**Argonne National
Laboratory**

**Brookhaven National
Laboratory**

**Lawrence Berkeley
Laboratory**

**Oak Ridge National
Laboratory**

**Pacific Northwest
Laboratory**

**Idaho National
Engineering Laboratory**

**Lawrence Livermore
National Laboratory**

**Los Alamos National
Laboratory
Sandia National
Laboratories**

U.S. Department of Energy

Multiprogram Laboratories

**1981 to 1991
A Decade of Change**

April 1993

**U.S. Department of Energy
Office of Laboratory Management
Washington DC, 20585**

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MASTER

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Introduction

The U.S. Department of Energy's (DOE) multiprogram laboratories are a key element of the national scientific and engineering resource base and major contributors to the U.S. science and technology enterprise. The original government-owned, contractor-operated (GOCO) laboratories in the group were conceived as a means of enlisting private enterprise and managerial skills to develop atomic weapons during World War II. Several laboratories were added after World War II, and the mission broadened to include enhancing civilian applications of nuclear technology. Today these laboratories perform research and development in a host of areas critical to the U.S.

The innovative GOCO concept was explicitly based on the development of a long-term partnership between the government and the private sector organizations it relied on to assist in furthering national goals in these fields. The operating contractors were motivated primarily by public service and the opportunity to participate in research and development of national and international importance. Most contracts are cost reimbursement, management and operating contracts that involve no fee and the assumption of low risk to the contractor. From these beginnings, the nine DOE multiprogram laboratories have evolved into the nation's largest performers of research and development (R&D) activities, with a total budget in FY 1991 of \$6.2 billion. The GOCO research laboratory framework has been an outstanding success and the accomplishments of DOE's laboratories are recognized throughout the world.

The multiprogram laboratories manage and conduct R&D in areas ranging from atomic physics to solar energy. Research and development areas incorporated within their missions include:

- technologies for maintaining national security
- the fundamental nature of matter and energy processes

- environmental and biological processes
- energy production technologies
- energy conserving technologies.

Scientists, engineers and technicians employed at the multiprogram laboratories total over 30,000. One example of the scientific excellence of the laboratories is the 23 Nobel prizes that have been received by their staff.

The laboratories also manage and operate cutting edge scientific user facilities, ranging from synchrotron light sources to environmental research parks and research reactors, used by scientists from government, universities, and private industry. They conduct programs for students and teachers to support science and engineering education at all levels. The transfer of technology to private industry enhances U.S. competitiveness. Examples of industries that have directly benefited from R&D performed by the laboratories include nuclear medicine and the superconductor industry.

The Multiprogram Laboratories in FY 1991

Aggregate Funding (\$Million)

Total	Operating	Capital Equipment	Construction
6233	5348	300	585

DOE Operating Funding (\$Million)

Total DOE	Defense Programs	Energy Research	Env. Res./ Waste Management	Nuclear Energy	New Prod. Reactor	Conserv. & Renew. Energy	Civilian Radioactive Waste	Fossil Energy	Other
4121	1642	856	572	363	98	168	87	43	292

Percent of Total Budget Provided to the Multiprogram Laboratories*

Total DOE	Defense Programs	Energy Research	Env. Res./ Waste Management	Nuclear Energy	New Prod. Reactor	Conserv. & Renew. Energy	Civilian Radioactive Waste	Fossil Energy
27%	28%	40%	21%	38%	40%	35%	37%	5%

*Includes funding provided to the laboratories that is subsequently subcontracted to private industry and universities.

Operating Funding by Major DOE Research Program (\$Million)

Weapons Activities	Basic Energy Sciences	Defense Materials Production	Biological/ Environmental	Advanced Reactors	Nuclear Physics	Isotopes Separation	High Energy Physics	Fusion Energy
1274	355	208	168	154	134	133	94	84

Non-DOE Operating Funding (\$Million)

Total Non-DOE	Dept. of Defense	Nuclear Regulatory Commission	Health & Human Services	Environmental Protection Agency	Non-Federal	Other
1227.6	899.5	94.3	23.5	6.8	78.5	125.0

Operating Funding by Laboratory (\$Million)

