBD-IP's goals are (1) to increase the number of active commercial licenses by 10 percent per year and to increase license income by 20 percent per year to generate revenue for research, education, and technology-transfer activities; and (2) to maintain a noncommercial license program that develops or enhances program/project development.

Achievements

- In FY2001, 53 new noncommercial licenses and 24 new commercial licenses were executed, and IBD-IP maintained a cumulative total of 70 active commercial licenses. License income totaled $1.54 million.

Partnership Agreements

The Laboratory provides a variety of mechanisms to establish partnerships and collaborations with industry, academia, and other research institutions. IBD-IP negotiates, executes, and administers the Laboratory's partnering mechanisms, including agreements for cooperative research and development, nonfederal work for others, and user facilities, personnel exchange, and nondisclosure of proprietary information.

Goal: IBD-IP's goal is to increase the number of research agreements per year with industries, universities, and other national laboratories that impact the Laboratory's science-and-technology development goals.

Achievements

- In FY2001, IBD-IP negotiated six new and 23 amended cooperative research and development agreements; 44 new, nonfederal, work-for-others agreements; nine new and five amended user-facility agreements; one personnel-exchange agreement; and 362 nondisclosure agreements.

Strategic Partnerships

The Strategic Partnerships Office (IBD-SP) develops and nurtures strategic relationships with industry in technical areas in which partnerships will be essential to the Laboratory's future. Strategic partnerships are long-term, working relationships, built on mutual trust and commitment between parties with complementary capabilities and shared goals and risks. The partnerships are beneficial to both parties and serve to achieve goals that may be difficult or impossible for either institution to accomplish alone.

Goals: IBD-SP's goals are (1) to manage three to five strategic partnerships with industry that involve collaborations with technical divisions across each of the Laboratory's four technical directorates; and (2) to place Industrial Fellows into corporations that are strategic partners or have strong potential to become strategic partners.

Achievements

- Ongoing Partnerships: In FY2001, IBD-SP nurtured ongoing strategic partnerships with Motorola, Procter & Gamble, and PPG Industries. These partnerships enabled collaborative efforts in such areas as modeling and simulation of semiconductor processing technologies, fluid dynamics, image processing, fuel-cell technologies, predictive modeling of material properties and reliability of manufacturing assembly lines, bioscience sensor technologies, and bioinformatics.

- Research Park: The Laboratory and the Department of Energy are working with the Los Alamos Commerce and Development Corporation and Los Alamos County to develop the Los Alamos Research Park. The 44-acre park, located directly north from the main technical area of the Laboratory, will house collaborative efforts among corporate, academic, and Laboratory researchers. The first building was dedicated in March 2001, with Motorola as the anchor tenant. Future plans call for a total of 300,000 square feet divided among five buildings with office and light-laboratory space for 1,500 researchers. IBD will continue to work with external entities to facilitate development of the Research Park.

Technology Commercialization Office

The IBD Technology Commercialization Office (IBD-TCO) develops mechanisms to use emerging Laboratory technologies to stimulate high-tech business start-ups, create job opportunities, and attract entrepreneurs, businesses, and capital to northern New Mexico. IBD-TCO offers a broad range of services to regional businesses and fledgling entrepreneurs, including business counseling, market assessments, training programs, and access to funding sources, networking events, and professional organizations.

Goals: IBD-TCO's goals are (1) to scout the Laboratory for potentially patentable technologies; (2) to facilitate the commercialization of three to five Laboratory technologies per year in northern New Mexico; and (3) to assist emerging technology firms in the region to ensure a more diversified business community and create job opportunities.

Achievements

- In FY2001, five new regional companies were established, 77 new regional jobs were created, and more than $300,000 in assistance was provided to 15 regional companies. In addition, six employees took entrepreneurial leave to commercialize Laboratory technologies, and seven master's-in-business-administration, summer, entrepreneurial interns provided business assistance for regional high-tech start-ups.

Laboratory-Directed Research and Development

Objectives

The Laboratory-Directed Research and Development (LDRD) Program is the principal means by which the Laboratory maintains its scientific and technological vitality. Sustained excellence in mission execution requires that Laboratory capabilities be continually reinvigorated. Through the LDRD program, the Laboratory invests in innovative research and development projects commensurate with its mission and supportive of the nation's scientific needs.

Scientific institutions must have ways to allow their best researchers to pursue innovative ideas that are too embryonic for programmatic focus. The ability to direct resources to such work is often the difference between institutional excellence and mediocrity. The LDRD program is the engine that drives the creation of powerful scientific and technological capabilities that are applied to national problems for which science can provide a solution. It is key to ensuring a high return on the nation's investment in the Laboratory.

The LDRD budget consists of both operating and capital equipment funds that are generated through the application of a uniform assessment to all direct-funded programs including all Department of Energy and reimbursable Work for Others programs. Congress has authorized annual funding for LDRD of up to 6% of the Laboratory budget.

Strategies

The LDRD program structure at Los Alamos consists of three components with distinct institutional objectives: Exploratory Research (ER), Directed Research (DR), and Postdoctoral Research and Development (PRD). In FY2001, LDRD funded 240 projects for a total expenditure of $83.8 million. For FY2002, the LDRD program had about 300 projects and an anticipated expenditure of $97 million.

The ER component of LDRD funds small projects (involving from one to a few scientists) that are at the forefront of science and technology in disciplines that support the Laboratory mission. LDRD DR is intended to be the component most guided by the longer-term Laboratory strategy and most influenced by the Laboratory's scientific management. The LDRD DR projects are generally somewhat larger coherent investments, averaging about a million dollars each, with a single and unifying strategic goal. The PRD component is intended to support innovative research projects engaging the most highly qualified postdoctoral fellows LANL can attract.

There are three ways in which LDRD extends Laboratory science and technology capabilities: First, it may explore new ways of tackling mission problems, thereby identifying opportunities to execute mission objectives in a cheaper, faster, or better way. Second, it may develop new capabilities in areas of expertise needed to fulfill the Laboratory mission, perhaps adding multidisciplinary approaches that provide new insight. Third, it may broaden the fundamental science and technology base in areas that underpin the Laboratory's ability to execute its mission.

Decisions on project funding are ultimately the responsibility of the Director. The LDRD program management process imposes accountability in the selection, execution, and documentation of projects. All projects are selected through competitive review by peers and/or scientific management. Innovation and scientific excellence are the key selection criteria.

In FY2003, an effort was made to increase the quality of peer review in the ER selection process. Each of the 10 ER category teams invited two to three highly reputable external reviewers to become ad hoc members of the ranking committee team. Having read all proposals in advance, external reviewers attended at least the final ranking meeting, and their comments and rankings were included with those of the internal committee members. Ranked lists were provided to a selection committee with the task of prioritizing the potential portfolio for presentation to the Laboratory Director's Office, which made the final selection.

The National Defense Authorization Act of 1993 authorizes LDRD funds to be used as matching funds on Cooperative Research and Development Agreements or other arrangements for technology transfer. This authorization enhances the opportunity to collaborate with private industry.

Achievements

The quality of LDRD-supported research and development is demonstrated by the number of related awards, scientific publications, and patents it produces. In 2001, as in previous years, LDRD-supported scientists garnered national and international recognition for their work. One individual was named a Senior Humboldt Fellow; one was named as a fellow by the American Academy of Arts and Sciences; two became fellows of the American Physical Society; one was given the Marie Curie Award for excellence in Radiation Sciences; one became a fellow of the Optical Society of America; and one won the Fleming Award from the American Geophysical Union.

LDRD products produced a disproportionate number of archival Laboratory publications—well over 500 in calendar year 2001. Through such publications, LDRD creates a strong Los Alamos presence and scientific reputation in the broader scientific community. This visibility and reputation, in turn, make Los Alamos science and scientists magnets to attract and retain the best talent needed to execute the Laboratory's mission.

The technological impact of the LDRD program can also be assessed by the number of patents issued. In FY2001, 15 patents were issued as a result of work conducted through LDRD research—39% of the patents issued to the Laboratory.

Another important measure of success is the formation of external collaborations. External collaborations on LDRD projects leverage the taxpayers' investment in accomplishing the goals of the project. They help establish the Laboratory as a premier scientific institution. They also enhance the Laboratory's ability to attract new employees. Fully 63% of the Laboratory's LDRD projects in FY2001 involved external collaborators. Some projects had several. The total number of external collaborators was 438. The people involved included international collaborators as well as collaborators who worked at other national Laboratories and at major universities in the

U.S. such as Harvard, Stanford, Princeton, Massachusetts Institute of Technology, and the University of California.

Following are some examples of successful LDRD projects.

A project entitled **Host-Pathogen Interactions** addresses the global threat from terrorists and adversarial countries that may unleash both conventional and bioengineered bacterial and viral pathogens. This multidisciplinary project studies the role of protein/protein and nucleic acid/protein interactions in bacterial pathogenesis and exploits this knowledge to develop next-generation tools for pathogen detection and countermeasures. In the past year, researchers have chosen to study the pathogenesis of staphylococcal and anthrax toxins that target human immune cells and subvert their ability to mount normal immune response.

A project called **In Situ Characterization and Failure Prediction of Composites** studies composite materials and how they fail. Composite materials are being used for more and more applications because of their unique properties, such as relatively high strength combined with light weight. Understanding their failure mechanisms can be critical in nuclear weapons and other military applications of these materials. This project is using state-of-the-art computational methods on high-performance computer systems and developing techniques with which damage to composite materials can be observed evolving under loads that cause failure.

Fundamental Electronic Interactions on Nanometer Lengthscales is a project that responds to a growing recognition that material properties on very small scales will play an increasingly important role in science. LDRD researchers invented an approach that leads to optical amplification and lasing in colloidal quantum dots. Very recently, the team incorporated the quantum dot solids into capillary tubes and demonstrated, for the first time, true lasing in a microcavity. These achievements in the areas of stimulated emission and lasing in quantum dots are attracting significant interest. QD materials hold great promise for applications ranging from biolabeling needed to reduce the threat of biological agents to single-electron electronic devices and tunable optical and optoelectronic devices needed for DOE and Department of Defense missions.

Student Internship, Science Education, and Critical Skills Development Program

GOALS, STRATEGIES, AND ACHIEVEMENTS

Goals: The Student Internship, Science Education, and Critical Skills Development Program seeks to meet its two objectives—workforce development and community involvement—by building career pathways for diverse, entry-level hires and by working with community leaders to improve education.

Both of these objectives are closely aligned with Los Alamos National Laboratory priorities. One of the Laboratory's focus areas stresses the importance of recruiting a workforce of scientists, engineers, and other staff members with "many required skills." Another focus area addresses

delivering on commitments to stakeholders and mentions the need to be a good neighbor to surrounding communities. One of the Laboratory's strategic goals is to "focus on diverse, entry-level, and strategic hiring."

Workforce development, through the Laboratory Science and Technology Base Program Office, focuses on training potential staff members in critical skills and engaging students in meaningful Laboratory work. Developing the future Laboratory workforce involves new challenges today because of the declining enrollment of United States citizens in college science and technology programs and because of strong competition from the private sector.

The mandate for community involvement comes from the University of California contract to manage the Laboratory and from the Laboratory's own commitment to being a good corporate citizen. Surveys of regional community leaders show that education at all levels is more important to local communities than ever before. The success of the Department of Energy (DOE), National Nuclear Security Administration (NNSA), and Laboratory missions depends heavily on the availability of a well-educated workforce and a science-literate public.

The Laboratory, through its Education Program Office and the University of California Coordination Team, promotes an active program to enhance critical skills development and establish strategic partnerships with universities and other institutions. Critical skills development at the Laboratory addresses needs not being addressed by universities. The Laboratory and DOE are able to provide motivating experiences and unique enrichment for both U.S.-citizen students and faculty members. Some of the projects are national in scope, others are regional, and still others are local.

The Science Education Program is directly connected with the Laboratory's unique resources, using technical programs as a basis and involving Laboratory staff members extensively. Many projects are conducted collaboratively or jointly with universities.

The most significant support for the Laboratory's wide variety of science education programs comes from two sources: the Office of Defense Programs (DP) within NNSA/DOE, and the Laboratory's own technical organizations, which provide support from programmatic funding. The Education Program Office also seeks funding from other DOE offices, the National Science Foundation, the National Aeronautics and Space Administration, and other sources.

The development of scientific, engineering, technical, and support personnel requires education programs that build upon unique Laboratory professional expertise. The primary objectives for 2003–2008 are to do the following things:

1. serve as a national model for critical skills development and community involvement;
2. ensure a highly trained, diverse workforce;
3. identify, develop, and inspire future scientific leaders;

4. improve the quality of science, mathematics, engineering, and technology education; and

5. lead systemic change in mathematics and science education.

Strategies: With the Laboratory mission and these objectives in mind, strategies during the next five years will focus on critical skills development, student internships, systemic change, and strategic university partnerships.

Critical Skills Development. The key indicator of success in critical skills development is to increase the number and diversity of potential employees likely to be successfully recruited for Laboratory positions. The Critical Skills Development Program is structured so that Laboratory managers and technical staff members identify disciplines and areas of concentration for critical skills initiatives. Students learning critical skills spend an extended period working at the Laboratory. Structured and targeted follow-up communications are sent to the most promising students to encourage continuing relationships.

Student Internships. The indicators of success in student internships are an increase in the number of students working in critical skills areas and improvement in the quality of student experiences at the Laboratory. The number of students working in critical skills areas is tracked using an individualized Workplan Discussion Guide that is jointly developed by the mentor and student. The quality of student experiences is measured using a formal evaluation instrument for students and mentors.

Systemic Change. Leading systemic change in northern New Mexico is a long-term initiative designed to move from one-time projects in schools to dramatic change in the teaching of science and mathematics. Efforts are focused on a vertical slice of the education system that ranges from elementary and secondary education through the university teacher-preparation process. The key indicators of success will be greater student achievement, documented changes in classroom teaching practices, and improvement in evaluated student work. The Northern New Mexico Council for Excellence in Education (NNMCEE) coordinates community involvement initiatives. The Science Education Program manager chairs NNMCEE.

Strategic Partnerships. Improvement in partnerships with selected universities and other institutions is measured through feedback from participating organizations and Laboratory personnel. It is coordinated through two groups, the Education Initiative Council and the University Relations Council. The Laboratory's deputy director for science, technology, and programs chairs both councils. The University Relations Council identifies and formalizes university partnerships.

The Science Education Program also coordinates, on an annual basis, the following critical-skills development and student-internship initiatives:

- **The Fuel Cell Documentary** involves the production of a professional video documentary called "Fuel Cells—The Energy Revolution."

- **The Los Alamos Space Science Outreach Program** is a collaboration linking the Laboratory technical community and the education community in an attempt to engage New Mexico teachers in sustained classroom activities directly tied to space science programs thus supporting improved knowledge in science.

- **The National Consortium for Graduate Degrees for Minorities in Engineering and Science** is designed to establish a pipeline of quality graduate students for the Laboratory.

- **Developing Information System Careers (DISC)** is a three-year program coordinated by the Laboratory in partnership with local education and industry alliances. It is designed to meet the critical and growing deficit of trained computer technicians and computer scientists.

- **Dynamics Summer School** focuses on defense-related engineering such as shock and vibration studies, rigid-body flight dynamics, earthquake studies, vibration isolation, and structural-health monitoring. Students are placed in three-person multidisciplinary teams and assigned a research activity that can be completed in an intense 10-week time frame.

- **Fulfilling the Educational Needs of the Nuclear Future: Modern f-Element Chemistry** is a course fully accredited by the University of New Mexico. The Laboratory offers a unique undergraduate/graduate-level course on the molecular chemistry of actinide elements that features both a lecture series and six selective research fellowships. Fellowship recipients are given a stipend and perform independent research in an area of actinide molecular science. They work under the guidance of one or more Laboratory technical staff members.

- **"Go Figure" Math Competition** focuses on concepts outlined in the book "Algebra Through Problem Solving." The contest's purpose is to identify, encourage, and recognize students who have exceptional talent in mathematics, and then to make sure that the talent is not lost.

- **Los Alamos Physics Summer School** is an eight-week summer program conducted jointly with the NSF and the University of New Mexico (UNM). It is designed to attract the best undergraduate and graduate students to work in science and mathematics. The goals are to teach basic physics skills not usually addressed in a university curriculum, to introduce high-performance computing and its applications in physics problems, and to influence the students to continue working in science and mathematics.

- **Nuclear and Radiochemistry** is a new offering that provides unique undergraduate/graduate-level courses in nuclear and radiochemistry with credit given by UNM.

- **Robotics Competition** is a workshop aimed at teaching young people the basics of robotic technology and identifying those with interest and talent in science and technology.

- **Adventures in Supercomputing** is an academic-year-long program in which teacher-sponsored teams of one to five high school students conduct computational science projects using high-performance computers. It stimulates interest in and provides the Laboratory with an opportunity to engage talented students in the use of supercomputers to solve complex problems.

Achievements

Major achievements during the last year have included the following:

- assumption of responsibility for programmatic implementation and institutional oversight of the high school co-op, undergraduate, and graduate student internship programs;
- recruitment and placement of Hertz Foundation Scholarship students;
- establishment of a College Co-op program;
- expansion of formal agreements with universities in California, Georgia, Michigan, and Texas;
- achievement of "proof of concept" for the NNMCEE-created Math and Science Academy in northern New Mexico, which was designed to improve both student performance and science and mathematics teaching practices dramatically; and
- refinement of critical-skills development programs that result in Laboratory hires.

University of California-Directed Research and Development

Objectives

The University of California Directed Research and Development (UCDRD) program, begun in 1994, exists as a means to promote interaction linking Los Alamos National Laboratory (LANL) with the University of California (UC) and New Mexico institutions of higher learning.

The objectives of the program are to create and enhance satisfying research collaborations that benefit the Laboratory, the UC system, the New Mexico universities, and the Department of Energy (DOE).

Strategies

In the past, UCDRD has supported researchers in three major areas: materials science, bioscience and technology, and earth and environmental sciences. The research chosen was selected through

a proposal/review process that supported faculty, staff, and students on campus and at the Laboratory. LANL has had five collaboration programs managed by the Science and Technology Base Program Office: the Collaborative UC/Los Alamos Research Program, the UC Research Partnership Initiatives, the New Mexico Universities Collaborative Research Program, the New Mexico Research Partnership Initiatives Program, and the Visiting Scholars program.

UCDRD has supported many exciting projects. The program grew from 15 projects in 1995 to a maximum of 94 in fiscal year 1999. In FY2000, there were 71 UCDRD-funded projects.

UCDRD programs have helped make world-class capabilities and facilities available to researchers, broadened student training and recruitment opportunities, developed professional ties between institutions, and strengthened the Laboratory's capabilities. Once successful ties were established, they could be expected to continue and grow beyond the end of a given project.

The Laboratory still greatly values collaborations, and UCDRD will continue to support its obligations to researchers and students who have agreements with the Laboratory, but the approach to this important means of sharing knowledge and research is becoming more strategic. The Laboratory's UCDRD program is in the process of restructuring its funding and activities to support a new initiative—the Laboratory-University Strategic Partnerships.

The transition reflects a student-centered concept. The goal is to be able to enhance students' research and education opportunities. There will be specific research areas selected, and they will be tailored to each campus to meet campus/LANL key needs. In the past, researchers at the Laboratory have linked up with researchers at universities, and the students associated with the university contacts have become associated with the Laboratory through their professors' affiliations. Now, instead, the Laboratory will seek to build a program that will make it easier to identify star students in key areas who can be cultivated as potential future LANL staff members.

Achievements

- In the past year, using the new, more strategic approach, UCDRD has achieved signed agreements and begun interactions with the University of California (UC) Santa Barbara, UC Riverside, and UC Davis. A request for proposals has been approved. Further agreements with the remaining UC schools are anticipated.

- There are plans to develop partnerships with New Mexico Highlands University, New Mexico State University (NMSU), New Mexico Institute of Mining and Technology, and the University of New Mexico.

- In addition, in collaboration with the Los Alamos Neutron Science Center (LANSCE), UCDRD is administering the LANSCE Professorships at the Lujan Center. Under this program, selected university professors spend part of each year at LANSCE while maintaining an active but relatively light teaching load. The program assists campuses by allowing their professors use of unique capabilities and facilities—a powerful recruiting tool. The program is valuable to the Laboratory because it enhances Laboratory access to faculty members, students, and postdoctoral researchers.

A successful and productive six-year relationship with NMSU will conclude in 2003, and there are plans to recruit a replacement for the current professor. A UC San Diego professor began work at LANSCE April 1, 2001, and although the position is too new to assess, the outlook is good. Professorships linking the Laboratory and other universities are anticipated.

Directorates

Administration Directorate

OVERVIEW

The responsibilities and functions of the Administration Directorate extend to every aspect of the Laboratory's mission and operation.

The directorate has four divisions—Business Operations (BUS), Communications and External Relations (CER), Human Resources (HR), and Information Management (IM). It also has six offices—Audits and Assessments (AA), Diversity (DVO), Equal Opportunity (OEO), Laboratory Counsel (LC), the Ombuds Program (Ombuds), and Quality Improvement (QIO).

The directorate includes approximately 1,200 employees and has a budget of approximately $150 million.

MISSION SUPPORT

The Administration Directorate supports the Laboratory's mission by ensuring that all business, personnel, outreach, and related matters operate effectively and efficiently and in accordance with contractual requirements.

While the directorate is inherently involved with two of the priority research and development goals set by Laboratory top management (strategic hiring and management excellence) through its Human Resources and Business Operations Divisions, it also directly supports the other eight priority goals. The functions of the six offices within the directorate apply to all organizations and operations of the Laboratory. For example, the Ombuds Program is at the service of every employee in the Laboratory.

PROGRAMS

COMMUNITY RELATIONS

STRATEGIC FOCUS

Los Alamos National Laboratory (LANL) strives to be a valued, respected, and responsible corporate neighbor in northern New Mexico. LANL recognizes the need for continuous improvement in its relationship with the surrounding region, as well as for both long- and short-

term strategic thinking in its community relations practices. This plan, therefore, will be used to guide rather than to direct these efforts and will be enhanced periodically as opportunities for improvement are identified.

GOALS, STRATEGIES, AND ACHIEVEMENTS

Goal #1: Promote public trust and confidence through corporate and personal candor, integrity, operational excellence, educational and community outreach, economic development, and philanthropic endeavors in northern New Mexico.

Strategies

1. Perform an annual evaluation of management's performance toward meeting community expectations.
2. Maximize the alignment between LANL internal organizations and its Strategic Plan, using the following approaches:
    - providing presentations and publications;
    - educating LANL employees about outreach programs;
    - identifying and using all points of contact;
    - developing and implementing efficient and effective processes;
    - utilizing employees and retirees as volunteers; and
    - implementing corporate-sponsored projects that enhance regional economic development.
3. Establish and maintain collaborative relationships and partnerships with organizations in the following categories:
    - business and regional economic development;
    - community technological assistance;
    - local and regional governments;
    - education and workforce development; and
    - quality-of-life planning.
4. Maintain a close liaison with the LANL Foundation by means of the following approaches:
    - sharing information about the LANL Foundation with regional audiences; and
    - effectively communicating philanthropic activities.

Achievements

- The Laboratory collected more than $667,000 in the annual United Way Campaign.
- The Laboratory conducted several major business conferences to educate New Mexico businesses on how they can work with LANL.
- The Laboratory initiated a new publication, The Lab Connection, to communicate news about LANL to surrounding communities.

Goal # 2: Develop a systematic approach to understanding community and tribal issues and priorities, and match them with appropriate Laboratory resources.

Strategies

1. Identify and understand community and tribal concerns through the following activities:
    - surveying status and incorporating data into performance measures and action plans;
    - maintaining dialogue through meetings and forums;
    - formulating strategies to respond to issues; and
    - increasing interactions.
2. Establish and maintain programs to provide access to Laboratory resources for regional businesses, institutions, and communities through the following approaches:
    - supporting the Laboratory's Small Business Office initiatives; and
    - supporting the Laboratory's Technology Commercialization Office.
3. Identify Laboratory resources and technical expertise available to assist the region, and oversee efforts to utilize assistance provided by the following:
    - the Bradbury Science Museum (University of California [UC]/LANL)
    - the Technical Assistance Program
    - employee giving programs
    - the Laboratory volunteer program
    - corporate volunteer projects
    - the public reading room.

Achievements

- The Four Accord Pueblos and LANL participated in a February workshop on environmental restoration to assist the pueblos in developing environmental programs funded by the Department of Energy (DOE) through Cooperative Agreements.

- The Laboratory set up monthly Wildfire Impact meetings involving DOE, the San Ildefonso cultural resources staff, and the Laboratory cultural resources team to address the pueblo's concern about the impact of the Cerro Grande Fire on cultural sites and rehabilitation activities.

- The Laboratory provided technical grant-writing support and other in-kind technical assistance on regional projects including Rio Arriba County's Rural Events Center Feasibility Study, and the City of Española's Colonization and Mission San Gabriel Projects.

Goal #3: Develop outreach programs, in collaboration with the Laboratory's Science and Technology Base (STB) Program Office, that enhance the quality of science education in the regional schools (kindergarten through college), working with Laboratory organizations, communities, and education leaders.

Strategies

1. Continue to target Laboratory resources in the following identified areas:
    - using the Laboratory's expertise to improve education;
    - supporting Bradbury Science Museum outreach and in-museum programs;
    - supporting telecommunications infrastructure expansion;
    - assisting the American Indian education programs in kindergarten through 12th grade;
    - continuing partnerships with the Northern New Mexico Council for Excellence in Education (NNMCEE) and with regional education associations;
    - encouraging and building the Laboratory's employee scholarship program;
    - working with schools and universities to improve the academic standing of students from the region; and
    - increasing the number of new employees hired into LANL technical positions from New Mexico colleges and universities.

2. Educate Laboratory employees and local communities about regional educational opportunities, using presentations, publications, and electronic communications plus the following approaches:

    - increasing employee participation in regional education programs;
    - continuing to work with NNMCEE, the Tri-County Higher Education Association, and local colleges and universities to advocate improved education and workforce development;
    - working with the Laboratory's STB Program Office to advocate Laboratory science education programs;
    - supporting the outreach efforts of STB through tours of the Laboratory and other communication means; and
    - making knowledge about the wide variety of Laboratory outreach-related educational opportunities more available.

Achievements

- LANL assumed a leadership role in NNMCEE.
- The Laboratory gave more than $2 million worth of excess equipment to schools and other organizations in 2001 through the LANL Education Equipment Gift Program.
- The Laboratory initiated the Science on Wheels Program through the Bradbury Science Museum, taking hands-on science demonstration programs into schools throughout the region.

FINANCIAL

STRATEGIC FOCUS

The Laboratory's financial strategic objective is to ensure that LANL continues to be a responsible steward of the taxpayers' money, delivering the best value for dollars spent and ensuring that it is recognized by its customers as the "laboratory of choice" for cost-effective project delivery and financial stewardship.

GOALS, STRATEGIES, AND ACHIEVEMENTS

Goal #1: Improve financial decision making by providing timely, accurate, and relevant information.

Strategies

1. Work in partnership with customers to plan and execute LANL programs, including implementation of the Planning, Programming, Budgeting, and Execution System (PPBES) to develop five-year financial and program plans.

2. Assure that key decisions are based on sound financial analysis as well as on technical requirements.

3. Participate in the development of the Enterprise Project, which integrates human resources, facilities, financial, project management, and other administrative activities and information.

Achievements

- LANL hired a PPBES project leader to implement the new support effort.

- The Laboratory hired IBM Corporation as subcontractor/integrator for the Enterprise Project.

Goal #2: Ensure that cost charging is in compliance with contractual requirements.

Strategies

1. Continue to reinforce processes that promote management's commitment to appropriate cost charging.

2. Update the charging guidelines to ensure that they assist management in appropriate charging.

3. Emphasize training for management, detailing the guidelines for charging, primarily through a module in Required Management Training.

4. Implement processes to ensure that costs are charged to associated projects, in conformance with Cost Accounting Standards.

Achievements

- The Laboratory implemented monthly training sessions to address appropriate charging and allowable costs as part of the Laboratory-wide mandatory management-training program.

Goal #3: Continue to improve quality and reduce costs associated with financial services.

Strategies

1. Work with customers and stakeholders to reduce operational costs of BUS and the Laboratory.

2. Implement institution-level cost reviews, with an emphasis on making the annual indirect budget review more comprehensive.

3. Incorporate process-improvement methodologies into budget reviews.

4. Examine opportunities for outsourcing.

Achievements

- LANL developed the UC/Tri-Lab Cost Efficiencies Initiative—with Lawrence Berkley National Laboratory (LBNL) and Lawrence Livermore National Laboratory (LLNL)—to achieve collaborative economies of scale. Teams were formed for every function at each institution to work together on a joint report with findings and recommendations based on cost impact, difficulty of implementation, impact on service, risk, and personnel/vendor displacement.

- LANL initiated a Laboratory-wide study of institutional indirect base budgets. By the end of fiscal year 2002, the Laboratory will have examined approximately 39% of its institutional indirect base budgets.

Goal #4: Develop and implement customer-driven pricing strategies in conjunction with implementation of the Enterprise Project.

Strategies

1. Provide the opportunity for all stakeholders and customers to understand the impact of any changes.

2. Continue to seek customer input.

3. Choose the best business practices.

Achievements

- As part of a four-year cycle, the Laboratory conducted a comprehensive assessment of overhead needs. The study included benchmarking with other laboratories. It resulted in approved recommendations for methodology changes in assessing cost impacts.

Goal #5: Ensure that the financial assets entrusted to the Laboratory are appropriately safeguarded.

Strategies

1. Continue to review internal controls to ensure that they provide adequate safeguards.

2. Use the Enterprise Project technology to strengthen controls.

3. Continue BUS self-validation and internal audit activities that provide independent oversight of the Laboratory's internal controls.

Achievements

- In concert with the Internal Audits and Assessments Division, BUS developed a control management loop for joint analysis of the control environment for financial/accounting activities via the Control Risk Self-Assessment process, thereby conforming to the DOE Financial Stewardship Program.

WORKFORCE

STRATEGIC FOCUS

Systematic workforce planning and management will assist technical, operational, and business divisions in identifying capability shortages and excesses, analyzing workforce and capability demographics, and identifying and filling workforce gaps in critical areas. These workforce plans will also guide future Laboratory efforts in attracting, acquiring, aligning, developing, and retaining talent—achievements crucial to the strategic hiring initiative.

GOALS, STRATEGIES, AND ACHIEVEMENTS

Goal #1: Attract and align a quality workforce matched to Laboratory budget and programmatic requirements.

Strategies

1. Develop recruiting, redeployment, and development strategies, tools, and programs for management to use in filling projected gaps between the current workforce and workforce needs/requirements.

2. Sharpen the focus of institutional recruiting by working with technical organizations to hire entry-level technical staff members from universities with diverse populations and relevant, top-notch scientific and technical programs.

3. Focus on long-term Laboratory needs and on replenishing the aging workforce in critical capability areas when hiring entry-level employees.

4. Enhance the critical-skill pipeline initiative by establishing strong relationships with talented students in critical-skill areas from undergraduate through graduate levels.

5. Work in partnership with LLNL to address Laboratory workforce shortages, particularly through joint recruiting efforts in an effort to maintain the pipeline to critical skill positions.

Achievements

- The Laboratory selected universities for FY2002-2003 recruitment efforts in accordance with the criteria of excellence, diversity, regional location, critical-skills needs, and acceptance rate (since 1998).

- The Laboratory implemented Just-in-Time Interview Events focusing on entry-level hiring needs in critical-skills pipeline areas.

- The Laboratory coordinated recruitment at diversity and professional conferences (in conjunction with LLNL and LBNL) as part of the Centers of Excellence Initiative.

Goal #2: Provide total compensation strategies to support the retention of the Laboratory workforce.

Strategies

1. Enhance pay-program delivery including such elements as premium pay for employees in key, hard-to-fill specialties.

2. Implement future directions for health care including a plan redesign.

3. Establish a childcare project to augment attraction and retention.

4. Provide flexible and user-friendly tools for performance assessment and salary management.

Achievements

- The Laboratory identified the need to design a premium-pay program for critical-skill employees working at the Laboratory Plutonium Facility.

- The Laboratory established the "Health Care: Pathways to Change" initiative to research, identify, and analyze alternatives to meet rising health care costs.

- LANL established a performance and salary management system whereby tools and processes are assessed and improved annually, based on customer feedback and process results.

- The Laboratory refocused education programs on critical-skill development needs in collaboration with DOE's Office of University Partnerships.

Goal #3: Optimize the performance of the current workforce through employee training and development and improved management and leadership effectiveness.

Strategies

1. Devise multiple approaches to employee development to provide employees with the tools necessary for successfully advancing their careers and enhancing their mobility within the Laboratory.

2. Maintain the focus on education and skill development by assisting organizations in matching their development needs with relevant educational strategies.

3. Improve career development opportunities through Career Builders, which provides a wide range of services, including individualized career assessments, resume advice, web resources, and specialized courses to develop skills needed to meet career goals and maximize opportunities for internal mobility.

4. Enhance the Laboratory's mentoring program (based on a philosophy of learning partnerships) to develop and sustain critical skills and knowledge across the Laboratory, promote the exchange of diverse capabilities and leadership experiences, and assist professional growth.

5. Strengthen management capabilities through Requirement Management Training provided to all Laboratory managers.

6. Institute Workforce Review programs including workforce and work environment status and planning and key-talent discussions.

7. Review and revise AM112–Discipline Policy and Procedures as appropriate.

Achievements

- The Laboratory developed learning@lanl to expand and increase the accessibility of Laboratory workforce development programs.

- The Laboratory expanded development and education programs and services, which now include an assessment center, a mentoring program, professional development courses, distance learning degree programs, and education options. The programs are provided to employees, free of charge or on a recharge basis, with educational opportunities provided through the Laboratory tuition reimbursement process (which currently totals more than $1 million annually).

- LANL expanded the Leadership Center, which offers programs to assist managers and supervisors at the Laboratory in achieving success in their roles as organizational leaders.

- LANL developed and initiated Required Management Training to ensure that managers know what is expected of them and are aware of available resources.

- The Laboratory initiated a Workforce Review pilot program to integrate initiatives that address workforce issues (e.g., work environment, key talent, and recruitment and hiring initiatives) across the Laboratory's technical and support divisions.

Operations Directorate

OVERVIEW

The Operations Directorate (Operations) is responsible for managing many activities and projects that support physical infrastructure, enable scientific and technical achievement, and strongly affect the quality of life and long-term health and direction at Los Alamos National Laboratory (LANL).

These activities include facilities management, project management, construction project oversight, environmental stewardship, safety, health, security, radiation protection, foreign visits, and performance surety.

In fiscal year 2002, the directorate, a $900-million operation ($700 million in direct-funded programs and $200 million in indirect-funded activities), included six divisions, two offices, 1,298 University of California (UC) employees, 394 contract employees, 1,546 site-support-service subcontract employees, and 660 security-subcontract employees.

MISSION SUPPORT

The Operations Directorate supports the Laboratory's mission by using the best models and business techniques to manage facilities and projects, to oversee environmental stewardship and waste management, and to ensure the safety and security of the Laboratory in an efficient and effective manner.

GOALS, STRATEGIES, AND ACHIEVEMENTS

While the Operations Directorate has established a number of goals within each of its programs and organizations, the following four goals represent the highest directorate priorities for the next one to three years:

Goal #1: Significantly improve the Laboratory's Environmental Stewardship performance.

Strategy

The environmental restoration and waste disposition activities at Los Alamos National Laboratory, which were previously spread among three divisions in two directorates, have been consolidated into a single division, Risk Reduction and Environmental Stewardship (RRES), in the Operations Directorate. The Operations associate director is now fully accountable for the

Laboratory's environmental program performance. The RRES division leader serves as the Laboratory's single point of contact for Department of Energy (DOE)/Environmental Management (EM) and for the New Mexico Environmental Department (NMED). It is critical to the Operations strategy for improving the Laboratory's environmental stewardship performance to make this new division's structure work effectively. The first step will be to select strong leadership for RRES. Operations will be actively involved in monitoring environmental stewardship performance and will solicit performance feedback from the DOE, NMED, and internal customers.

A second component of the Operations strategy in environmental stewardship will be to accelerate the cleanup of sites at the Laboratory and to accelerate waste shipments to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico. The Laboratory is currently negotiating with EM to obtain the funding necessary to accelerate site cleanup. The current proposal would complete the Laboratory environmental remediation of legacy sites by the year 2015. Estimates of the cost avoidance that would result from current and proposed acceleration of cleanup schedules come to more than $70 million for Environmental Restoration (ER) and more than $500 million for Waste Disposition (WD). These amounts would more than repay the investment of increased funding that Operations has requested to support plans for accelerated cleanup and waste disposal.

Achievements

- LANL was the first site in the DOE complex to ship waste to WIPP and has successfully completed 25 shipments to date.

- LANL has also developed key technologies for characterization of transuranic waste that are being used at other DOE sites. These technologies include almost all equipment used for assay of radioactivity at all sites, the "crate counter" used at Rocky Flats Environmental Technology Site, and equipment used for "head-space gas" measurements at Argonne National Laboratory and Rocky Flats.

- Up to this point, the Laboratory has successfully completed the following ER/WD activities:

    - developed 28 major workplans to address 2,124 potential release sites (PRSs) located on LANL land or on areas impacted by LANL operations;

    - reduced the 2,124 PRSs to 870 through permit modifications and DOE approvals for "no further action";

    - completed the cleanup of Material Disposal Area P, which involved the removal of 55,000 cubic yards of contaminated soil, some of which had extremely high concentrations of high explosives. This project was one of the first Resource Conservation and Recover Act (RCRA) "clean closures" of major industrial landfills in New Mexico;

- drilled nine deep wells and three intermediate wells as part of the NMED-mandated Hydrogeologic Work Plan;

- completed transuranic waste retrieval 22 months early and $19 million under budget; and

- completed 90% of mixed-low-level waste disposal at a cost $14 million under budget.

Goal #2: Improve Laboratory facility capabilities and performance 1) by consolidating and modernizing the Laboratory's aging infrastructure and 2) by implementing a more centralized facility management model.

Operations will continue developing Laboratory facility consolidation and modernization plans. Laboratory Director John Browne said in his March 13, 2001, statement to Congress, "The entire nuclear weapons complex managed by the production plants and laboratories is faced with serious aging problems that threaten our ability to carry out the stockpile stewardship mission. To continue to work effectively on these DOE/National Nuclear Security Administration (NNSA) missions, our Laboratory needs outstanding scientists and engineers working in state-of-the-art facilities. Unfortunately, our facilities have deteriorated badly. Buildings, roads, sewer systems, electrical power grids, and other critical infrastructure are approaching 50 years in age and are crumbling at an alarming rate. The ability to conduct our programmatic mission is clearly at stake. A dedicated revitalization effort is crucial for the long-term viability of this Laboratory." The first component of this Operations goal is to press forward vigorously with consolidation and modernization.