ENERGY RESEARCH LABORATORIES						DEFENSE PROGRAM LABORATORIES				NUCLEAR ENERGY LABORATORY	
ANL	BNL	LBL	ORNL	PNL	Total	LLNL	LANL	SNL	Total	INEL	
348	260	195	458	343	1603	1095	892	1148	3135	610	

Personnel

Total Staff	BY PROFESSION				BY DEGREE LEVEL		
	Scientists/ Engineers	Technicians	Mgmt. & Admin.	Other	PhDs	MSs/MAs	BSs
52577	19211	11182	6900	15284	8521	7892	9827

Facilities (FY 1990)

FACILITY AGE				
Average Age	Percent Built Before 1950	Percent Built Before 1960	Percent Built Before 1970	Percent Built Before 1980
25 years	9%	47%	67%	78%

Education and Technology Transfer (FY 1990)

Total University Faculty/Student Participants in Lab. Coop. Program	Number of Precollege Educational Programs Offered	Number of Designated User Facilities	Total Non-DOE Users of Designated User Facilities	Technology Licenses Issued	Annual License Income
2034	186	22	5956	82	\$2.3 Million

HISTORICAL TRENDS

The multiprogram laboratories accomplished \$6.2 billion of weapons R&D, basic research, and advanced energy R&D in FY 1991, which represented almost 30% of DOE's total budget. They employed the equivalent of nearly 53,000 full-time persons.

AGGREGATE FUNDING

Total Laboratory Funding

Total funding for the nine laboratories has increased since FY 1981.

- Total growth of all nine laboratories in current dollars has been 93% since FY 1981.
- In real purchasing power, expressed in FY 1991 constant dollars, this growth is nearly 30%.
- Personnel levels over the same period increased nearly 9%.

Operating, Equipment and Construction Funding

Operating funding composes the bulk of laboratory funding.

- Operating—86% of total funding in FY 1991—provides for the salaries and benefits of laboratory employees, the laboratory overhead, purchased materials, and subcontracts with universities and the private sector.
- Capital Equipment—4.8% of total funding in FY 1991—provides for the purchase of equipment items over \$3,000 in value for use in laboratory activities.
- Construction—nearly 10% of total funding in FY 1991—provides for the construction of program and general purpose facilities, "line-items," and for major maintenance projects.

FUNDING AS A PERCENTAGE OF DOE BUDGETS

Percentage of Total DOE Budget

The percentage of total DOE funding allocated to the laboratories has increased since FY 1981, leveling off in recent years.

- The increase in the relative proportion of funding provided to the laboratories results both from increased laboratory funding and decreased funding in other DOE areas.

Percent of DOE Assistant Secretarial Budgets

The multiprogram laboratories compose more than 25% of the total budget of every

AGGREGATE FUNDING

Total Laboratory Funding

Operating, Equipment and Construction Funding (\$Current)

FUNDING AS A PERCENTAGE OF DOE BUDGETS

Percentage of Total DOE Budget Allocated to the Laboratories

Percentage of DOE Assistant Secretarial Budgets

Assistant Secretary except Fossil Energy (FE) and Environmental Restoration and Waste Management (EM).

- The proportion of total funding allocated to the laboratories from the Office of Energy Research (ER) and Defense Programs (DP) declined since 1981, even though total funding from these sources increased substantially.
- The increase in proportional laboratory funding for Conservation and Renewable Energy (CE) is mainly attributable to

increased emphasis on R&D programs and increased subcontracting through the laboratories.

- The decrease in proportional funding for ER is primarily related to large capital projects at several of the ER single program laboratories, while the decrease for DP is associated with increased funding at DP's production sites.

Construction and capital equipment funding at the multiprogram laboratories generally declined relative to inflation since the mid-1980s.

CONSTRUCTION AND CAPITAL EQUIPMENT FUNDING

Construction Funding

Construction funding levels at the multiprogram laboratories have not kept pace with operating funding.

- Construction funding increases significantly during the construction of major scientific or general purpose facilities, unaccompanied by an increase in laboratory R&D effort. The large jump in funding in FY 1991 was largely due to construction of facilities for Environmental Restoration and Waste Management (EM) and DP materials production at INEL.
- Capital equipment funding is more closely tied to laboratory programmatic activity level. In real terms, it peaked in FY 1986 and then declined to FY 1990. An increase in FY 1991 funding occurred at nearly all nine laboratories.