Externally conducted studies and reviews, including the recently completed BWX Technologies, Inc., Laboratory Nuclear Facility Study (conducted under Appendix O of UC's prime contract to manage the Laboratory), indicate that Laboratory facility management performance could be significantly improved through a more centralized facility management model. A new, centralized facility model has been developed after extensive consultation with divisions and directorates, the UC, and independent facility operators and experts. Laboratory senior management has approved the implementation of this new model. The second component of this Operations goal is to make the new facility management model work effectively.

Strategy

The Laboratory has stated on several occasions that while facilities will only be operated in a safe and secure fashion, the level of available funding has not ensured sustainability. The principal Laboratory strategies in addressing sustainability are consolidation planning and a graded approach to maintenance based on long-term mission need.

The Operations position is that the "catch-up" approach to the maintenance backlog will not work, and even if there were enough funding to make it work, it would not be in the best interests of the ongoing Defense Programs (DP). Instead, a smaller footprint for facilities—addressing the mission of today and tomorrow instead of the Cold War mission of the

1950s and 1960s—will provide for a more effective and robust capability. This strategy provides a progressively more cost-efficient approach to providing effective facilities.

As the Laboratory consolidates functions and then excesses facilities, operating costs are reduced. When the Laboratory decommissions and demolishes buildings that have no future use, it removes associated surveillance and maintenance costs forever. In addition, from an environmental standpoint, former building sites provide very good options for future facilities to support the Laboratory mission. Demolition of as much as a million square feet of Laboratory space over the next five to 10 years seems viable.

Another component of this Operations strategy involves the new facility-management model. In the new model, the institution will have responsibility for facility management activities, and divisions will continue to have responsibility for programmatic equipment maintenance. This new model will provide for direct support of Laboratory operations goals, clear control for facility operations, consistent management practices, a critical mass of expertise and capabilities, and improved regulatory compliance. Operations is committed to expediting the implementation of this facility-realignment project.

A third piece of the Operations facility strategy is to complete successfully all of the facility requirements established by Appendix O.

Achievements

- A 10-year comprehensive site plan has been developed and approved by NNSA.
- A consolidation effort at Engineering Sciences and Applications Division (ESA) is already under way and has resulted in people moving from old, temporary structures to a new, permanent building.
- Old facilities totaling approximately 50,000 square feet were decommissioned and demolished in FY2001. In FY2002 and FY2003, facilities totaling an additional 300,000 square feet are scheduled for decommissioning and demolition.
- A more centralized facility-management model has been developed; a project manager has been named; and a project plan to implement the new facility-management model has been developed and will be executed.
- All Appendix O facility project plan milestones continue to be met on or ahead of schedule as validated by UC.
- A formal project plan has been developed, and a project manager has been named to address each of the recommendations that resulted from the Appendix O facility report prepared by BWX Technologies, Inc. The project plan and the project manager will assure that all milestones are met on time.

Goal #3: Strive for outstanding performance in integrated safety and security management.

Safety and security are prerequisites for all Laboratory work. The Laboratory will never sacrifice safety or security in order to deliver on programmatic or scientific tasks. With the Integrated Safety Management Program in place, the Laboratory has made enormous progress in transforming safety from a check-the-box activity to an internalized value that pervades every activity. Operations will drive further improvements in the Laboratory's safety culture and will continue maturing Integrated Safeguards and Security Management (ISSM), a corresponding value-driven culture of security initiated in early FY2000. Operations recognizes that Laboratory customers and the nation depend on nothing less.

Strategy

Operations will continue to utilize nested safety committee meetings as the communication tool for improving safe work practices. However, the scope of these meetings will be expanded to include security. There will be nested safety-and-security committee meetings so that safety and security and their critical interfaces can continue to be improved. Operations organizations will provide a safety advisor and a security advisor to each directorate to assist each associate director in managing safety and security programs.

A second component of the Operations security strategy is to complete all of the security requirements established by Appendix O.

Achievements

- Laboratory safety statistics have improved dramatically. The total-recordable-incident rate, which was six per 200,000 hours worked in FY1997, was less than two in FY2001. The lost-workday-case rate fell from four to less than one in the same period. Many divisions have recently achieved outstanding safety records. ESA has gone 500 days without a lost-workday case. Many nontechnical divisions have gone more than one year without a recordable injury. Some technical divisions have gone many months without recordable injuries.

- Similarly, security incidents have dropped more than 30% since FY2000, and self-reporting is high.

- Comprehensive DOE security inspections have resulted in the highest possible overall ratings for the last two years.

- Major ISSM process improvements include: establishment of a "one-stop customer service" Security Help Desk; formation of a cross-directorate ISSM Positive Security Behaviors Team for achieving a more positive Labwide security environment; initiation of an annual "Community Safety and Security Day" to promote partnership between the Laboratory and surrounding communities; revision of General Employee Training and the Annual Security Refresher to reinforce ISSM expectations; initiation of Labwide ISSM-based Required Management Training; initiation of Labwide "line" self-assessments including management walkarounds and sharing "lessons learned";

and streamlining of the Laboratory's entire set of internal security requirements (from more than 4,400 pages to fewer than 400 pages).

- All Appendix O security/ISSM project plan milestones continue to be met on or ahead of schedule as validated by UC.

Goal #4: Strive for outstanding performance in project management.

Operations will strive to complete construction projects at or below budget and on or ahead of schedule. During the Cold War, many challenging projects were completed successfully and to the benefit of our nation—regardless of their cost. Operations recognizes that those times are past and that the policymakers and taxpayers can rightly hold the Laboratory to an expert standard of formal project management. Great strides have been made in this direction. Operations' goal is to continue and accelerate this progress.

Strategy

All construction project scopes, schedules, and budgets will be reviewed monthly at a Laboratory project review. High-risk projects will be placed on the "Director's Watch List." Director's Watch List projects will be reviewed by the Laboratory's Senior Executive Team on a quarterly basis. Each construction project will be assigned a project management professional from the Project Management Division.

A second component of the Operations project strategy is to complete all of the project management requirements established by Appendix O.

Achievements

- The Strategic Computing Complex construction project was completed ahead of schedule and $13 million under budget.

- The Chemistry and Metallurgy Research Upgrade project was completed ahead of schedule and $15 million under budget.

- The Nonproliferation and International Security Center construction project is on schedule to be completed early and under budget.

- All Appendix O Project Management Plan milestones continue to be met on or ahead of schedule as validated by UC.

- A Project Management Training Initiative has begun and is promoting work with regional colleges, high schools, and businesses to assure a long-term supply of qualified project controls staff members.

Strategic Research Directorate

OVERVIEW

The Strategic Research Directorate (SR) creates and develops science and technology in support of Los Alamos National Laboratory's mission.

The directorate has approximately 2,000 employees, including more than 1,600 scientists, engineers, postdoctoral fellows, and graduate students. It originates most of the Laboratory's scientist-to-scientist collaborations with universities, industrial firms, other government laboratories, and international research centers. SR also has the largest share of the Laboratory's fellows, long-term visiting scientists, postdoctoral researchers, and graduate students.

SR operates a number of science and engineering "user facilities" including the National High Magnetic Field Laboratory and the Stable Isotope Resource. All of these facilities are available to qualified members of the national and international science and engineering community.

SR has five divisions: the Chemistry Division, the Earth and Environmental Science Division, the Industrial Business Development Division, the Materials Science and Technology Division, and the Theoretical Division.

The directorate also has one program office—Energy and Sustainable Systems (ESS). ESS and IBD act as the Laboratory's customer interface in key nondefense areas. ESS works to ensure that the Laboratory's technical resources are directed toward energy issues of national and global importance in four major areas: energy science and technology; the nuclear fuel cycle; resource ecology; and civilian infrastructure. IBD works with inventors/authors and the Laboratory Counsel to identify, protect, and manage the Laboratory's intellectual property through patents and copyrights; it negotiates, executes, and administers the Laboratory's commercial, noncommercial, and government-use licenses and partnership agreements; it develops and nurtures strategic relationships with industry; and it develops mechanisms to use emerging Laboratory technologies to stimulate high-tech business start-ups, create job opportunities, and attract entrepreneurs, businesses, and capital to northern New Mexico.

MISSION SUPPORT

SR supports the Laboratory mission by advancing knowledge across a broad range of scientific disciplines. In collaboration with the Nuclear Weapons and Threat Reduction Directorates, SR promotes basic and applied research directed toward solving complex scientific and technological problems in support of the Laboratory's missions in national security and threat reduction. SR takes the lead in the Laboratory's broad national security missions in energy security, environmental security, and critical infrastructure. As a broker of scientific knowledge and understanding, it supports the mission of the Laboratory by fostering innovation and creativity by staff members; supporting and enhancing the scientific reputation of the Laboratory through a vigorous basic research program; and serving as a gateway from the scientific world to

industry and academia by means of collaborations with government laboratories, universities, and industry.

The directorate's collaborations with the Threat Reduction Directorate include efforts toward civilian infrastructure protection and analyses of the security of civilian communications, financial, energy, transportation, water, and health systems. The SR staff conducts research in a customer-focused, cost-effective manner while striving for operational excellence, maintaining a safe and healthful workplace, and protecting the public and the natural environment.

GOALS, STRATEGIES, AND ACHIEVEMENTS

Goal: Provide technical solutions to grand challenges in national security through basic and applied science, building the scientific foundation for Stockpile Stewardship and Homeland Defense. Increase knowledge and competence in key areas involving advanced materials, energy, and energy and environmental security.

The directorate has seven major thrust areas: the Advanced Nuclear Fuel Cycle, Carbon Management, Energy/Water Security, Genomes to Ecology, the Hydrogen Economy, Nanoscience and Nanotechnology, and Science-Based Prediction. Synergies among these areas create the basis for a comprehensive research-and-development effort of national and international significance. Strategies for individual thrust areas are summarized below.

Strategies

Strategy One: In collaboration with other Department of Energy (DOE) laboratories, develop an Advanced Nuclear Fuel Cycle program that couples nuclear energy security with nuclear materials management.

Efforts related to SR's Advanced Nuclear Fuel Cycle thrust incorporate a new national-security-driven strategy which will seek to close the nuclear fuel cycle, manage excess plutonium, safely and securely store spent fuel in Yucca Mountain, and promote construction of a new generation of thermal reactors. These objectives will be accomplished by developing and demonstrating technologies to recycle spent nuclear fuel, to transmute nuclear wastes, and to generate electricity in fast spectrum systems.

Strategy Two: Develop the technologies that will be required to stabilize and reduce high concentrations of global greenhouse gases in the atmosphere.

SR's Carbon-Management thrust seeks to develop technologies including carbon dioxide capture, separation, and storage or reuse.

The Laboratory's plan is to develop viable options for sequestering the CO_2 waste produced by fossil fuels through its carbon sequestration research program.

Achievements

One of the most significant accomplishments in the area of carbon sequestration research at the Laboratory is mineral carbonation, a process in which a pressurized CO_2 stream reacts with magnesium or calcium silicate mineral deposits to form geologically stable mineral carbonates. The resulting mineral end products are naturally occurring, completely benign, and offer permanent fixation of CO_2, eliminating legacy issues for future generations.

Strategy Three: Launch a national research, development, and demonstration program that focuses on the interrelationships between water and energy.

SR's Energy/Water Security thrust addresses technical challenges and recognizes that the continued security and the economic health of the U.S. depend on sustainable supplies of energy and water. National defense, food production, manufacturing, recreation, and the daily functioning of households all rely on a clean and affordable supply of one or both of them. These two critical resources are inextricably and reciprocally linked. The production of energy requires large volumes of water, and the treatment and distribution of water is equally dependent upon readily available, low-cost energy. The electricity industry is second only to agriculture as the largest user of water in the U.S. The nation's ability to continue providing clean, affordable energy and water is seriously challenged by a number of emerging issues:

- Population and economic growth are increasing demand and competition for both water and energy.
- Populations are shifting to water-deficient regions.
- Demand for electricity is increasing.
- Climate change, exacerbated by increasing energy use, affects water availability and distribution.
- Water and wastewater infrastructures are deteriorating.

Achievements

Los Alamos National Laboratory, Sandia National Laboratories, and the National Energy Technology Laboratory—with appropriate partners from other federal agencies, industry, and the university community—hope to launch a national program that will lead to predictive tools, technological innovations, and validated solutions designed to ensure continued water and energy security. This research and development program would help:

- Ensure a stable water resource for energy producers;
- Reduce the energy cost of providing clean, affordable water;
- Create a detailed source of water/energy information to aid policy-makers;

- Provide well-targeted technological solutions;
- Improve the quality of the nation's fresh water supplies; and
- Alleviate competition between energy producers and other water users.

The benefits of understanding the complex relationship between water and electricity and developing technologies to keep that relationship healthy are important keys to a sustainable and secure future for the U.S.

Strategy Four: Establish new facilities and a resource center to extend the accomplishments of the Human Genome Program, working toward major payoffs in energy, climate, and environment.

The Genomes to Ecology thrust area is still in its formative stages, but it is clear that understanding of relationships between organisms and their environment will experience a dramatic breakthrough in the next decade as scientists adopt a comprehensive systems approach. For the first time in history, mankind is poised to understand the functioning of cells and organisms and their interactions with their environment. One lesson learned from the Human Genome Project is that new facilities and scientific resources are essential in meeting the needs of the biological, physical, and computing sciences. Examples include but are not limited to: facilities for mapping and modeling gene regulatory networks, facilities for protein production, dedicated computational biology centers, major capabilities for high-throughput mass spectrometry for protein analysis, large-scale DNA sequencing capabilities, and nuclear magnetic resonance and molecular imaging capabilities.

To meet these goals, technical divisions are developing concepts and idea papers that describe an integrated program in biological technologies. A comprehensive proposal entitled "A Systems Biology Approach to Decoding Genomic and Functional Foundations of Carbon and Nitrogen Cycles of *Nitrosomonas europaea* in Soil Microbial Communities" was prepared and submitted to the DOE Office of Science; a computational biology initiative with specific institutional goals is being formulated; and a document entitled "Opportunity Assessment: Computational Biology" has been prepared. Communication links within the DOE Office of Science (Biological and Environmental Research, Advanced Scientific Computing, and Basic Energy Sciences) are being enhanced to exploit links between these program offices for facility planning.

Achievements

Recent technical accomplishments that underpin these goals include a greatly enhanced sequencing production in the Joint Genome Institute, assembly of a dynamic group capable of defining the transforming phase necessary to go from DNA sequencing to what is embodied by Genomes to Life, and the initial acquisition of new high-throughput proteomics capabilities.

Strategy Five: Expand the Los Alamos High Temperature Superconductivity Center and develop the Fuel Cell National Resource Center.

The Hydrogen Economy thrust within SR includes work in superconductivity, fuel cells, and alternative fuels and technologies.

The Superconductivity Technology Center

Los Alamos National Laboratory (LANL) has been a world leader in High Temperature Superconductivity (HTS) for more than a decade. The Superconductivity Technology Center (STC) coordinates a multidisciplinary program for research, development, and technology transfer in the area of HTS. Applied research and development efforts in this area include powder synthesis, tape/coil processing, thin/thick film deposition, characterization of microstructural and superconducting properties, power cryogenic engineering, and prototype devices. The Laboratory's focus is on effective collaborations with industry, universities, and other national laboratories to develop electric power and electronic device applications of high-temperature superconductors.

The objectives of this program are to advance the technology in the manufacturing of HTS tape with IGC-SuperPower of Latham, New York, a subsidiary of Intermagnetics General Corp.; to develop second-generation YBCO (yttrium, barium, copper oxide)-coated conductors produced by ion beam-assisted deposition; and to develop facilities to test fault current limiter superconducting coils. Coils are supplied by IGC in collaboration with Pirelli Cable Company and General Atomics at a test site provided for this project by Southern California Edison.

Achievements

- Projects conducted with industry include development of superconducting tapes, current controllers, generators, power transmission cables, and magnetic separators. New facilities at the Los Alamos Research Park will enable co-location of industrial partners and acceleration of development of superconducting tapes.

- First-generation superconducting tapes are being developed with industrial partners including American Superconductor and Oxford Superconductivity Technology.

- Patents and applications related to the technology of manufacturing second-generation superconducting tapes based on LANL coated-conductor processing have been licensed to IGC-SuperPower.

- The STC is working in partnership with industry to develop a variety of superconducting power applications including a 15 KV current controller with General Atomics and Intermagnetics General. Other applications are being pursued with DuPont, General Electric, and Pirelli Cables.

Fuel Cell National Resource Center

LANL has been a leader in fundamental fuel cell research since the Laboratory first began developing fuel cells for the National Aeronautics and Space Administration more than 30 years

ago. Fuel cell technologies promise increased flexibility within the energy economy, maximum efficiency, and reduced air pollution.

The planned Fuel Cell National Resource Center would house scientists and engineers from LANL as well as collaborators from such institutions as Argonne National Laboratory, Pacific Northwest National Laboratory, and Sandia National Laboratories, and industrial partners from companies such as Motorola, DuPont, General Motors, and Ford. The plan is to work together to address large-scale problems in national energy sustainability.

Achievements

- LANL is currently the leading DOE laboratory for fuel cell and hydrogen energy research with ongoing research support totaling $10 million.

- LANL has the leading research role under the new Freedom Car Initiative, a DOE auto industry collaborative program that focuses on the research needed to develop enabling technologies (e.g., fuel cells and the ability to produce hydrogen from domestic renewable sources) without sacrificing freedom of mobility, freedom of vehicle choice, or affordability.

Strategy Six: Support a multiagency National Nanotechnology Initiative by improving understanding of materials and material interactions at the nanoscale.

As a result of LANL's Nanoscience and Nanotechnology thrust, understanding of nanoscale phenomena will be applied to new materials, devices, and nanosystems, in support of the Laboratory's national security mission.

LANL is one of the most important materials science laboratories in the world, with a significant effort in support of the Laboratory's missions in nuclear weapons and threat reduction. Its basic and applied science in materials embraces work in advanced materials, biomaterials, and materials theory, with nanoscience and nanotechnology playing increasingly important roles. The evolution of nanoscience is one of the Laboratory's 10 Institutional Goals.

Center for Integrated Nanotechnologies

A major objective within the Nanoscience Initiative will be the partnership with Sandia National Laboratories in creating and operating the DOE-funded Center for Integrated Nanotechnologies (CINT). This center will bring basic research programs and a new nanoscale science research building to the Laboratory.

Achievements

CINT is intended to be a focal point for collaborations with industry, universities, and other national laboratories. Significant research and development (R&D) activities are already in place, funded by DOE and Laboratory-Directed Research and Development. Through the New Mexico Nanoscience Alliance, LANL will work in partnership with Sandia, the University of

New Mexico, and other New Mexico universities and institutions to create a regional center of excellence for nanotechnologies of national and international significance. Advances in nanoscience and nanotechnology will focus on developing innovative solutions for nuclear weapons, energy, environment, and threat-reduction activities.

Strategy Seven: Develop competency and become the partner of choice in the science of predicting the behavior, responses, and uncertainties of complex systems and network.

Advances in simulation, visualization, and data access—combined with the crucial needs for national security and independence—have created the opportunity to develop a new science of prediction in the 21st century: Science-Based Prediction.

Because of its national security work, LANL is positioned to become the first R&D organization to develop this competency to its fullest. It could become the partner of choice as government, academia, and the private sector come to grips with the accelerating complexity of technological, social, and economic systems, the potential for global magnification of local effects, and the need for decision-maker tools. LANL's competency in this area should provide leadership to the nation and create a center of excellence built on existing and new scientific staff members.

Achievements

To accomplish its national security mission, LANL has assembled the components of a core expertise in the integration of theory, modeling, simulation, and visualization—in a bold strategy to provide new cutting-edge tools to interpret and guide experiments and to further fundamental understanding of and predictive capabilities for complex phenomena.

The science-based Stockpile Stewardship Program depends critically on the viability of this approach. However, its applicability extends well beyond the stewardship program. Virtually every major initiative at LANL relies heavily, if not critically, on this integrated capability.

This reliance does, however, engender its own challenge: the coupling of computational simulations and experiments as a cornerstone of technical programs—in weapons, threat reduction, biology, nanomaterials, energy, infrastructure, and frontier science (from biology to cosmology)—requires a new generation of ideas and concepts to improve greatly the fidelity, reliability, certainty, and usability of these tools.

SR, working in partnership with the Nuclear Weapons and Threat Reduction Divisions, envisions an institutional enterprise built on existing programs such as Stockpile Stewardship, climate studies, and transportation modeling, and targeting important new challenges including homeland defense, systems biology, studies of energy and the environment, nanotechnology, and the Advanced Hydrotest Facility.

Strategy Eight: Develop a broad competency in quantum information science—including quantum computing and cryptography—in order to establish LANL as the provider of choice for quantum technologies.

Quantum information science (QIS) is an emerging field of scientific research and experimentation that exploits the nonclassical features of quantum physics to achieve performance in communications and computation superior to what may be achievable with systems based solely on classical physics. The work is related not only to the basic research that supports the future of high-performance computing, but may also someday be an important element of the Laboratory's national security mission. QIS research involves work in the fields of physics, chemistry, computer science, electrical engineering and materials science. QIS is a Labwide effort with participation from six divisions in three directorates.

Achievements

LANL is currently a world leader in the theoretical foundations of quantum computation and the application of quantum physics to cryptography.

At LANL, two experimental schemes have been used to demonstrate the basic operations of a quantum computer with existing technology—the manipulation of nuclear spin qubits using nuclear magnetic resonance methods; and photon polarization qubits manipulated with conventional linear optical elements. With these systems, researchers have demonstrated several logic operations with a few qubits. In addition, simple instances of quantum algorithms and quantum error-correction have also been implemented.

The appeal of quantum cryptography (or, more accurately, quantum key distribution or QKD) is that its security is based on theoretically secure laws of nature and information. This approach is in contrast to existing methods of key distribution that derive their security from the perceived intractability of certain problems in number theory, or from the physical security of the distribution process.

LANL researchers have demonstrated that quantum cryptography can allow completely secure communications between distant parties. Specifically, by using single photons to distribute a secret random cryptographic key, one can ensure that no eavesdropping goes unnoticed. More precisely, one can set rigid upper bounds on the possible information known to a potential eavesdropper, based on measured error rates, and then use appropriate methods of "privacy amplification" to reduce this information to an acceptable level.

A particularly attractive use of QKD is single-photon transmission through the atmosphere for "free-space," line-of-sight communications, such as surface-to-aircraft, surface-to-satellite, or satellite-to-satellite communication in low-earth orbits. Because conventional key-distribution techniques are subject to ever-increasing computational challenges, it is critically important to develop new technologies for rekeying satellites in orbit with greater security and convenience. Using the successful transmission of QKD over optical fibers, LANL quantum researchers recently demonstrated free-space QKD over a 10-km point-to-point outdoors path in daylight with the idea that the turbulence and optical properties encountered in these 10-km free-space

experiments duplicate an earth-to-orbit signal path. The results provide strong evidence for the feasibility of surface-to-satellite QKD.

Building on these strengths, the Laboratory has created a Quantum Information Research Institute with an executive board; a steering committee having multidivisional, interdirectorate representation; technical issues working groups; and sets of strategic and tactical goals.

Threat Reduction Directorate

OVERVIEW

The Los Alamos National Laboratory (LANL) Threat Reduction Directorate provides an important part of the technical and scientific expertise to address national security challenges to the U.S.

The directorate's work includes programs to counter nuclear, biological, and chemical terrorism; programs to encourage cooperative threat reduction; activities to promote national and international nuclear safeguards and security; efforts toward threat monitoring and analysis; and related research. These programs contribute to dissuading and deterring possible threats, particularly threats from weapons of mass destruction (WMD).

Research and development on behalf of the Department of Defense (DoD) and other agencies is aimed at defeating enemies. These activities range from developing technologies to detect and defeat terrorists to inventing cutting-edge science to support and equip conventional military forces.

The Threat Reduction Directorate is pursuing research on methods to defeat or respond to attacks on the U.S. homeland from any source employing any type of weapon.

Threat Reduction has three technical divisions and eight program offices. The divisions are Bioscience, Decision Applications, and Nonproliferation and International Security. The program offices are Biothreat Reduction, the Center for Space Science Exploration, DoD Programs, Homeland Defense Nuclear Programs, International Technology, Nonproliferation Programs, Nuclear Materials Management, and Research and Development.

Threat Reduction has approximately 1,300 employees including more than 370 people with doctoral degrees and 150 with master's degrees. The directorate's staff includes more than 150 physicists, 190 engineers, 38 computer scientists, 50 chemists, and 42 life scientists.

Threat Reduction's available funding in FY2002 totaled approximately $380 million. The National Nuclear Security Administration (NNSA) Office of Defense Nuclear Nonproliferation provides about 50 percent of the budget. The remainder comes from numerous other sources including the DoD, the National Aeronautics and Space Administration, the Department of Energy (DOE) Office of Security, and other U.S. government agencies. The Laboratory-Directed Research and Development program funds promising science and technology ideas.

MISSION SUPPORT

The Threat Reduction Directorate supports the Laboratory's mission in the following ways:

- preventing, detecting, assessing, and responding to threats of the proliferation and/or use of WMD by terrorists or nations;
- encouraging and developing U.S. cooperative threat-reduction initiatives; and
- enabling innovative, nonnuclear responses to unconventional and military threats to U.S. military forces, the nation, and the nation's infrastructure.

GOALS, STRATEGIES, AND ACHIEVEMENTS

Goal: Create and develop science, technology, and innovative approaches to prevent, detect, and counter threats to the U.S. and its people.

Strategy One: Prevent the proliferation of WMD.

LANL Threat Reduction has a critical role

- in combating nuclear terrorism;
- in addressing proliferation threats from chemical and biological WMD;
- in creating advanced sensors and detection and analysis technologies for use in monitoring and verification activities;
- in developing technologies and expertise to assess foreign WMD programs and to support arms-control and nonproliferation agreements;
- in developing nuclear safeguards for national and international use; and
- in mitigating threats to U.S. infrastructure.

Nuclear, chemical, or biological weapons that may be obtained by terrorists or rogue states constitute a threat to the U.S. and its allies. The central elements of U.S. nonproliferation and counterterrorism policy are preventing the spread of WMD materials, technology, and expertise; detecting proliferation worldwide; and reversing proliferation.

Improving proliferation-detection efforts depends primarily on new developments in remote-detection technology including low-cost satellites and remote-sensing and remote-monitoring devices for detecting and identifying the distinctive signatures of nuclear weapons research and development. The Laboratory is also exploring new uses of on-site sensors. Notable successes in proliferation-detection technologies include standoff chemical analysis, precision thermal

measurements, imagery in conditions of extremely low light levels, and advanced radio-frequency analysis.

Long-standing activities include providing technical support to protect U.S. borders against nuclear smuggling, managing nuclear materials (an activity that includes the development and implementation of both national and international civilian safeguards), and analyzing export-control and dual-use technology issues. LANL assists the International Atomic Energy Agency by providing training to its inspectors from around the world, developing detection and measurement technology, and advising on nuclear safeguards capabilities. LANL applies both computer modeling and innovative technology development to help keep risks as low as possible.

Priority projects for future technology development include wide-band radio-frequency data collection and a hybrid system to study effluent plumes from facilities. For domestic security and homeland defense, efforts are focused on development of advanced nuclear measurement and imaging systems for shielded and difficult-to-measure materials and on development of distributed networks of small, reconfigurable sensors. The next generation of highly secure DOE facilities will also require new technologies for real-time asset management and information protection. Data fusion, data mining, and development of a portfolio of proliferation signatures all are essential parts of the proliferation-detection initiative.

Achievements

- There have been major successes recently in nuclear-explosion detection. A network of 10 infrasound units was fielded to a remote site, and a combined x-ray dosimeter sensor was launched into the Global Positioning System constellation.

- The Multispectral Thermal Imager (MTI) was launched. (MTI is a joint effort with Sandia National Laboratories and Savannah River Technology Center.)

- LANL developed the remote ultralow-light imager. Both low-light passive imaging and active three-dimensional imaging have recently been field demonstrated.

- LANL developed and transferred to agency users a new data analysis method called Genetic Imagery Exploitation for scanning image data sets for indications of WMD production.

- LANL has developed and fielded two new nuclear materials detection and measurement technologies: a highly sensitive Active Interrogation Package Monitor for Highly Enriched Uranium; and underwater spent-fuel counters for fissile material determination.

Strategy Two: Reach out to Russia.

In the early 1990s, several programs were initiated to deal with the threat that materials associated with nuclear weapons—even nuclear weapons themselves—might be transported from the Former Soviet Union (FSU) to countries of proliferation concern or terrorist groups.

Today the U.S., with support from the national laboratories, is engaged with Russian and other FSU institutes in an effort to protect and reduce nuclear materials and Russia's nuclear complex. Current work includes the following:

- aiding in nuclear-material disposition technologies and treaty support;
- participating in programs to convert FSU nuclear weapons facilities and to redirect FSU scientists to nonweapons work; and
- encouraging laboratory-to-laboratory outreach linking LANL directly to counterpart institutions in Russia to preclude proliferation of WMD materials and expertise.

The Materials Protection, Control, and Accounting program is securing nuclear weapons materials at defense facilities throughout Russia. To date, the result has been significant security enhancements for 70 percent of the nuclear materials at Russia's Ministry of Atomic Energy locations.

Under the DoD's Cooperative Threat Reduction (CTR) program, a secure storage facility is under construction at Mayak in Russia to store fissile material no longer needed by Russia's nuclear weapons program. LANL is now playing a key role in providing technical support to CTR in the development of technical measures to ensure that nuclear materials arriving at the site do, in fact, come from the Russian nuclear weapons program.

Achievements

- LANL expertise in nuclear measurements and computerized accounting systems has been transferred successfully to nuclear sites all across Russia.
- The Open Computing Center at Sarov now employs 100 former defense workers, and there are plans to increase that number to 500 by the year 2005.
- The security fence at the Avangard nuclear production facility has been moved to allow access to industrial buildings. This action converted 500,000 square feet of nuclear industrial space into nondefense work space.

Strategy Three: Counter proliferation and terrorism.

LANL initiatives combine detection, characterization, and response technologies into systems that can be deployed by agencies charged with responding to terrorist events. The Laboratory continues its long-standing involvement with the DOE Nuclear Emergency Search Team and conducts research into the problem of cyber-terrorism. Current work includes

- development of chemical and biological detection technology;
- development of a bioagent database;

- integrated early warning systems for detection, identification, and nationwide alerts; and

- techniques for homeland defense against terrorism.

Counterproliferation is the response to nations or groups that intend to deploy or use WMD, whereas counterterrorism is the response to the possible use of WMD against civilian populations. Defense against biological and chemical threats is a major new initiative in the Threat Reduction Directorate. LANL efforts in counterproliferation and counterterrorism fall principally into four areas: developing sensitive and rapid methods of detecting various biological or chemical threats; modeling and simulating the spread of biological or chemical agents after they are released; developing new decontamination technologies to reclaim essential facilities after a release of chemical or biological agents; and assembling critical biological information (DNA sequence information that can identify strains of a microbe and point to signs of human tinkering, for example)—a technique that is useful in forensic analysis of outbreaks of bioagents.

Achievements

- LANL's Biological Aerosol Sentry and Information System provides early warning of airborne biological incidents for special events such as large assemblies and high-visibility meetings. Deployed at the Salt Lake City Olympics, it had the potential to detect a biological incident within a few hours of an attack—early enough to mount an effective medical response.

- An optical biosensor has been developed at LANL for use in the rapid detection of toxins and pathogens that might be used by terrorists. This sensor is convenient enough for use by emergency first responders and has exchangeable sensor elements for reuse.

Strategy Four: Build defense technologies.

LANL has long-standing relationships with the DoD and the Ballistic Missile Defense Organization (BMDO), among others, to meet next-generation military needs. The Laboratory has developed innovative technologies that will be required to meet future military challenges.

Recent and projected investments in the NNSA laboratories present significant opportunities for DoD programs. These investments are intended to support the core nuclear weapons programs necessary to ensure a safe and reliable U.S. nuclear deterrent into the next century. Efforts include a strategic and sustained push in computational, virtual, and live-fire testing, and in materials-based technologies required to support science-based stockpile stewardship. This revitalized science and technology base for stockpile stewardship and management will result in an unparalleled array of people skills, facilities, diagnostics, and analytical capabilities that can address many of the demanding technological challenges facing DoD in the 21st century. LANL supports DoD interests when the Laboratory's unique capabilities are applied to technological needs in conventional defense. For example, the joint DoD/DOE Nonnuclear Munitions Technology Program conducted at three laboratories meets DoD's conventional munitions

science and technology needs in energetic materials; in detonators, fuses, and sensors; in warhead technology; and in supporting technologies. Successful teaming with the DoD laboratories, industry, and academia has led to a rapid deployment of innovative, affordable technologies to the field.

LANL's future emphases include the following technology and programmatic platforms, each supporting new DoD initiatives and requirements while addressing current commitments:

- Conventional Weapons Technologies;
- Defense Advanced Concepts;
- Defense Sensor Technologies;
- Defense Environmental Technologies;
- High-Performance Computing;
- Chemical and Biological Defense;
- Modeling, Simulation, and Analysis Application;
- The Joint DoD/DOE Munitions Technology Program;
- The International Security Program; and
- Other DoD programs.

Achievements

The NNSA labs have expanded their partnerships with BMDO. The laboratories are providing innovation and technical assistance for the BMDO in the following areas:

- boost-phase intercept;
- mid-course discrimination of countermeasures;
- modeling and simulation to support acquisition and planning methodologies;
- advanced kinetic kill vehicles; and
- testing and evaluating of component designs.

Strategy Five: Understand infrastructure vulnerabilities.

LANL's proven technical competencies in computer modeling and simulation are critical for the assessment of U.S. infrastructure vulnerabilities and the design and operation of more-robust

infrastructures. Laboratory strengths in these areas aid in understanding the linkages and synergy between related infrastructure areas. Such capabilities include the following:

- cyber-protection tools derived from systems to protect high-bandwidth computer communications;
- transportation flow modeling;
- detailed analysis and modeling of the national power grid; and
- examination of urban security, the relationships linking urban infrastructures, and the natural environment.

The national infrastructure involves links joining transportation, communications, power, financial, and natural systems. These systems are increasingly complex and interdependent. Small perturbations can propagate across entire infrastructures with catastrophic results.

LANL has proven technical competencies that place it in a unique position to aid the national efforts in understanding the frameworks, strengths, and vulnerabilities of these infrastructures. These competencies include modeling and simulation capabilities (key for the assessment of vulnerabilities) and the design and operation of more-robust infrastructures. Such capabilities also allow the U.S. to develop cyber-protection tools that are derived from LANL work to design and protect high-bandwidth computer communications.

Achievements

- The National Infrastructure Simulation and Analysis Center will provide a decision-support environment for government and industry decision makers in the areas of infrastructure policy, education, planning and assessment, and crisis response.
- TRANSIMS, the urban transportation-flow modeling program, continues to provide groundbreaking insight into the movement of thousands of individual vehicles that are tracked moment-to-moment through specific city and road systems.
- Related applications in electrical grid modeling (ELECTRISIMS) and epidemiological tracking (EPISIMS) have impact across national energy policy and health security.

Weapons Engineering and Manufacturing Directorate

OVERVIEW

The Weapons Engineering and Manufacturing (WEM) Directorate is a multidisciplinary, integrated organization that sustains and advances the engineering and manufacturing technologies necessary to support the stewardship of the nation's nuclear weapon stockpile. WEM is responsible for maintaining the certification basis for weapon systems in the enduring

stockpile and for developing the design, engineering, testing, and manufacturing capabilities needed for stewardship of the stockpile.

The U.S. nuclear deterrent has contributed to global security for more than 50 years and has helped to establish the conditions necessary for cooperative threat reduction with U.S. adversaries. The Cold War ended more than a decade ago, and a new capabilities-based approach to nuclear-force planning is unfolding. The January 2001 Nuclear Posture Review (NPR) proposes a "New Triad" of flexible response capabilities that comprises a diverse set of nuclear and nonnuclear strike means (including systems for command and control), passive and active defenses (including ballistic missile defense), and a research and development and industrial infrastructure necessary to build and sustain the offensive and defensive systems. The NPR reaffirmed that nuclear weapons, for the foreseeable future, will remain a key element of national security strategy and that the weapons in the enduring stockpile need to be certified without nuclear testing.

The total number of nuclear weapons in the nation's stockpile will decrease over the next 10 years with a concomitant desire for reassurance that the remaining weapons are safe, secure, and reliable. Providing this reassurance while observing the ongoing moratorium against nuclear testing is a grand challenge. Problems in the stockpile must be predicted, detected, evaluated, and resolved. Warheads and associated weapon systems must be refurbished or modified to extend service lifetimes and must meet changing operational requirements.

The Stockpile Stewardship Program (SSP) is the structural framework for meeting this challenge. Embedded within the SSP is the Department of Energy (DOE)/National Nuclear Security Administration (NNSA) nuclear weapons complex Integrated Strategy. Within the SSP framework, the WEM Directorate is tasked with the engineering and manufacturing functions necessary to support the stewardship of the stockpile.

Funding for the WEM Directorate comes from NNSA in support of stockpile stewardship and stockpile management to conduct directed stockpile work and execute campaigns. Directed stockpile work includes those activities that directly support the weapons in the enduring stockpile, including assessment, surveillance, maintenance, manufacturing, and the scientific and engineering development capabilities necessary for the refurbishment and certification of the weapon systems. Campaigns are tri-laboratory efforts that focus resources on developing critical enabling capabilities with milestones and end dates to support confident certification of or manufacturing activities for the enduring stockpile.

MISSION SUPPORT

The WEM Directorate supports the Laboratory mission by ensuring the safety and reliability of the U.S. nuclear weapons stockpile by reestablishing the nation's capability to manufacture weapon components and by applying the best engineering, design, development, and diagnostic tools available to the maintenance and refurbishment of the stockpile.

CAPABILITIES

The WEM Directorate supports a portfolio of technical capabilities required to accomplish its engineering and manufacturing mission. These capabilities reside with the workforce of more than 1,700 University of California (UC) and contract employees in the two technical line organizations that compose the directorate—Engineering Sciences and Applications (ESA) Division, and Nuclear Materials Technology (NMT) Division.