Breakdown of Construction Funding

After peaking in FY 1982, programmatic "line item" funding was nearly constant in real terms for much of the 1980s.

- The relatively high level of activity in FY 1982 was primarily related to the construction of defense and fusion energy R&D facilities. The increase in FY 1991 is due to activities at INEL as previously noted.
- After significant increases in projects (GPP) and multiprogram general purpose facility (MGPF) projects in the early 1980s, funding fell then leveled off in real terms in the late 1980s. MGPF funding dropped significantly in FY 1991.
- Major programmatic construction projects for which additional funding is needed include the Advanced Photon Source at ANL, Relativistic Heavy Ion Collider at BNL, Advanced Light Source at LBL, Advanced Neutron Source at ORNL, Environmental and Molecular Sciences Laboratory at PNL, Modular High-Temperature Gas-Cooled Reactor at INEL, Contained Firing Facility at LLNL, Dual Axis Radiogenetic Hydrotest Facility at LANL, and the Center for National Security and Arms Control at SNL.

CONSTRUCTION AND CAPITAL EQUIPMENT FUNDING

Construction Funding (\$Current)

Capital Equipment Funding (\$Current)

Breakdown of Construction Funding (\$Current)

Construction Funding as a Percentage of Operating Funding

Construction Funding as a Percentage of Operating Funding

Program construction averaged between 5 and 6% of operating funding during the 1980s.

- Funding for general purpose facility projects (GPP and MGPF) was generally steady in relation to operating funding, but in the low range of 2% to 3%. In FY 1991, this slipped below 2%.

- At this level of funding, the backlog of general purpose facility projects needed at the laboratories grew substantially. Facilities at the multiprogram laboratories average 25 years of age and almost 70% of them were constructed before 1970.

The nine multiprogram laboratories fall into three groups: the defense laboratories, the energy laboratories and a nuclear energy laboratory (Idaho National Engineering Laboratory). Organizational assignment of DOE management oversight and the nature of major activities differentiate the three, although some intermingling of program assignments and funding sources has taken place.

OPERATING FUNDING AND TOTAL STAFF

Operating Funding

The major growth in operating funding from FY 1981 to FY 1991 was in the defense laboratories.

- In current dollars, defense laboratory operating funding grew 110% from \$1.5 billion in FY 1981 to \$3.1 billion in FY 1991.
- The energy laboratories' operating funding increased by 62% (from \$986 million to \$1.6 billion) over the same period.
- Real constant dollar growth in defense laboratories' operating funding was 41% while energy laboratories grew 10% in real terms.

Total Staff

Although changes in personnel levels generally follow changes in constant dollar operating funding, the following occurred:

- The defense laboratory personnel increase of 8% did not keep pace with the 41% real growth in operating funding. This implies a significant increase in subcontracting and outside purchases.
- Energy laboratory personnel levels remained basically unchanged which, when compared to real growth of 10%, also implies increased subcontracting and purchases. Increased costs for waste disposal and electricity prices that increase faster than the rate of general inflation are examples of factors that can increase constant dollar purchase costs.

LABORATORY FUNDING PERCENTAGES

Percentage of Total Operating Funding

Although energy laboratory operating funding has increased over the decade, its portion of the total laboratory budget has been reduced from 36% to 31% because of the larger increases in defense laboratory and INEL funding.

OPERATING FUNDING AND TOTAL STAFF

Operating Funding for Defense and Energy Laboratories (\$Current)

Total Full-Time Equivalent Staff (FTEs) at Defense and Energy Laboratories

LABORATORY FUNDING PERCENTAGES

Percentage of Total Operating Funding in FY 1981

Percentage of Total Operating Funding in FY 1991

- The increased funding of the defense laboratories came primarily from DOE Defense Programs (DP) and the Department of Defense (DOD).

- The energy laboratories experienced increases in funding from the DOE Office of Energy Research (ER) and DOD. However, the magnitude of these increases was

substantially less than the DP and DOD funding increases at the defense laboratories. DP funding of ER laboratories actually declined from FY 1981 to FY 1991.

- Energy Research funding increased a similar amount (about 65%) at both ER and DP laboratories from FY 1981 to FY 1991.

The DOE funding for the laboratories in FY 1991 primarily came from four major program areas, which provided 75% of the total operating funds for that year. The two largest programs, Defense Programs and the Office of Energy Research, provided 61% of laboratory funding from DOE.

PROGRAMMATIC FUNDING AREAS

Percentage of Laboratory DOE Operating Funding by Assistant Secretary

- The expansion of Defense Program's (DP) funding, reductions in energy-related funding, and establishment of new programs in New Production Reactors and Environmental Restoration & Waste Management (EM) were primary causes of shifting program mix. Ninety-one percent of the DP FY 1991 laboratory funding went to the defense laboratories.

- Consistent with the Office of Energy Research's (ER's) small change in constant dollar funding, its relative position as a funding source did not change appreciably. Seventy-two percent of the ER FY 1991 laboratory funding went to the energy laboratories.

Operating Funding Provided by Defense Programs and the Office of Energy Research

- Funding from DP for the design and testing of nuclear weapons is the largest single programmatic activity at the multiprogram laboratories. DP funding at the laboratories peaked in FY 1989.

- Funding from ER for fundamental studies of materials and energy-related processes in the Basic Energy Sciences program is the largest ER programmatic activity.

Operating Funding Provided by NE, CE, FE, CRW, and EM.

- The Civilian Radioactive Waste (CRW) program area was established in FY 1983. Since then its funding at the laboratories has grown to \$87 million.

- The decrease in funding from Conservation and Renewable Energy (CE) and Fossil Energy (FE) primarily reflects overall budget declines for CE and the R&D component of FE (excluding the Clean Coal program) from FY 1981 to FY 1991.

PROGRAMMATIC FUNDING AREAS

Percentage of Laboratory DOE Operating Funding by Assistant Secretary in FY 1981

Operating Funding Provided by DP and ER (\$Current)

Percentage of Laboratory DOE Operating Funding by Assistant Secretary in FY 1991

Operating Funding Provided by EM, NE, NPR, CRW, CE, and FE (\$Current)

- EM was established in FY 1989. At \$572 million, it was the third largest source of DOE operating funding at the laboratories in FY 1991.

Although DOE provides most of the funding for the multiprogram laboratories, other federal agencies and the private sector provided one-fourth of laboratory operating funding in FY 1991.

WORK FOR OTHERS FUNDING

Comparison of DOE and Work for Others Operating Funding

Work for other federal agencies and the private sector is called Work for Others (WFO) and is almost exclusively operating funding.

- WFO increased by 160% from FY 1981 to FY 1991, and its share of laboratory operating funding increased from 17% to 23%.
- Almost all of the growth in WFO is attributable to increased funding from the Department of Defense (DOD).
- Over the past decade, the DOE laboratories became an important element of DOD research and development activities. In FY 1991, DOD provided 73% of the WFO funding, which represented 17% of total laboratory operating funding.

Work for Others Operating Funding by Sponsor

- DOD funding grew from \$128 million in FY 1981 to \$900 million in FY 1991 - an increase of over 600%.
- The Nuclear Regulatory Commission (NRC), which has legislated access to DOE laboratories, reduced its funding of R&D at the laboratories by FY 1991 to 40% of its peak of activity in FY 1982. NRC funding at the laboratories declined every year between FY 1982 and FY 1991.
- Work for non-federal organizations, such as state agencies and private companies, more than doubled over the past six years. Non-federal work was the third largest source of WFO work in FY 1991, representing 1.5% of total laboratory operating funding.
- Most of the work funded by the Department of Health and Human Services (HHS) at the laboratories is connected with National Institutes of Health (NIH) R&D programs in the biological sciences.
- Environmental Protection Agency (EPA) funding decreased by 70% to less than \$7 million in FY 1991, despite increased national attention to environmental R&D.

WORK FOR OTHERS FUNDING

Comparison of DOE and Work for Others Operating Funding (\$Current)

- Increases in the "All Other" category of WFO were caused by across-the-board increases in a number of relatively small program areas.