In addition, the WEM Directorate relies upon capabilities present in other directorates and divisions in the Laboratory and upon partnerships with other national laboratories, universities, and industry as appropriate. To accomplish its programmatic mission, the WEM Directorate engages relevant line and program management in the Weapons Physics (WP), Strategic Research (SR), and Threat Reduction (TR) Directorates to plan programs, resource allocations, capability assessments, hiring, and partnering.

The capabilities that the WEM Directorate requires to accomplish its mission cross the technical directorates at the Laboratory. They are as follows:

- engineering, modeling, analysis, and assessment;
- measurement, testing, and instrumentation;
- materials science and mechanical engineering;
- chemical, actinide, polymer, and separations science;
- nuclear, particle, and high-energy-density physics;
- mathematics, information science, and computer science; and
- environmental science and geoscience.

PROGRAMMATIC GOALS, STRATEGIES, AND ACHIEVEMENTS

WEM Directorate's programmatic goals are directly linked to Laboratory goals and UC strategic initiatives to develop and implement a near-term balanced weapons program plan that meets top-priority customer deliverables and maintains a balanced approach in accomplishing responsibilities for the stockpile.

Executing the WEM Directorate's engineering and manufacturing mission requires continuing emphasis on the following five programmatic areas:

1. surveillance and assessment of nuclear weapons systems;
2. manufacture of nuclear and nonnuclear weapons components;

3. maintenance and refurbishment of nuclear weapons systems;

4. advanced manufacturing and engineering science; and

5. nuclear weapons complex production and testing support.

Goal 1: Maintain the certification basis for the weapons systems in the stockpile for which Los Alamos has design responsibility.

Strategies

1. Assess the condition of nuclear weapons through aggressive surveillance, analysis, and experimental programs.

2. Balance resources to investigate and resolve significant findings.

3. Submit required assessment documentation and support the annual certification process.

4. Baseline and archive historical design, engineering, and test data as a national resource.

Achievements

1. Performed surveillance activities as planned and completed the seventh annual assessment of the stockpile weapon systems.

2. Closed more than 45 significant-finding investigations, and developed action plans and estimated closure dates for resolution of continuing investigations.

3. Completed baseline activities for the W80 and initiated knowledge transfer to Lawrence Livermore National Laboratory (LLNL) for the life-extension program.

Goal 2: Reestablish the nation's capability to manufacture war-reserve-quality nuclear and nonnuclear weapon components.

Strategies

1. Produce development, standard, and qualification (certifiable) plutonium pits as specified in the W88 Pit Manufacturing and Certification Integrated Project Plan.

2. Produce nonnuclear components as required, including detonators, calorimeters, pellet-can assemblies, tritium-loaded neutron-tube targets, beryllium cap inserts, and mock pits for joint test assemblies.

3. Deliver products on time and within budget, satisfying technical specifications, and meeting stringent war-reserve-quality manufacturing standards.

Achievements

1. Produced a total of 13 plutonium pits—eight development pits and five standard pits—and remained on schedule to produce a certifiable pit in 2003.

2. Produced more than 8,000 war-reserve-quality nonnuclear components in 2001.

Goal 3: Extend the service lifetimes of nuclear weapon systems in the enduring stockpile.

Strategies

1. Manage the Life-Extension Programs for the W76 and the B61-7/11 under the Phase 6.X process.

2. Conduct maintenance and refurbishment activities on stockpile weapons systems as specified in the approved Implementation Plans.

3. Conduct engineering design and development activities with the technical rigor necessary for the certification of the refurbished weapon systems.

Achievements

1. Examined alternative gas-transfer technologies and established the Acorn system as the baseline technology for the W76 refurbishment.

2. Finalized plans with the Pantex Plant and the Y-12 Site to begin refurbishment of canned subassemblies for the B-61-7/11.

Goal 4: Enhance the scientific underpinnings of directed stockpile work .

Strategies

1. Develop enhanced surety options to maintain and enhance the engineered safety and security of the stockpile weapons systems.

2. Develop improved predictive capabilities to assess component performance and the impact of aging through enhanced surveillance, including characterizing and modeling aging effects and validating accelerated-aging studies.

3. Develop and validate engineering models to predict weapon system response to normal, abnormal, and hostile environments.

4. Explore advanced design and production concepts to continue capability to respond to new military requirements.

5. Continue to support space and terrestrial missions through plutonium-238 heat source and generator design, testing, evaluation, production, and recycling.

Achievements

1. Successfully conducted a neutron irradiation experiment on an aged pit in the Annular Core Research Reactor to verify nuclear survivability in a hostile environment.

2. Developed a high-explosive radiotelemetry system to measure and transmit detonation data from the explosive system onboard joint test assembly missile flight tests.

3. Successfully accelerated the aging of a plutonium isotope to observe inherent radiation damage equivalent to hundreds of years of aging in weapons-grade plutonium.

Goal 5: Support weapons complex production and testing activities.

Strategies

1. Provide technical support for dismantlement and production operations at the plants and meet commitments in the Integrated Weapons Activities Plan.

2. Cooperate with the Nevada Test Site to supply the technical resources necessary to sustain readiness to conduct underground nuclear tests.

Achievements

1. Completed the safety-basis authorizations for disassembly and inspection of the W88 and the W78 at the Pantex Plant.

2. Supported the successful Vito subcritical experiment at the Nevada Test Site, conducted in collaboration with the United Kingdom's Atomic Weapons Establishment.

Weapons Physics Directorate

OVERVIEW

The Weapons Physics (WP) Directorate is a multidisciplinary, integrated organization that sustains, advances, and applies science and technology to support a sustainable stewardship of the nation's nuclear weapons stockpile.

WP is composed of the Applied Physics (X), Dynamic Experimentation (DX), Physics (P), Computer and Computational Sciences (CCS), and Computing, Communications, and Networking (CCN) Divisions, and the Los Alamos Neutron Science Center (LANSCE)—staffed, in all, by a total of 2,260 personnel.

WP has responsibilities within the Stockpile Stewardship Program for conducting a number of National Nuclear Security Administration (NNSA) campaigns as well as contributing to key

areas of Directed Stockpile Work (DSW). WP has responsibility for the Primary Certification Campaign, the Dynamic Materials Properties Campaign, the Advanced Radiography Campaign, the Secondary Certification and Nuclear Systems Margins Campaign, the Advanced Simulation and Computing Campaign, and the High Energy Density Physics Campaign. In addition, WP has key responsibility under DSW for Assessment and Certification, Baselining, Archiving, and Support Research and Development.

WP also manages a number of major facilities including the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility, LANSCE, and the Nicholas C. Metropolis Center for Modeling and Simulation (the Metropolis Center).

The directorate conducts operations safely and in a formal manner, maintains classified and sensitive information in a secure environment, and demonstrates respect for every individual's opinions and contributions.

MISSION SUPPORT

The WP Directorate supports the Laboratory's mission by ensuring confidence in the safety, reliability, and performance of the nuclear weapons in the U.S. stockpile. This stewardship mission requires a science-based approach supported by a broad range of science and technology capabilities at the Laboratory. Decisions are based on sound technical and scientific understanding and expert judgment developed through theoretical studies, state-of-the-art computational simulations, and coordinated experimental activities.

PROGRAM GOALS, STRATEGIES, AND ACHIEVEMENTS

The WP Directorate owns three of the Laboratory's principal goals: Science-Based Certification; development of LANSCE as a world-class experimental facility for the Laboratory; and exploration and development of a technology-and-requirements path to an Advanced Hydrotest Facility (AHF).

SCIENCE-BASED CERTIFICATION

Goal #1: Accurately assess the safety, reliability and performance of nuclear weapons based on a scientific understanding of the materials they contain and the processes and physics phenomena intrinsic to their operation.

Strategies

Stockpile Stewardship is an implementing strategy for retaining confidence in the safety, security, reliability, and effectiveness of the nation's nuclear weapons stockpile without the benefit of underground nuclear testing. This approach to sustaining the stockpile is an unprecedented technical challenge. To address this challenge in the certification process, the WP Directorate applies scientific investigation and enhanced understanding of fundamental physical processes that govern nuclear weapons performance and safety. Certification of physics and

engineering performance demands a systematic and explicit application of the scientific method toward ensuring that quantified uncertainties in key weapons performance metrics are managed and are smaller than the margins within which one can be confident in performance as designed. Ultimately, expected performance and physical characteristics of weapons, as assessed by experimentally validated numerical simulation codes and bounded by quantified uncertainties, must be successfully demonstrated to satisfy military requirements for a given weapon system.

Goal #2: Build a new confidence, founded on quantitative understanding of the principles, processes, margins, and uncertainties involved, as a basis for high-fidelity simulation of nuclear weapons performance.

Strategies

The current confidence in stockpile systems and their designers was built upon a certification capability validated by nuclear tests—the ultimate integral experiment. Because the nation relied on such tests, the fidelity required of simulation tools was limited and not fully predictive.

The Laboratory's current certification methodology focuses on quantifying margins and uncertainties to enable scientifically sound programmatic and strategic decisions.

Past reliance on full-scale integral nuclear tests is being replaced by more fundamental nonnuclear experiments aimed at testing and refining understanding of the underpinning science and engineering. The understanding the Laboratory seeks must be both broad and deep, spanning all aspects of weapons physics and engineering—from high explosives to materials under extreme conditions, from nuclear reactions to radiation transport. The Laboratory and WP Directorate are committed to a vigorous investment in such validating experiments.

This predictive capability requires computational simulation of weapons performance built from theories, models, and codes and run on high-performance computing platforms. It must be validated using these precision experiments. To enable high-fidelity simulations, the Laboratory is committed to building and using the most advanced computational resources.

The predictive capability gained will not only establish confidence in the effectiveness and safety of aging or remanufactured weapons, but will also provide a technically responsible legacy for next-generation nuclear weapons designers, ensuring certification readiness for the stockpile upon which the nation's ultimate security rests.

Goal #3: Build an outstanding workforce that will use the most advanced tools and facilities.

Strategies

To support the goal of establishing confidence in a science-based approach, the Laboratory is committed to building a stronger workforce with theoretical, experimental, and computational capability. The Laboratory will give this workforce access to a broad array of state-of-the-art tools and facilities to enable its research and meet programmatic requirements. WP is committed to LANSCE as the centerpiece among the required experimental facilities and a key vehicle

toward attracting a talented workforce. WP will explore a proton AHF as a precision experimental tool to validate prenuclear primary physics models and to qualify designers. To nurture this research, WP will actively promote the highest level of innovation through strategic investment in enabling Laboratory-Directed Research and Development. WP will further seek to leverage internal skills and facilities through aggressive strategic collaborations with other laboratories and with the larger national and international academic communities.

Steps toward the goals above can be separated into three interrelated elements—establishing a certification framework and methodology, maintaining certification readiness, and ensuring sustainable stewardship. These elements and the objectives for LANSCE and AHF are addressed below.

Certification Framework and Methodology

Objective: WP will implement a "quantification of margins and uncertainties" (QMU) certification methodology that quantifies the uncertainty in all aspects of performance of the stockpile and that guides the design of and priorities within the entire stewardship program.

Strategies

- Establish a discipline for quantifying uncertainty in weapon assessments and for flexibly adjusting program objectives to reduce the uncertainties that affect performance margins.

- Based on the QMU framework developed by Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL), develop science-based certification plans for stockpile life-extension programs and remanufacturing efforts, most significantly for the W88 weapon system recertification based on rebuilt pits.

- Integrate measurements of fundamental physical properties made at several experimental facilities (including LANSCE) into this framework to reduce uncertainty.

Key Deliverables

- Development of a consistent certification methodology applicable to all certification issues; and

- Creation of predictive simulation tools and understanding of their "regions of validity."

Achievements

- WP has begun applying the Certification Methodology to the W88 System as a pilot to address the requirements for specific experiments and has received positive feedback from external review committees.

- WP participates in the NNSA Accelerated Strategic Computing Program (ASCI) code-development strategy that incorporates both current capabilities (migrating to production capabilities) and the design of future capabilities coupled to QMU for predictive simulation capability.

- WP has accomplished the 2000 ASCI Level 1 Verification and Validation Milestone.

- WP has in place a broad program of experimental science aimed at developing and validating the computationally based simulation capability.

Certification Readiness for the Stockpile

Objective: Guided by a coherent and unifying methodology, manage the timely integration of science into nuclear weapon certification assessments to ensure a ready ability to assess the safety, reliability, and performance of the stockpile.

Strategies

- Reinvigorate the enabling science campaigns to provide both short- and long-term deliverables aimed at demonstrably building and improving the predictive capabilities on which the confidence in the stockpile depends, absent nuclear testing.

- Identify the drivers and links among the campaigns to facilitate the effective integration and appropriate balance of experimental and computational programs.

- Reinvigorate the program-targeted experiments designed to validate new theories of critical weapons phenomena using a broad range of institutional facilities.

Key Deliverables

- The LANL certification campaigns will develop an integrated plan for enhanced predictive capability.

- WP will validate LANL simulation tools.

Achievements

- The W88 certification plan has been integrated into the primary and secondary certification campaigns.

- The LANL ASCI Strategic Plan has been integrated with DSW deliverables.

- WP has completed Level 1 ASCI milestones.

- WP has validated computational physics components delivered to integrated applications.

- WP understands the "corner-turning" phenomenon in high explosives as a result of proton radiography investigations.

Stewardship Sustainability—
Validating Understanding of the Underlying Science and Engineering

Objective: Commit to increasing stockpile confidence through a robust predictive capability built on high-fidelity simulation of the underpinning science and engineering—one that is validated by experiment.

The capability to certify aging weapons confidently or to certify performance after engineered and manufactured life-extension alterations requires methodical and objectively demonstrable development of predictive capability in advanced nuclear weapon design and analysis simulations. WP is providing a sustainable infrastructure to test the developed predictive capability through a balanced program of fundamental experiments, integral hydrotests, and subcritical experiments.

LANL is applying its historic strength in strongly coupling physics design and weapons engineering capability to stockpile stewardship. "Manufacturability," robustness, and accessibility to experimental evaluation must be reflected in any remanufactured or advanced weapon designs.

Strategy

Carefully managed technical collaboration among physics designers, weapon engineers, and manufacturing/production stewards demands that the Laboratory commit itself to the goal of preserving an ability to conduct concurrent design engineering and rapid prototyping, as needed.

Nurturing this institutional capability will not only provide the nation with more affordable and realizable life-extension options, but it will also provide adequate flexibility to respond to the demands of the "New Triad" envisioned by the 2002 Nuclear Posture Review.

Key Deliverables

- Engagement in an aggressive, forward-looking, advanced research and development program encompassing all aspects of high-performance computing and computational science, including operating systems, advanced architectures, computational physics algorithm prototyping, visualization, software verification, and software component architectures for the nuclear weapons simulation enterprise.

- Conduct of stockpile-related hydrotests in FY2003 and making of the National Hydrotest Plan into a governing document for a national hydrotest strategy.

- Conduct of three key subcritical experiments this fiscal year utilizing "racklets."

- Meeting of DynEx commitments by continuing the development, utilizing a consensus standard, of the required vessel system in support of an FY2005 experiment date.

- Developing the authorization basis to support level two milestones.

- Providing fundamental data on plutonium, high explosives, polymers, and foams.

- Beginning of commissioning work on the DARHT Axis 2.

- Increasing of staffing to levels that meet the long-term certification and assessment deliverables.

Achievements

- WP conducted an active, integrated hydrotest program.

- Injector commissioning began on DARHT Axis 2.

- WP conducted the Vito-Etna Subcritical experiment on February 14, 2002.

- WP achieved consensus on the development of a DynEx Construction Standard for vessels in concert with the NNSA, the Defense Nuclear Facilities Safety Board, and the LANL Blue Ribbon Panel on DynEx.

- WP successfully completed one of the largest weapons simulations ever attempted on the then-largest supercomputer in the world using the latest advanced numerical methods.

- WP installed new computational facilities and capabilities including the following:

    - The 300,000-square-foot Metropolis Center was completed, occupied, and dedicated three months ahead of schedule and $9 million under budget.

    - One third (1,024 nodes) of the planned "Q" (computer) system were delivered and are being integrated for production classified use.

    - The Reconfigurable Advanced Visualization Environment facility was put into classified production use for weapons program simulation and visualization activities on a routine basis.

- WP developed a nuclear weapons code development strategy that encompasses short- and long-term capabilities needed to meet current stockpile deliverables and to create predictive capability.

- WP accepted delivery of advanced hydrodynamic algorithms and advanced particle transport methods to ASCI code projects engaged in stockpile simulations.

- WP met staffing goals for hiring the next generation of designers and is initiating a formalized mentoring and training program for new staff members to integrate them into our workforce.

- WP delivered fundamental material characteristics on plutonium, high explosives, polymers, and foams.

LANSCE

LANSCE is a unique facility in the DOE national laboratory complex. It produces a beam of medium-energy protons to irradiate experimental targets directly or to produce intense pulses of spallation neutrons for the nation's Defense Program.

LANSCE conducts stewardship-enabling research in materials science, nuclear science, hydrodynamics, condensed-matter physics, advanced radiography, isotope production, and radiation effects testing.

Data from LANSCE experiments directly enhance understanding of physical phenomena and materials behavior in nuclear devices. They are incorporated into ASCI next-generation design codes and used in analyzing previous nuclear tests for the Stockpile Stewardship Program.

LANSCE also provides a "portal" to the broader national and international community to attract science leaders.

Objective: Provide institutional focus and attention to ensure that LANSCE is a unique Laboratory experimental "flagship" for conducting stewardship-enabling, world-class experimental research.

Strategies

LANL is committed to building and maintaining excellent facilities at LANSCE that will attract the best and brightest scientists to conduct cutting-edge research at the Laboratory. The ability of LANL to conduct stewardship science at the required level will depend on having the strongest possible facilities and scientists.

Key Deliverables

- Significant contributions to a "best-in-class" scientific and engineering workforce at LANL carrying out excellent research in a research-conducive environment with strong mutually supportive collaborations with academia and other national laboratories.

- Facilities and infrastructure for the following programs:

    - proton radiography and neutron resonance spectroscopy as special techniques for the understanding of materials under dynamic conditions;

    - continued operations of the national user facilities in basic and applied neutron science;

    - a potential injector for a 50-GeV AHF synchrotron.

- Work on the following fundamental physics studies:

    - studies of the nucleus;

    - studies of materials properties of direct relevance to stewardship, including special nuclear materials and high explosives over a neutron energy range relevant to weapons systems; and

    - work on using cold and ultracold neutrons.

- Research on mission-critical requirements of Stockpile Stewardship by experimental validation of predictive tools and models.

- Development of a proton radiography governance plan for 2003.

Achievements

- Primary Yield Assessment: Completed measurements and final evaluations of the ^{239}Pu(n,2n) reaction for improved primary yield assessment with direct stockpile impact. Initiated assessment of (n,xn) and (n,γ) reactions in radchem tracers for improved total yield assessment.

- Proton Radiography: Achieved 100% success in 35 dynamic shots investigating a wide range of weapons hydrodynamics and materials issues of high relevance to the stockpile, including the following:

    - an assessment of cold insensitive high explosive performance; and

    - two high-fidelity implosion experiments (in collaboration with the United Kingdom Atomic Weapons Establishment) that yielded high-resolution, time-sequenced images for implosion hydrodynamics studies.

- Dynamic Materials Studies: Developed neutron resonance spectroscopy for investigating the equation of state of dynamically loaded materials and for testing critical modeling calculations.