Work for Others Operating Funding in Energy and Defense Laboratories

- Defense laboratory WFO increased by about 275% from FY 1981 to FY 1991 to become about 26% of total operating funding, and energy laboratory WFO about doubled to represent about 19% of operating funding.
- In real terms, defense laboratory WFO increased by about 150% and energy laboratory WFO increased by about 25%.
- In FY 1991, 84% of defense laboratory WFO was funded by DOD, while 47% of energy laboratory WFO was DOD-funded. DOD is the largest WFO sponsor at every laboratory except BNL and LBL, where the NRC and HHS provide the most WFO funding.
- WFO at the defense and energy laboratories increased slightly, but overall WFO at the multiprogram laboratories declined by \$71 million due to a decrease of \$104 million at Idaho National Engineering Laboratory.

Work for Others Operating Funding by Sponsor (\$Current)

Work for Others Operating Funding in Energy and Defense Laboratories (\$Current)

External interactions in conducting technology transfer, operating user facilities, and supporting education have become increasingly important missions of the laboratories.

TECHNOLOGY TRANSFER

An overriding goal of laboratory technology transfer efforts is improving U.S. industrial competitiveness. Conducting licensing programs and operating user facilities are important elements of these efforts.

Licenses Issued by the Multiprogram Laboratories

Licensing of technologies by the laboratories has increased since the enactment of new legislation and policies designed to encourage technology transfer.

- The Stevenson-Wydler Act of 1980, as amended by the Federal Technology Transfer Act of 1986, required the laboratories to carry out specific technology transfer functions.
- Stevenson-Wydler established Offices of Research and Technology Applications (ORTAs) to coordinate technology transfer and make the laboratories more "user friendly" to industry.
- Executive Order 12591 on Facilitating Access to Science and Technology provides additional direction to the laboratories for implementing the 1986 Act.
- The Bayh-Dole Act of 1980, as amended by P.L. 98-620 of 1984, allows nonprofit contractors who operate federal laboratories to take title to inventions that are not defense-related or of a sensitive nature.
- The National Competitiveness Technology Transfer Act of 1989 gave laboratory Directors the ability to directly negotiate Cooperative Research and Development Agreements (CRADAs) with private industry.

Licensing Revenues for the Multiprogram Laboratories

Laboratory licensing activities are intended to reduce the administrative requirements associated with technology transfer, provide incentives, and defray government investment costs.

- Most of the licensing income realized by the laboratories has been used to defray licensing program costs. In addition, nearly all laboratory contractors have established

programs to return a share of licensing income to technology inventors.

- Most laboratory technology transfer functions are currently supported through laboratory overhead funds, although an eventual goal of the licensing programs is to become self-supporting through revenues.

Non-DOE Users of Designated Scientific User Facilities

Constructing and operating scientific user facilities are major missions of the multiprogram laboratories.

- DOE laboratory user facilities provide unique capabilities for the research community. Programs to provide access to these facilities by non-DOE users reduce facility duplication.
- University scientists have traditionally been the predominant non-DOE users of laboratory user facilities, but industrial interest is increasing.
- Laboratory user facilities serve a wide variety of university and industry needs - from fundamental particle acceleration to applied materials testing.
- The major user facilities have established oversight committees which allocate access to the facilities and perform other functions. The ORTAs also perform a vital linking function between potential industrial users and laboratory capabilities.

Non-DOE Users of Designated Scientific User Facilities

Cooperative Research and Development Agreements

The laboratories are placing substantial emphasis on CRADAs as a means of improving technology transfer through direct interaction with U.S. industry.

- During the first full year of CRADA activity (FY 1991), DOE's GOCO laboratories initiated about 75 CRADA's, and hundreds more were under development.

The multiprogram laboratories conduct numerous programs to stimulate interest in science and engineering and provide training opportunities for students and teachers. The importance of the programs has increased in light of a national consensus that U.S. scientific competence and literacy must improve. The unique scientific capabilities of the laboratories' workforce and facilities are a vital component of efforts to foster this improvement.

SCIENCE EDUCATION PROGRAM TRENDS

Participants in University/Laboratory Cooperative Research and Science and Engineering Research Semester Programs

These research "learning" programs provide an opportunity for direct participation by university students and faculty in laboratory R&D programs.