- Actinide Material Studies: Completed an initial study of gallium-stabilized plutonium properties, including aged materials. Fielded the High-Pressure Preferred Orientation Spectrometer for materials studies (including plutonium) at weapons-relevant temperatures and pressures.

- High Explosive Studies: Completed explosive microstructure characterizations and high-explosives binder-aging analysis to address direct stockpile issues.

- Materials Characterization: Completed extensive measurements of U_6Nb (uranium six niobium) materials properties. Completed manufacturing qualification studies of welded beryllium components.

- Excellence in Operations and User Program: Exceeded all goals of reliable, predictable operations in calendar year 2001 by providing more than 90% beam availability.

An AHF Based on Proton Radiography

Objective: LANL will develop proton radiographic capability at 800 MeV as a national user facility to validate predictive capability and explore multi-GeV proton radiography as the basis for an AHF.

Future certification and the next generation of design expertise must be built upon a simulation-based predictability validated by nonnuclear experimental measurement. Today's premier radiographic technology (centered nationally on DARHT, based on x-rays, and augmented by test-based expertise) is central to the current path to certification, but future expert judgment will require new approaches to qualifying designs and designers without testing experience.

DARHT is in operation and is being used for stockpile applications. It is currently the most advanced hydrotest facility in the world. The second axis of this facility will be commissioned in calendar year 2002. With operation of two axes and multipulse capability, it will be the centerpiece of the national hydro program for at least a decade to come and will continue to evolve to meet the needs of the program. Looking beyond the next decade, it is anticipated that the role of radiography for certification will continue to increase and that there will be a requirement for a quantitatively new way of thinking about the problem.

LANL is therefore committed to explore new technologies that can significantly advance stewardship capability—in particular, by exploring development of proton radiography.

Strategies

LANL will continue to develop proton radiographic capability at 800 MeV as a national user facility to validate predictive capability. At multi-GeV energies, protons offer superior quantitative dynamic radiographic imaging capability for high-density materials, and so LANL will explore higher-energy proton radiography as the basis for an AHF. Commitment to construction of an AHF must be contingent on establishing clear requirements and cost/benefit. LANL will lead the ongoing multilab studies of a proton AHF to completion to understand and document requirements and establish cost/benefit.

To establish these requirements, the following work elements have begun:

- deriving radiographic requirements from anticipated certification requirements in the next decade;
- establishing quantitative links between radiographic data and performance;
- examining the limitations of underlying radiographic technologies; and
- establishing an integrated strategy for advanced radiography capability and requirements transitioning from x-ray to protons.

Key Deliverables

- Completion and commissioning of the DARHT second axis;
- Providing the certification requirements that will define the mission need of the AHF;
- Expanding the access of LANSCE proton radiography to the national program; and
- Developing agreement with NNSA on AHF strategy.

Achievements

- The Laboratory has drafted a governance plan for the LANSCE proton radiography facility and discussed it with LLNL.
- LANL has continued to carry out at the LANSCE proton radiography facility a robust program of dynamic experiments that both develops technology and applies it to stockpile issues.
- The Laboratory has begun a study of criticality determination that will define the initial capability of the AHF, leading to a staged approach to the AHF.

Appendices

The tables on the following pages provide Los Alamos National Laboratory budget figures in a variety of ways. The tables are presented in the following order:

- Laboratory Funding Summary;
- Laboratory Personnel Summary;
- Funding by Secretarial Officer;
- Personnel by Secretarial Officer;
- Resources by Department of Energy Major Program;
- Subcontracting and Procurement; and
- Small and Disadvantaged Business Procurement.

Table A-1. Laboratory Funding Summary

LABORATORY FUNDING SUMMARY

($s in Thousands)	Actual Budget Authority (BA) FY02	BA FY03	BA FY04	BA FY05	BA FY06	BA FY07	BA FY08
DOE Funding 1/	1,536,278.9	1,656,542.1	1,819,382.8	1,794,295.8	1,838,625.4	1,839,266.2	1,840,566.5
Work for Others	201,278.8	201,958.8	206,140.8	209,275.8	212,476.6	215,744.6	219,081.2
TOTAL OPERATING	1,737,557.7	1,858,500.9	2,025,523.6	2,003,571.6	2,051,102.0	2,055,010.8	2,059,647.7
Program Capital Equipment	169,832.8	83,520.0	10,937.0	500.0	500.0	500.0	500.0
Program Construction 2/	34,811.6	39,824.2	1,500.0	111,605.9	152,988.0	139,608.0	145,020.6
General Purpose Facilities 2/				-	-	-	-
General Plant Projects	61,296.7	58,000.0	28,643.0	-	-	-	-
General Purpose Equipment		-	-	-	-	-	-
Total Laboratory Funding	2,003,498.8	2,039,845.1	2,066,603.6	2,115,677.5	2,204,590.0	2,195,118.8	2,205,168.3
TOTAL PROJECTED FUNDING	2,003,498.8	2,039,845.1	2,066,603.6	2,115,677.5	2,204,590.0	2,195,118.8	2,205,168.3

1/ “DOE Funding” includes net of transfers to other DOE contractors.

2/ DOE’s policy change requiring full funding of all construction projects before work begins means that estimates of future construction funding are included in the BA estimate.

Table A-2. Laboratory Personnel Summary

LABORATORY PERSONNEL SUMMARY

(Personnel in FTEs)	FY02	FY03	FY04	FY05	FY06	FY07	FY08
DIRECT							
DOE Effort	3,884	4,246	4,229	4,181	4,299	4,295	4,325
Work for Others	467	500	566	566	566	566	566
TOTAL OPERATING	4,351	4,746	4,795	4,747	4,865	4,861	4,891
Program Capital Equipment	14	53	40	40	40	40	40
Program Construction	55	55	3	3	3	3	3
TOTAL DIRECT	4,420	4,854	4,838	4,790	4,908	4,904	4,934
TOTAL INDIRECT	3,382	3,344	3,344	3,344	3,344	3,344	3,344
TOTAL PERSONNEL	7,802	8,198	8,182	8,134	8,252	8,248	8,278

Table A-3. Funding by Secretarial Officer

FUNDING BY SECRETARIAL OFFICER

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
COUNTERINTELLIGENCE							
Operating	2,746.0	2,680.0	2,830.0	2,943.0	3,061.0	3,184.0	3,310.9
Capital Equipment	-	-	-	-	-	-	-
Construction	(200.0)	-	-	-	-	-	-
TOTAL FOR COUNTERINTELLIGENCE	2,546.0	2,680.0	2,830.0	2,943.0	3,061.0	3,184.0	3,310.9
CHIEF FINANCIAL OFFICER							
Operating	1,880.0	2,274.0	1,880.0	1,880.0	1,880.0	1,880.0	1,880.0
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR CHIEF FINANCIAL OFFICER	1,880.0	2,274.0	1,880.0	1,880.0	1,880.0	1,880.0	1,880.0
OFFICE OF ENERGY ASSURANCE							
Operating	209.8	-	-	-	-	-	-
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR OFFICE OF ENERGY ASSURANCE	209.8	-	-	-	-	-	-
ENERGY EFFICIENCY & RENEWABLE ENERGY							
Operating	15,580.6	22,250.0	27,240.0	26,496.0	26,496.0	26,496.0	26,496.0
Capital Equipment	1,023.9	250.0	250.0	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR ENERGY EFFICIENCY & RENEWABLE ENERGY	16,604.5	22,500.0	27,490.0	26,496.0	26,496.0	26,496.0	26,496.0
ENVIRONMENT SAFETY & HEALTH							
Operating	378.5	334.0	159.0	158.0	158.0	158.0	158.0
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR ENVIRONMENT SAFETY & HEALTH	378.5	334.0	159.0	158.0	158.0	158.0	158.0

Table A-3. Funding by Secretarial Officer (Continued)

FUNDING BY SECRETARIAL OFFICER (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
ENVIRONMENTAL RESTORATION							
Operating	97,919.9	67,524.0	131,096.0	120,815.8	116,109.6	116,418.1	116,742.0
Capital Equipment	1,194.9	220.0	500.0	500.0	500.0	500.0	500.0
Construction	(450.0)	-	-	-	-	-	-
TOTAL FOR ENVIRONMENTAL RESTORATION	98,664.8	67,744.0	131,596.0	121,315.8	116,609.6	116,918.1	117,242.0
FOSSIL ENERGY							
Operating	7,632.0	7,150.0	4,994.0	5,039.0	5,084.0	5,129.0	6,074.0
Capital Equipment	25.0	(3.0)	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR FOSSIL ENERGY	7,657.0	7,147.0	4,994.0	5,039.0	5,084.0	5,129.0	6,074.0
OFFICE OF THE CHIEF INFORMATION OFFICER							
Operating	960.0	500.0	1,000.0	1,100.0	1,200.0	1,300.0	1,400.0
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR OFFICE OF THE CHIEF INFORMATION OFFICER	960.0	500.0	1,000.0	1,100.0	1,200.0	1,300.0	1,400.0
OFFICE OF INDEPENDENT OVERSIGHT AND PERFORMANCE ASSURANCE							
Operating	22.9	-	-	-	-	-	-
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR OFFICE OF INDEPENDENT OVERSIGHT AND PERFORMANCE ASSURANCE	22.9	-	-	-	-	-	-
INTELLIGENCE							
Operating	2,996.3	3,800.0	4,630.0	4,100.0	4,200.0	4,300.0	4,400.0
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR INTELLIGENCE	2,996.3	3,800.0	4,630.0	4,100.0	4,200.0	4,300.0	4,400.0

Table A-3. Funding by Secretarial Officer (Continued)

FUNDING BY SECRETARIAL OFFICER (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
ADMINISTRATOR FOR NATIONAL NUCLEAR SECURITY ADMINISTRATION							
Operating	1,213,923.6	1,376,250.0	1,453,209.0	1,456,813.8	1,503,184.2	1,501,291.7	1,499,121.1
Capital Equipment	160,614.9	78,308.0	6,000.0	-	-	-	-
Construction	93,690.3	97,824.2	30,143.0	104,000.0	152,880.0	139,500.0	144,912.6
TOTAL ADMIN FOR NATIONAL NUCLEAR SECURITY ADMINISTRATION	1,468,228.8	1,552,382.2	1,489,352.0	1,560,813.8	1,656,064.2	1,640,791.7	1,644,033.7
NUCLEAR ENERGY, SCIENCE, AND TECHNOLOGY							
Operating	27,845.3	29,626.0	58,686.0	58,686.0	58,686.0	58,686.0	58,686.0
Capital Equipment	1,316.0	735.0	-	-	-	-	-
Construction	2,494.0	1,700.0	-	-	-	-	-
TOTAL FOR NE,S, &T	31,655.3	32,061.0	58,686.0	58,686.0	58,686.0	58,686.0	58,686.0
SCIENCE							
Operating	63,947.4	67,627.0	68,647.0	65,626.5	66,427.6	67,571.5	68,660.5
Capital Equipment	5,171.1	3,480.0	3,700.0	-	-	-	-
Construction	395.0	-	10,000.0	7,500.0	-	-	-
TOTAL FOR SCIENCE	69,513.5	71,107.0	82,347.0	73,126.5	66,427.6	67,571.5	68,660.5
SECURITY AND EMERGENCY OPERATIONS							
Operating	5,635.5	5,085.0	5,000.0	6,490.0	7,139.0	7,852.0	8,638.0
Capital Equipment	487.0	530.0	487.0	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR SECURITY AND EMERGENCY OPERATIONS	6,122.5	5,615.0	5,487.0	6,490.0	7,139.0	7,852.0	8,638.0
WORKER AND COMMUNITY TRANSITION							
Operating	84.0	-	-	-	-	-	-
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR WORKER & COMMUNITY TRANSITION	84.0	-	-	-	-	-	-

Table A-3. Funding by Secretarial Officer (Continued)

FUNDING BY SECRETARIAL OFFICER (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
Miscellaneous DOE Programs	-	-	-	-	-	-	-
Other DOE Facilities	94,517.1	71,442.1	60,011.8	44,147.7	45,000.0	45,000.0	45,000.0
Net Reimbursable DOE Work	94,517.1	71,442.1	60,011.8	44,147.7	45,000.0	45,000.0	45,000.0
TOTAL DOE OPERATING 1/	1,536,278.9	1,656,542.1	1,819,382.8	1,794,295.8	1,838,625.4	1,839,266.2	1,840,566.5
WORK FOR OTHERS							
NRC	2,058.3	2,000.0	2,000.0	2,000.0	2,000.0	2,000.0	2,000.0
DoD	87,219.7	84,047.0	82,129.0	83,853.7	85,614.6	87,412.5	89,248.2
HHS/NIH	20,369.0	24,862.8	26,462.8	26,462.8	26,462.8	26,462.8	26,462.8
NASA	8,799.2	8,000.0	5,889.0	6,012.7	6,138.9	6,267.9	6,399.5
EPA	-	460.0	-	-	-	-	-
Other Federal Agencies	57,427.9	54,594.0	61,266.0	62,552.6	63,866.2	65,207.4	66,576.7
Private Industry	19,432.2	20,000.0	20,000.0	20,000.0	20,000.0	20,000.0	20,000.0
All Other Non-Federal	5,972.5	7,995.0	8,394.0	8,394.0	8,394.0	8,394.0	8,394.0
TOTAL WORK FOR OTHERS	201,278.8	201,958.8	206,140.8	209,275.8	212,476.6	215,744.6	219,081.2
TOTAL PROGRAM FUNDING	1,737,557.7	1,858,500.9	2,025,523.6	2,003,571.5	2,051,102.0	2,055,010.8	2,059,647.7
Program Capital Equipment	169,832.8	83,520.0	10,937.0	500.0	500.0	500.0	500.0
General Purpose Equipment				-	-	-	-
TOTAL CAPITAL EQUIPMENT	169,832.8	83,520.0	10,937.0	500.0	500.0	500.0	500.0
Program Construction 2/	34,811.6	39,824.2	1,500.0	111,605.9	152,988.0	139,608.0	145,020.6
General Plant Projects	61,296.7	58,000.0	28,643.0	-	-	-	-
General Purpose Facilities	-	-	-	-	-	-	-
Proposed Construction 3/	-	-	-	-	-	-	-
TOTAL GPP/CONSTRUCTION 4/	96,108.3	97,824.2	30,143.0	111,605.9	152,988.0	139,608.0	145,020.6

1/ "DOE Operating" includes net of transfers to other DOE contractors.

2/ "Program Construction" does not include any proposed construction.

3/ "Proposed Construction" is an optional estimate of future construction funding.

4/ "Total GPP/Construction" is also included in the individual program construction funding.

Table A-4. Personnel by Secretarial Officer (Full-Time Equivalents [FTEs])

DOE Secretarial Office	Actual FTEs FY02	Projected FTEs FY03	Projected FTEs FY04	Projected FTEs FY05	Projected FTEs FY06	Projected FTEs FY07	Projected FTEs FY08
COUNTER INTELLIGENCE	10	14	14	15	15	16	16
CHIEF FINANCIAL OFFICER	-	-	-	-	-	-	-
OFFICE OF ENERGY ASSURANCE	-	-	-	-	-	-	-
ENERGY EFFICIENCY & RENEWABLE ENERGY	39	54	54	54	54	54	54
ENVIRONMENT SAFETY & HEALTH	1	1	-	-	-	-	-
ENVIRONMENTAL RESTORATION	193	140	191	174	167	168	168
FOSSIL ENERGY	24	19	13	13	13	13	16
OFFICE OF THE CHIEF INFORMATION OFFICER	3	1	2	2	2	3	3
OFFICE OF INDEPENDENT OVERSIGHT AND PERF ASSURANCE	-	-	-	-	-	-	-
INTELLIGENCE	8	11	10	9	9	9	10
ADMINISTRATOR FOR NATIONAL NUCLEAR SECURITY ADMINISTRATION	3,115	3,523	3,422	3,435	3,552	3,541	3,563
NUCLEAR ENERGY, SCIENCE, AND TECHNOLOGY	92	91	169	169	169	169	169
SCIENCE	201	198	197	188	190	194	197
SECURITY AND EMERGENCY OPERATIONS	19	18	13	17	19	20	22
WORKER AND COMMUNITY TRANSITION	-	-	-	-	-	-	-
DOE REIMBURSABLES	179	176	144	106	108	108	108
SUBTOTAL DOE PROGRAMS	3,884	4,246	4,229	4,181	4,299	4,295	4,325

Table A-4. Personnel by Secretarial Officer (Full-Time Equivalents [FTEs]) (Continued)

	Actual FTEs FY02	Projected FTEs FY03	Projected FTEs FY04	Projected FTEs FY05	Projected FTEs FY06	Projected FTEs FY07	Projected FTEs FY08
NRC	5	5	5	5	5	5	5
DoD	173	196	236	236	236	236	236
HHS/NIH	46	66	68	68	68	68	68
NASA	22	27	19	19	19	19	19
EPA	-	1	-	-	-	-	-
Other Federal Agencies	127	122	149	149	149	149	149
Private Industry	70	59	58	58	58	58	58
All Other Non-Federal	24	24	31	31	31	31	31
TOTAL WORK FOR OTHERS	467	500	566	566	566	566	566
TOTAL PROGRAM EFFORT	4,351	4,746	4,795	4,747	4,865	4,861	4,891
Program Capital Equipment	14	53	40	40	40	40	40
Program Construction	53	40	2	2	2	2	2
General Purpose Facilities							
General Plant Projects	2	15	1	1	1	1	1
General Purpose Equipment							
TOTAL DIRECT PERSONNEL	4,420	4,854	4,838	4,790	4,908	4,904	4,934
TOTAL INDIRECT PERSONNEL	3,382	3,344	3,344	3,344	3,344	3,344	3,344

Table A-5. Resources by DOE Major Program

RESOURCES BY MAJOR PROGRAM

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
COUNTERINTELLIGENCE							
CN COUNTERINTELLIGENCE							
Operating	2,746.0	2,680.0	2,830.0	2,943.0	3,061.0	3,184.0	3,310.9
Capital Equipment					-	-	-
Construction	(200.0)				-	-	-
TOTAL FOR CN COUNTERINTELLIGENCE	2,546.0	2,680.0	2,830.0	2,943.0	3,061.0	3,184.0	3,310.9
DIRECT PERSONNEL FTEs	10	14	14	15	15	16	16
COUNTERINTELLIGENCE							
Operating	2,746.0	2,680.0	2,830.0	2,943.0	3,061.0	3,184.0	3,310.9
Capital Equipment	-	-	-	-	-	-	-
Construction	(200.0)	-	-	-	-	-	-
TOTAL FOR COUNTERINTELLIGENCE	2,546.0	2,680.0	2,830.0	2,943.0	3,061.0	3,184.0	3,310.9
DIRECT PERSONNEL FTEs	10	14	14	15	15	16	16
CHIEF FINANCIAL OFFICER							
WN COST OF PRODUCTS SOLD							
Operating	1,880.0	2,274.0	1,880.0	1,880.0	1,880.0	1,880.0	1,880.0
Capital Equipment					-	-	-
Construction					-	-	-
TOTAL FOR COST OF PRODUCTS SOLD	1,880.0	2,274.0	1,880.0	1,880.0	1,880.0	1,880.0	1,880.0
DIRECT PERSONNEL FTEs	-	-	-	-	-	-	-
CHIEF FINANCIAL OFFICER							
Operating	1,880.0	2,274.0	1,880.0	1,880.0	1,880.0	1,880.0	1,880.0
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR CHIEF FINANCIAL OFFICER	1,880.0	2,274.0	1,880.0	1,880.0	1,880.0	1,880.0	1,880.0
DIRECT PERSONNEL FTEs	-	-	-	-	-	-	-

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
ENERGY EFFICIENCY & RENEWABLE ENERGY							
EB SOLAR AND RENEWABLE RESOURCE TECHNOLOGIES							
Operating	7,603.5	12,500.0	13,600.0	13,885.6	14,177.2	14,474.9	14,778.9
Capital Equipment	846.0	200.0	200.0		-	-	-
Construction					-	-	-
TOTAL FOR SOLAR AND RENEWABLE RESOURCE TECHNOLOGIES	8,449.5	12,700.0	13,800.0	13,885.6	14,177.2	14,474.9	14,778.9
DIRECT PERSONNEL FTEs	20	30	32	33	33	34	35
EC BUILDING TECHNOLOGY, STATE AND COMMUNITY SECTOR							
Operating	450.0	500.0	300.0	306.3	312.7	319.3	326.0
Capital Equipment				-	-	-	-
Construction		-		-	-	-	-
TOTAL FOR BUILDING TECHNOLOGY, STATE AND COMMUNITY SECTOR	450.0	500.0	300.0	306.3	312.7	319.3	326.0
DIRECT PERSONNEL FTEs	1	1	1	1	1	1	1
ED INDUSTRIAL SECTOR							
Operating	800.0	2,000.0	2,040.0	2,080.0	2,120.0	2,162.0	2,205.0
Capital Equipment	-	-	-	-	-	-	-
Construction		-		-	-	-	-
TOTAL FOR INDUSTRIAL SECTOR	800.0	2,000.0	2,040.0	2,080.0	2,120.0	2,162.0	2,205.0
DIRECT PERSONNEL FTEs	2	5	5	5	5	5	5
EE TRANSPORTATION SECTOR							
Operating	6,727.1	7,250.0	11,300.0	11,537.3	11,779.6	12,027.0	12,279.5
Capital Equipment	177.9	50.0	50.0		-	-	-
Construction		-	-	-	-	-	-
TOTAL FOR TRANSPORTATION SECTOR	8,622.0	7,300.0	11,350.0	11,537.3	11,779.6	12,027.0	12,279.5
DIRECT PERSONNEL FTEs	16	18	28	29	29	30	30

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
ENERGY EFFICIENCY & RENEWABLE ENERGY							
Operating	15,580.6	22,250.0	27,240.0	26,496.0	26,496.0	26,496.0	26,496.0
Capital Equipment	1,023.9	250.0	250.0	-	-		
Construction	-	-	-	-	-	-	-
TOTAL FOR ENERGY EFF & RENEWABLE ENERGY	16,604.5	22,500.0	27,490.0	26,496.0	26,496.0	26,496.0	26,496.0
DIRECT PERSONNEL FTEs	39	54	54	54	54	54	54
ENVIRONMENT SAFETY & HEALTH							
HA ENVIRONMENT SAFETY & HEALTH							
Operating	366.0	180.0	-	-	-	-	-
Capital Equipment				-	-	-	-
Construction				-	-	-	-
TOTAL FOR ES&H	366.0	180.0	-	-	-	-	-
DIRECT PERSONNEL FTEs	1	1	-	-	-	-	-
HC ENVIRONMENT SAFETY & HEALTH (NON-DEFENSE)							
Operating	12.5	89.0	85.0	84.5	84.5	84.5	84.5
Capital Equipment				-	-	-	-
Construction				-	-	-	-
TOTAL FOR ES&H (NON-DEFENSE)	12.5	89.0	85.0	84.5	84.5	84.5	84.5
DIRECT PERSONNEL FTEs	-	-	-	-	-	-	-
HD ENVIRONMENT, SAFETY & HEALTH (DEFENSE)							
Operating	-	65.0	74.0	73.5	73.5	73.5	73.5
Capital Equipment				-	-	-	-
Construction				-	-	-	-
TOTAL FOR ES&H (DEFENSE)	-	65.0	74.0	73.5	73.5	73.5	73.5
DIRECT PERSONNEL FTEs	-	-	-	-	-	-	-

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
ENVIRONMENT SAFETY & HEALTH							
Operating	378.5	334.0	159.0	158.0	158.0	158.0	158.0
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR ENVIRONMENT SAFETY & HEALTH	378.5	334.0	159.0	158.0	158.0	158.0	158.0
DIRECT PERSONNEL FTEs	1	1	-	-	-	-	-
ENVIRONMENTAL RESTORATION							
EW ERWM - DEFENSE							
Operating	95,026.5	65,216.0	125,536.0	117,315.8	112,609.6	112,918.1	113,242.0
Capital Equipment	1,194.9	220.0	500.0	500.0	500.0	500.0	500.0
Construction	(150.0)	-	-				
TOTAL FOR ERWM - DEFENSE	96,071.4	65,436.0	126,036.0	117,815.8	113,109.6	113,418.1	113,742.0
DIRECT PERSONNEL FTEs	183	134	176	164	158	158	159
EX ERWM - NON - DEFENSE							
Operating	2,893.4	2,308.0	5,560.0	3,500.0	3,500.0	3,500.0	3,500.0
Capital Equipment	-			-	-	-	-
Construction	(300.0)			-	-	-	-
TOTAL FOR ERWM - NON - DEFENSE	2,593.4	2,308.0	5,560.0	3,500.0	3,500.0	3,500.0	3,500.0
DIRECT PERSONNEL FTEs	10	6	15	9	9	9	9
ENVIRONMENTAL RESTORATION							
Operating	97,919.9	67,524.0	131,096.0	120,815.8	116,109.6	116,418.1	116,742.0
Capital Equipment	1,194.9	220.0	500.0	500.0	500.0	500.0	500.0
Construction	(450.0)	-	-	-	-	-	-
TOTAL FOR ENVIRONMENTAL RESTORATION	98,664.8	67,744.0	131,596.0	121,315.8	116,609.6	116,918.1	117,242.0
DIRECT PERSONNEL FTEs	193	140	191	174	167	168	168

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
FOSSIL ENERGY							
AA COAL							
Operating	4,631.0	3,500.0	1,299.0	1,299.0	1,299.0	1,299.0	1,299.0
Capital Equipment	25.0	(3.0)	-	-	-	-	-
Construction				-	-	-	-
TOTAL FOR COAL	4,656.0	3,497.0	1,299.0	1,299.0	1,299.0	1,299.0	1,299.0
DIRECT PERSONNEL FTEs	15	10	4	4	4	4	4
AB GAS							
Operating	1,005.0	1,250.0	1,275.0	1,300.0	1,325.0	1,350.0	1,375.0
Capital Equipment	-	-	-	-	-	-	-
Construction				-	-	-	-
TOTAL FOR GAS	1,005.0	1,250.0	1,275.0	1,300.0	1,325.0	1,350.0	1,375.0
DIRECT PERSONNEL FTEs	2	3	3	3	3	3	3
AC PETROLEUM							
Operating	1,493.0	2,000.0	2,020.0	2,040.0	2,060.0	2,080.0	3,000.0
Capital Equipment	-	-	-	-	-	-	-
Construction				-	-	-	-
TOTAL FOR PETROLEUM	1,493.0	2,000.0	2,020.0	2,040.0	2,060.0	2,080.0	3,000.0
DIRECT PERSONNEL FTEs	6	5	5	5	5	5	7
AY CLEAN COAL POWER INITATIVE							
Operating	123.0	-	-	-	-	-	-
Capital Equipment				-	-	-	-
Construction				-	-	-	-
TOTAL FOR CLEAN COAL POWER INITATIVE	123.0	-	-	-	-	-	-
DIRECT PERSONNEL FTEs	-	-	-	-	-	-	-

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
AZ INNOVATIVE CLEAN COAL TECHNOLOGY							
Operating	380.0	400.0	400.0	400.0	400.0	400.0	400.0
Capital Equipment				-	-	-	-
Construction				-	-	-	-
TOTAL FOR INNOVATIVE CLEAN COAL TECHNOLOGY	380.0	400.0	400.0	400.0	400.0	400.0	400.0
DIRECT PERSONNEL FTEs	1	1	1	1	1	1	1
FOSSIL ENERGY							
Operating	7,632.0	7,150.0	4,994.0	5,039.0	5,084.0	5,129.0	6,074.0
Capital Equipment	25.0	(3.0)	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR FOSSIL ENERGY	7,657.0	7,147.0	4,994.0	5,039.0	5,084.0	5,129.0	6,074.0
DIRECT PERSONNEL FTEs	24	19	13	13	13	13	16
OFFICE OF THE CHIEF INFORMATION OFFICER							
CS CIO CYBER SECURITY							
Operating	960.0	500.0	1,000.0	1,100.0	1,200.0	1,300.0	1,400.0
Capital Equipment					-	-	-
Construction					-	-	-
TOTAL FOR CIO CYBER SECURITY	960.0	500.0	1,000.0	1,100.0	1,200.0	1,300.0	1,400.0
DIRECT PERSONNEL FTEs	3	1	2	2	2	3	3
OFFICE OF THE CHIEF INFORMATION OFFICER							
Operating	960.0	500.0	1,000.0	1,100.0	1,200.0	1,300.0	1,400.0
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR OFFICE OF THE CHIEF INFORMATION OFFICER	960.0	500.0	1,000.0	1,100.0	1,200.0	1,300.0	1,400.0
DIRECT PERSONNEL FTEs	3	1	2	2	2	3	3

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
OFFICE OF ENERGY ASSURANCE							
ES OFFICE OF ENERGY ASSURANCE	209.8						
Operating		-					
Capital Equipment							
Construction							
TOTAL FOR ES OFFICE OF ENERGY ASSURANCE	209.8	-					
DIRECT PERSONNEL FTEs		-					
OFFICE OF ENERGY ASSURANCE							
Operating	209.8	-					
Capital Equipment	-	-					
Construction	-	-					
TOTAL FOR OFFICE OF ENERGY ASSURANCE	209.8	-					
DIRECT PERSONNEL FTEs	-						
INTELLIGENCE							
IN INTELLIGENCE							
Operating	2,996.3	3,800.0	4,630.0	4,100.0	4,200.0	4,300.0	4,400.0
Capital Equipment	-	-	-		-	-	-
Construction					-	-	-
TOTAL FOR IN INTELLIGNCE	2,996.3	3,800.0	4,630.0	4,100.0	4,200.0	4,300.0	4,400.0
DIRECT PERSONNEL FTEs	8	11	10	9	9	9	10
INTELLIGENCE							
Operating	2,996.3	3,800.0	4,630.0	4,100.0	4,200.0	4,300.0	4,400.0
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR INTELLIGNCE	2,996.3	3,800.0	4,630.0	4,100.0	4,200.0	4,300.0	4,400.0
					-	-	-
DIRECT PERSONNEL FTEs	8	11	10	9	9	9	10

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
ADMINISTRATOR FOR NATIONAL NUCLEAR SECURITY ADMINISTRATION							
CG CERRO GRANDE							
Operating	(6,678.1)	-	-	-	-	-	-
Capital Equipment	(2,215.0)	-	-	-	-	-	-
Construction	10,436.5	-	-	-	-	-	-
TOTAL FOR CERRO GRANDE	1,543.4	-	-	-	-	-	-
DIRECT PERSONNEL FTEs	36	51	-	-	-	-	-
DP0701 STOCKPILE MAINTENANCE							
Operating	22,164.5	22,722.0	20,331.0	17,881.0	18,779.0	21,027.0	114,816.0
Capital Equipment	1,207.3	1,000.0	-				
Construction	1,923.7			-	-	-	-
TOTAL FOR STOCKPILE MAINTENANCE	25,295.5	23,722.0	20,331.0	17,881.0	18,779.0	21,027.0	114,816.0
DIRECT PERSONNEL FTEs	70	67	59	52	54	61	333
DP0702 STOCKPILE EVALUATION							
Operating	17,686.8	20,073.0	21,095.0	21,095.0	24,708.0	25,261.0	36,172.0
Capital Equipment	1,377.2	1,000.0	-				
Construction				-	-	-	-
TOTAL FOR STOCKPILE EVALUATION	19,064.0	21,073.0	21,095.0	21,095.0	24,708.0	25,261.0	36,172.0
DIRECT PERSONNEL FTEs	54	60	62	62	73	74	106
DP0703 DISMANTLEMENT/DISPOSAL							
Operating	1,355.0	1,969.0	1,521.0	1,494.0	1,866.0	2,629.0	2,629.0
Capital Equipment							
Construction				-	-	-	-
TOTAL FOR DISMANTLEMENT/DISPOSAL	1,355.0	1,969.0	1,521.0	1,494.0	1,866.0	2,629.0	2,629.0
DIRECT PERSONNEL FTEs	9	8	6	6	7	10	10

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
DP0705 PRODUCTION SUPPORT							
Operating	12,064.0	13,780.0	13,678.0	13,850.4	14,180.6	14,610.4	15,174.5
Capital Equipment	-	-	-				
Construction				-	-	-	-
TOTAL FOR PRODUCTION SUPPORT	12,064.0	13,780.0	13,678.0	13,224.0	13,161.0	13,270.0	13,266.0
DIRECT PERSONNEL FTEs	24	25	25	25	26	27	28
DP0706 STOCKPILE R&D							
Operating	111,376.6	148,042.0	154,648.0	156,026.0	167,805.0	174,934.0	189,090.0
Capital Equipment	6,167.5	7,000.0	-				
Construction	899.0	5,000.0		-	-	-	-
TOTAL FOR STOCKPILE R&D	118,443.1	160,042.0	154,648.0	156,026.0	167,805.0	174,934.0	189,090.0
DIRECT PERSONNEL FTEs	333	410	419	423	455	474	512
DP0801 PRIMARY CERTIFICATION							
Operating	972.0	2,940.0	8,269.0	8,395.0	8,276.0	8,063.0	8,466.2
Capital Equipment	-						
Construction				-	-	-	-
TOTAL FOR PRIMARY CERTIFICATION	972.0	2,940.0	8,269.0	8,395.0	8,276.0	8,063.0	8,466.2
DIRECT PERSONNEL FTEs	4	10	28	28	28	27	29
DP0802 DYNAMIC MATERIALS PROPERTIES							
Operating	32,005.7	30,650.0	27,870.0	28,615.0	29,830.0	30,539.0	32,730.0
Capital Equipment	1,427.2	-	-				
Construction				-	-	-	-
TOTAL FOR DYNAMIC MATERIALS PROPERTIES	33,432.9	30,650.0	27,870.0	28,615.0	29,830.0	30,539.0	32,730.0
DIRECT PERSONNEL FTEs	93	94	78	80	83	85	92

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
DP0803 ADVANCED RADIOGRAPHY							
Operating	42,191.9	24,500.0	41,940.0	47,615.0	35,168.0	37,150.0	39,007.5
Capital Equipment	5,381.1	-	-				
Construction	(247.0)	-	-	-	-	-	-
TOTAL FOR ADVANCED RADIOGRAPHY	47,326.0	24,500.0	41,940.0	47,615.0	35,168.0	37,150.0	39,007.5
DIRECT PERSONNEL FTEs	99	56	91	103	76	81	85
DP0804 SECONDARY CERTIFICATIONS AND NUCLEAR SYSTEMS MARGINS							
Operating	6,760.4	9,848.0	13,860.0	20,790.0	26,383.0	28,858.0	32,224.0
Capital Equipment	880.6	-	-				
Construction				-	-	-	-
TOTAL SECONDARY CERTIFICATIONS & NUCLEAR SYSTEMS MARGINS	7,641.0	9,848.0	13,860.0	20,790.0	26,383.0	28,858.0	32,224.0
DIRECT PERSONNEL FTEs	20	30	39	59	74	81	91
DP0805 ENHANCED SURETY							
Operating	2,234.3	2,326.0	3,000.0	3,500.0	3,900.0	4,500.0	4,500.0
Capital Equipment	22.7	-	-				
Construction				-	-	-	-
TOTAL FOR ENHANCED SURETY	2,257.0	2,326.0	3,000.0	3,500.0	3,900.0	4,500.0	4,500.0
DIRECT PERSONNEL FTEs	5	7	10	12	13	15	15
DP0806 WEAPONS SYSTEMS CERTIFICATION							
Operating	2,152.8	2,533.0	2,647.0	2,749.0	2,841.0	2,936.0	3,168.0
Capital Equipment	66.2						
Construction				-	-	-	-
TOTAL FOR WEAPONS SYSTEMS CERTIFICATION	2,219.0	2,533.0	2,647.0	2,749.0	2,841.0	2,936.0	3,168.0
DIRECT PERSONNEL FTEs	7	8	7	7	8	8	8

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
DP0807 CERTIFICATION IN HOSTILE ENVIRONMENTS							
Operating	780.0	745.0	990.0	1,030.0	1,031.0	1,070.0	1,167.0
Capital Equipment							
Construction				-	-	-	-
TOTAL FOR CERTIFICATION IN HOSTILE ENVIRONMENTS	780.0	745.0	990.0	1,030.0	1,031.0	1,070.0	1,167.0
DIRECT PERSONNEL FTEs	2	3	3	3	3	3	4
DP0808 ENHANCED SURVEILLANCE							
Operating	15,054.5	14,663.0	22,845.0	24,541.0	26,255.0	26,993.0	28,224.0
Capital Equipment	279.5	200.0	-				
Construction	-			-	-	-	-
TOTAL FOR ENHANCED SURVEILLANCE	15,334.0	14,863.0	22,845.0	24,541.0	26,255.0	26,993.0	28,224.0
DIRECT PERSONNEL FTEs	50	49	70	75	80	83	86
DP0809 ADVANCED DESIGN AND PRODUCTION TECHNOLOGIES							
Operating	38.1	6,417.0	7,498.0	8,311.0	6,795.0	6,899.0	7,554.0
Capital Equipment	1.9	-	-				
Construction				-	-	-	-
TOTAL FOR ADVANCED DESIGN AND PRODUCTION TECHNOLOGIES	-	6,417.0	7,498.0	8,311.0	6,795.0	6,899.0	7,554.0
DIRECT PERSONNEL FTEs	-	22	23	25	21	21	23
DP0810 ICF IGNITION AND HIGH YIELD							
Operating	23,940.1	26,782.0	29,487.0	32,670.0	37,966.0	39,339.0	42,555.0
Capital Equipment	3,176.9	-	1,000.0				
Construction	822.0		-	-	-	-	-
TOTAL FOR ICF IGNITION AND HIGH YIELD	27,939.0	26,782.0	30,487.0	32,670.0	37,966.0	39,339.0	42,555.0
DIRECT PERSONNEL FTEs	75	83	84	93	108	112	121

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
DP0811 DEFENSE COMPUTING AND MODELING							
Operating	164,853.2	188,257.0	174,575.0	182,431.0	190,640.0	199,219.0	208,184.0
Capital Equipment	103,013.0	55,200.0	-				
Construction	(489.8)	-	-	-	-	-	-
TOTAL FOR DEFENSE COMPUTING AND MODELING	267,376.4	243,457.0	174,575.0	182,431.0	190,640.0	199,219.0	208,184.0
DIRECT PERSONNEL FTEs	448	497	426	445	465	486	508
DP0812 PIT MANUFACTURING READINESS							
Operating	168,790.6	240,500.0	245,708.0	235,000.0	233,000.0	188,000.0	16,000.0
Capital Equipment	13,148.4	1,500.0	5,000.0				
Construction	5,000.0			-	-	-	-
TOTAL FOR PIT MANUFACTURING READINESS	186,939.0	242,000.0	250,708.0	235,000.0	233,000.0	188,000.0	16,000.0
DIRECT PERSONNEL FTEs	472	659	627	600	595	480	41
DP0815 NONNUCLEAR READINESS							
Operating	644.0	590.0	1,980.0	2,210.0	2,387.0	1,930.0	-
Capital Equipment							
Construction	2,970.0		-	-	-	-	-
TOTAL FOR NONNUCLEAR READINESS	3,614.0	590.0	1,980.0	2,210.0	2,387.0	1,930.0	-
DIRECT PERSONNEL FTEs	1	1	4	4	5	4	-
DP0817 TRITIUM READINESS CAMPAIGN							
Operating	4,900.0	5,000.0	-	-	-	-	-
Capital Equipment							
Construction	(820.0)	(75.8)	-	-	-	-	-
TOTAL FOR TRITIUM READINESS CAMPAIGN	4,080.0	4,924.2	-	-	-	-	-
DIRECT PERSONNEL FTEs	10	8	-	-	-	-	-

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
DP0901 OPERATIONS OF FACILITIES							
Operating	271,822.5	280,874.0	312,274.0	313,051.3	320,514.5	330,229.3	342,980.4
Capital Equipment	6,654.2	6,000.0	-				
Construction	12,412.5	20,000.0	-	-	-	-	-
TOTAL FOR OPERATIONS OF FACILITIES	290,889.2	306,874.0	312,274.0	313,051.3	320,514.5	330,229.3	342,980.4
DIRECT PERSONNEL FTEs	708	673	743	745	763	786	816
DP0902 PROGRAM READINESS							
Operating	694.9	-	-	-	-	-	-
Capital Equipment							
Construction				-	-	-	-
TOTAL FOR PROGRAM READINESS	694.9	-	-	-	-	-	-
DIRECT PERSONNEL FTEs	3	-	-	-	-	-	-
DP0903 SPECIAL PROJECTS							
Operating	4,443.0	1,252.0	1,261.0	1,264.1	1,294.3	1,333.5	1,385.0
Capital Equipment	-	-	-				
Construction	-	-	-	-	-	-	-
TOTAL FOR SPECIAL PROJECTS	4,443.0	1,252.0	1,261.0	1,264.1	1,294.3	1,333.5	1,385.0
DIRECT PERSONNEL FTEs	12	4	3	3	3	3	3
DP0904 MATERIAL RECYCLE AND RECOVERY							
Operating	12,106.2	16,848.0	15,666.0	15,705.0	16,079.4	16,566.8	17,206.5
Capital Equipment	927.8	500.0	-				
Construction				-	-	-	-
TOTAL FOR MATERIAL RECYCLE AND RECOVERY	13,034.0	17,348.0	15,666.0	15,705.0	16,079.4	16,566.8	17,206.5
DIRECT PERSONNEL FTEs	63	49	49	49	50	52	54

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
DP0909 WEAPONS INCIDENT RESPONSE							
Operating	10,694.5	14,073.0	10,218.0	10,243.4	10,487.6	10,805.5	11,222.8
Capital Equipment	1,870.9	-	-				
Construction	350.0			-	-	-	-
TOTAL FOR WEAPONS INCIDENT RESPONSE	12,915.4	14,073.0	10,218.0	10,243.4	10,487.6	10,805.5	11,222.8
DIRECT PERSONNEL FTEs	29	48	31	31	32	33	34
DP10 NNSA FACILITIES & INFRASTRUCTURE							
Operating	12,176.3	13,100.0	30,200.0	30,275.2	30,996.9	31,936.5	33,169.6
Capital Equipment	128.7						
Construction	21,695.0	33,000.0	25,000.0	104,000.0	152,880.0	139,500.0	144,912.6
TOTAL FOR NNSA FACILITIES & INFRASTRUCTURE	34,000.0	46,100.0	55,200.0	134,275.2	183,876.9	171,436.5	178,082.2
DIRECT PERSONNEL FTEs	2	6	14	14	14	15	15
DP20 RTBF CONSTRUCTION PROJECTS							
Operating	-			-	-	-	-
Capital Equipment	-						
Construction	(15,409.6)	26,000.0	-	-	-	-	-
TOTAL FOR RTBF CONSTRUCTION PROJECTS	(15,409.6)	26,000.0	-	-	-	-	-
DIRECT PERSONNEL FTEs	-	-	-	-	-	-	-
DP WEAPONS ACTIVITIES							
Operating	941,901.9	1,088,484.0	1,161,561.0	1,178,742.4	1,211,183.3	1,204,829.0	1,187,625.5
Capital Equipment	145,731.1	72,400.0	6,000.0	-	-	-	-
Construction	29,105.8	83,924.2	25,000.0	104,000.0	152,880.0	139,500.0	144,912.6
TOTAL FOR WEAPONS ACTIVITIES	1,116,738.8	1,244,808.2	1,192,561.0	1,282,742.4	1,364,063.3	1,344,329.0	1,332,538.1
DIRECT PERSONNEL FTEs	2,593	2,877	2,901	2,945	3,037	3,021	3,015

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
FS SAFEGUARDS & SECURITY							
Operating	109,363.9	105,643.0	120,879.0	125,714.4	130,742.9	135,972.7	141,411.6
Capital Equipment	4,558.8	-	-				
Construction	11,072.0	8,900.0	3,643.0				
TOTAL FOR SAFEGUARDS & SECURITY	124,994.7	114,543.0	124,522.0	125,714.4	130,742.9	135,972.7	141,411.6
DIRECT PERSONNEL FTEs	147	157	167	174	181	188	195
NN NONPROLIFERATION AND NATIONAL SECURITY PROGRAM DIRECTION							
Operating	169,335.9	182,123.0	170,769.0	152,357.0	161,258.0	160,490.0	170,084.0
Capital Equipment	12,540.0	5,908.0	-	-	-	-	-
Construction	43,076.0	5,000.0	1,500.0	-	-	-	-
TOTAL NONPROLIFERATION & NATIONAL SECURITY PROGRAM DIRECTION	224,951.9	193,031.0	172,269.0	152,357.0	161,258.0	160,490.0	170,084.0
DIRECT PERSONNEL FTEs	339	438	354	316	334	333	353
ADMINISTRATOR FOR NATIONAL NUCLEAR SECURITY ADMINISTRATION							
Operating	1,213,923.6	1,376,250.0	1,453,209.0	1,456,813.8	1,503,184.2	1,501,291.7	1,499,121.1
Capital Equipment	160,614.9	78,308.0	6,000.0	-	-	-	-
Construction	93,690.3	97,824.2	30,143.0	104,000.0	152,880.0	139,500.0	144,912.6
TOTAL ADMIN FOR NATIONAL NUCLEAR SECURITY ADMINISTRATION	1,468,228.8	1,552,382.2	1,489,352.0	1,560,813.8	1,656,064.2	1,640,791.7	1,644,033.7
			-				
DIRECT PERSONNEL FTEs	3,115	3,523	3,422	3,435	3,552	3,541	3,563

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
OFFICE OF INDEPENDENT OVERSIGHT AND PERFORMANCE ASSURANCE							
PB OFFICE OF INDEPENDENT OVERSIGHT AND PERF ASSURANCE (DEFENSE) - PD							
Operating	22.9	-					
Capital Equipment							
Construction							
TOTAL PB INDEPENDENT OVERSIGHT & PERF ASSURANCE (DEFENSE) - PD	22.9	-					
DIRECT PERSONNEL FTEs		-					
OFFICE OF INDEPENDENT OVERSIGHT AND PERF ASSURANCE							
Operating	22.9	-					
Capital Equipment	-	-					
Construction	-	-					
TOTAL FOR INDEPENDENT OVERSIGHT AND PERFORMANCE ASSURANCE	22.9	-					
DIRECT PERSONNEL FTEs	-	-	-	-	-	-	-
NUCLEAR ENERGY, SCIENCE, AND TECHNOLOGY							
AF NUCLEAR ENERGY RESEARCH & DEVELOPMENT							
Operating	24,270.3	25,236.0	52,390.0	52,390.0	52,390.0	52,390.0	52,390.0
Capital Equipment	1,316.0	735.0	-	-	-	-	-
Construction				-	-	-	-
TOTAL FOR NUCLEAR ENERGY R&D	25,586.3	25,971.0	52,390.0	52,390.0	52,390.0	52,390.0	52,390.0
DIRECT PERSONNEL FTEs	81	78	151	151	151	151	151

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
ST ISOTOPE PRODUCTION & DISTRIBUTION PROGRAM							
Operating	3,575.0	4,390.0	6,296.0	6,296.0	6,296.0	6,296.0	6,296.0
Capital Equipment	-	-		-	-	-	-
Construction	2,494.0	1,700.0	-	-	-	-	-
TOTAL FOR ISOTOPE PROD & DIST PROGRAM	6,069.0	6,090.0	6,296.0	6,296.0	6,296.0	6,296.0	6,296.0
DIRECT PERSONNEL FTEs	11	13	18	18	18	18	18
NUCLEAR ENERGY, SCIENCE, AND TECHNOLOGY							
Operating	27,845.3	29,626.0	58,686.0	58,686.0	58,686.0	58,686.0	58,686.0
Capital Equipment	1,316.0	735.0	-	-	-	-	-
Construction	2,494.0	1,700.0	-	-	-	-	-
TOTAL FOR NE,S, &T	31,655.3	32,061.0	58,686.0	58,686.0	58,686.0	58,686.0	58,686.0
DIRECT PERSONNEL FTEs	92	91	169	169	169	169	169
SCIENCE							
AT FUSION ENERGY SCIENCE							
Operating	7,464.0	7,331.0	5,672.0	4,803.2	4,867.1	4,939.1	5,003.0
Capital Equipment	65.0	-					
Construction	270.0	-	-	-	-	-	-
TOTAL FOR FUSION ENERGY SCIENCE	7,799.0	7,331.0	5,672.0	4,803.2	4,867.1	4,939.1	5,003.0
DIRECT PERSONNEL FTEs	23	21	16	14	14	14	14
KA HIGH ENERGY PHYSICS							
Operating	984.0	826.0	974.0	824.8	835.8	848.1	859.1
Capital Equipment	-	-	-				
Construction				-	-	-	-
TOTAL FOR HIGH ENERGY PHYSICS	984.0	826.0	974.0	824.8	835.8	848.1	859.1
DIRECT PERSONNEL FTEs	7	5	6	5	5	5	5

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
KB NUCLEAR PHYSICS							
Operating	8,813.0	9,000.0	9,413.0	7,971.2	8,077.3	8,196.6	8,302.7
Capital Equipment	839.0	280.0	400.0				
Construction				-	-	-	-
TOTAL FOR NUCLEAR PHYSICS	9,652.0	9,280.0	9,813.0	7,971.2	8,077.3	8,196.6	8,302.7
DIRECT PERSONNEL FTEs	24	25	26	22	22	23	23
KC BASIC ENERGY SCIENCES							
Operating	21,931.0	24,900.0	25,000.0	25,525.0	26,061.0	26,608.3	27,167.1
Capital Equipment	3,008.0	2,500.0	2,500.0				
Construction	125.0		10,000.0	7,500.0	-	-	-
TOTAL FOR BASIC ENERGY SCIENCES	25,064.0	27,400.0	37,500.0	33,025.0	26,061.0	26,608.3	27,167.1
DIRECT PERSONNEL FTEs	70	76	74	76	77	79	80
KJ COMPUTATIONAL & TECHNOLOGY RESEARCH							
Operating	3,709.0	5,570.0	7,088.0	6,002.3	6,082.2	6,172.1	6,252.0
Capital Equipment	-	-	100.0				
Construction				-	-	-	-
TOTAL FOR COMPUTATIONAL & TECHNOLOGY RESEARCH	3,709.0	5,570.0	7,188.0	6,002.3	6,082.2	6,172.1	-
DIRECT PERSONNEL FTEs	12	17	21	18	18	18	19
KP BIOLOGICAL & ENVIRONMENTAL RESEARCH							
Operating	20,998.9	20,000.0	20,500.0	20,500.0	20,504.2	20,807.2	21,076.6
Capital Equipment	1,306.6	700.0	700.0	-			
Construction	-	-	-	-	-	-	-
TOTAL FOR BIO & ENVIRON RESEARCH	22,305.5	20,700.0	21,200.0	20,500.0	20,504.2	20,807.2	21,076.6
DIRECT PERSONNEL FTEs	65	54	54	54	54	55	56

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
KS SUPERCONDUCTING SUPER COLLIDER							
Operating	47.5	-	-	-	-	-	-
Capital Equipment	(47.5)						
Construction				-	-	-	-
TOTAL FOR SUPERCONDUCTING SUPER COLLIDER	-	-	-	-	-	-	-
DIRECT PERSONNEL FTEs	-	-	-	-	-	-	-
SCIENCE							
Operating	63,947.4	67,627.0	68,647.0	65,626.5	66,427.6	67,571.5	68,660.5
Capital Equipment	5,171.1	3,480.0	3,700.0	-	-	-	-
Construction	395.0	-	10,000.0	7,500.0	-	-	-
TOTAL FOR SCIENCE	69,513.5	71,107.0	82,347.0	73,126.5	66,427.6	67,571.5	68,660.5
DIRECT PERSONNEL FTEs	201	198	197	188	190	194	197
SECURITY AND EMERGENCY OPERATIONS							
GD NUCLEAR SAFEGUARDS & SECURITY							
Operating	5,635.5	5,085.0	5,000.0	6,490.0	7,139.0	7,852.0	8,638.0
Capital Equipment	487.0	530.0	487.0				
Construction		-		-	-	-	-
TOTAL FOR NUCLEAR SAFEGUARDS & SECURITY	6,122.5	5,615.0	5,487.0	6,490.0	7,139.0	7,852.0	8,638.0
DIRECT PERSONNEL FTEs	19	18	13	17	19	20	22
SECURITY AND EMERGENCY OPERATIONS							
Operating	5,635.5	5,085.0	5,000.0	6,490.0	7,139.0	7,852.0	8,638.0
Capital Equipment	487.0	530.0	487.0	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR SECURITY AND EMERGENCY OPERATIONS	6,122.5	5,615.0	5,487.0	6,490.0	7,139.0	7,852.0	8,638.0
DIRECT PERSONNEL FTEs	19	18	13	17	19	20	22

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
WORKER AND COMMUNITY TRANSITION							
GG WORKER AND COMMUNITY TRANSITION PROGRAM							
Operating	84.0			-	-	-	-
Capital Equipment	-			-	-	-	-
Construction				-	-	-	-
TOTAL FOR GG WORKER & COMMUNITY TRANSITION PROGRAM	84.0	-	-	-	-	-	-
DIRECT PERSONNEL FTEs	-			-	-	-	-
WORKER AND COMMUNITY TRANSITION							
Operating	84.0	-	-	-	-	-	-
Capital Equipment	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
TOTAL FOR WORKER AND COMMUNITY TRANSITION	84.0	-	-	-	-	-	-
DIRECT PERSONNEL FTEs	-	-	-	-	-	-	-
DOE REIMBURSABLES	94,517.1	71,442.1	60,011.8	44,147.7	45,000.0	45,000.0	45,000.0
DIRECT PERSONNEL FTEs	179	176	144	106	108	108	108
DOE TOTALS							
Operating	1,536,278.9	1,656,542.1	1,819,382.8	1,794,295.8	1,838,625.4	1,839,266.2	1,840,566.5
Capital Equipment	169,832.8	83,520.0	10,937.0	500.0	500.0	500.0	500.0
Construction	96,108.3	99,700.2	40,287.0	111,605.9	152,988.0	139,608.0	145,020.6
DOE TOTAL	1,802,220.0	1,839,762.3	1,870,606.8	1,906,401.7	1,992,113.4	1,979,374.2	1,986,087.0
DIRECT PERSONNEL FTEs	3,884	4,246	4,229	4,181	4,299	4,295	4,325

Table A-5. Resources by DOE Major Program (Continued)

RESOURCES BY MAJOR PROGRAM (CONTINUED)

($s in thousands; parentheses indicate negative funding resulting from conversion from one type of funding to another, e.g., operating to capital equipment.)	Actual Budget Authority (BA) FY02	Projected BA FY03	Projected BA FY04	Projected BA FY05	Projected BA FY06	Projected BA FY07	Projected BA FY08
WORK FOR OTHERS							
NRC	2,058.3	2,000.0	2,000.0	2,000.0	2,000.0	2,000.0	2,000.0
DoD	87,219.7	84,047.0	82,129.0	83,853.7	85,614.6	87,412.5	89,248.2
HHS/NIH	20,369.0	24,862.8	26,462.8	26,462.8	26,462.8	26,462.8	26,462.8
NASA	8,799.2	8,000.0	5,889.0	6,012.7	6,138.9	6,267.9	6,399.5
EPA	-	460.0	-	-	-	-	-
Other Federal Agencies	57,427.9	54,594.0	61,266.0	62,552.6	63,866.2	65,207.4	66,576.7
Private Industry	19,432.2	20,000.0	20,000.0	20,000.0	20,000.0	20,000.0	20,000.0
All Other Non-Federal	5,972.5	7,995.0	8,394.0	8,394.0	8,394.0	8,394.0	8,394.0
TOTAL WORK FOR OTHERS	201,278.8	201,958.8	206,140.8	209,275.8	212,476.6	215,744.6	219,081.2
DIRECT PERSONNEL FTEs	467	500	566	566	566	566	566
LABWIDE TOTALS							
Operating	1,737,557.7	1,858,500.9	2,025,523.6	2,003,571.5	2,051,102.0	2,055,010.8	2,059,647.7
Capital Equipment	169,832.8	83,520.0	10,937.0	500.0	500.0	500.0	500.0
Construction	96,108.3	99,700.2	40,287.0	111,605.9	152,988.0	139,608.0	145,020.6
LABWIDE TOTALS	**2,003,498.8**	**2,041,721.1**	**2,076,747.6**	**2,115,677.5**	**2,204,590.0**	**2,195,118.8**	**2,205,168.3**
				-	-	-	-
DIRECT PERSONNEL FTEs	4,351	4,746	4,795	4,747	4,865	4,861	4,891

Table A-6. Subcontracting and Procurement

SUBCONTRACTING AND PROCUREMENT

($s in Millions - Obligated) 1/	Actual FY02	Projected FY03	Projected FY04	Projected FY05	Projected FY06	Projected FY07	Projected FY08
Subcontracting and Procurement from:							
Universities	21.6	21.6	21.6	21.6	21.6	21.6	21.6
All Others	1,052.3	1,052.3	1,052.3	1,052.3	1,052.3	1,052.3	1,052.3
Transfers to Other DOE Facilities	26.1	26.1	26.1	26.1	26.1	26.1	26.1
Total External Subcontracts and Procurements	1,100.0	1,100.0	1,100.0	1,100.0	1,100.0	1,100.0	1,100.0

1/ Shows total dollars obligated within each fiscal year.

Table A-7. Small and Disadvantaged Business Procurement

SMALL AND DISADVANTAGED BUSINESS PROCUREMENT

($s in Millions - Obligated) 1/	Actual FY02	Projected FY03	Projected FY04	Projected FY05	Projected FY06	Projected FY07	Projected FY08
Procurement from S&DB	360.4	360.4	360.4	360.4	360.4	360.4	360.4
Transfers to Other DOE Facilities	33%	33%	33%	33%	33%	33%	33%

1/ Shows total dollars obligated within each fiscal year.

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