- Participants work at the laboratories for periods varying from 3 months for undergraduate students to longer periods for selected graduate students and faculty.
- Program participation during the 1980s was primarily a function of funding levels. Participation increased substantially from FY 1987 to FY 1990 when the DOE increased funding levels.
- Laboratory support to post-secondary education is also provided through activities outside the formal cooperative program. For example, laboratory equipment is often made available to students and faculty, and laboratory staff often teach at local colleges.

Number of Precollege Science Education Programs

Conducting science education programs for precollege students and teachers has become increasingly important at a time when student interest and competence in science and mathematics are declining, while projected needs are increasing.

- Precollege science education programs are supported through volunteerism, laboratory overheads, and direct funding from DOE and other organizations.
- The number of formally identified precollege science education programs increased by over 300% from FY 1981 to FY 1991.
- The types of programs conducted by the laboratories vary widely—from half-day laboratory tours for students to extended participation by teachers in laboratory research. Many of the programs are conducted in partnership with state/local groups

SCIENCE EDUCATION PROGRAM TRENDS

Participants in University/Laboratory Cooperative Research and Science Engineering Research Semester Programs

DOE Funding for Precollege Science Education Programs (\$Current)

and the private sector, and additional collaborative efforts are being initiated.

DOE Funding for Precollege Science Education Programs

DOE funding for precollege science education programs fluctuated widely from FY 1981 to FY 1991.

- Budget levels increased to about \$14.5 million in FY 1991, marking the first time that funding would exceed the FY 1980 peak.

FY 1991 Precollege Science Education Programs by Grade Level

Efforts are increasing to stimulate interest

Number of Formal Precollege Science Education Programs Conducted by the Laboratories

FY 1991 Precollege Science Education Programs by Grade Level

in science and engineering in the lower grade levels so that the future "pipeline" of students in these fields will increase.

- Increasing emphasis is also being placed on training and encouraging teachers because of their potential to leverage their increased knowledge and interest to large numbers of students.
- Particular focus is also being given to encouraging participation by women, minorities, and the disabled in science and engineering. A Department of Labor report indicates that 85% of new employees entering the workforce by 2000 will be women, minorities, and immigrants.

LABORATORY PROJECTIONS

The multiprogram laboratories project their funding to be nearly \$6.5 billion in constant FY 1991 dollars by FY 1997.

PROJECTED FUNDING

Projected Capital and Operating Funding

The laboratories project their funding to increase slightly faster than inflation.

- Constant dollar operating funding is projected to increase by 1.8% per year.
- Constant dollar capital funding for construction and equipment is also projected to increase, but by nearly 4% per year.

Projected Personnel Levels

The laboratories expect personnel to increase from about 50,000 to 52,600 full-time equivalent staff (FTEs) by FY 1997.

- Direct personnel are projected to increase by 2100 FTEs.
- Indirect personnel are projected to increase by 440 FTEs.

Projected Defense Laboratory Capital and Operating Funding

The defense laboratories project their operating funding to increase at a significantly slower rate than during the 1980s.

- Constant dollar operating funding is forecast to rise by 1.3% per year, compared with the 3.4% annual increase occurring from FY 1981 to FY 1991.
- Constant dollar capital (construction and equipment) funding from FY 1991 to FY 1997 is expected to rise 9% per year.

Projected Energy Laboratory Capital and Operating Funding

The energy laboratories project their funding to increase faster than during the 1980s.

- Constant dollar operating funding is forecast to rise by just less than 3.0% per year compared with less than 1% growth that occurred from FY 1981 to FY 1991.

PROJECTED FUNDING

Projected Multiprogram Laboratory Capital and Operating Funding (\$Constant FY 1991)

Projected Multiprogram Laboratory Full-Time Equivalent Staff Levels

Projected Defense Laboratory Capital and Operating Funding (\$Constant FY 1991)

Projected Energy Laboratory Capital and Operating Funding (\$Constant FY 1991)

- Constant dollar capital funding from FY 1991 to FY 1996 is expected to grow at an average annual rate of 4%.

Defense Programs, Office of Energy Research, and Work for Others are projected to remain the dominant funding sources at the multiprogram laboratories.

DEFENSE LABORATORY FUNDING PROJECTIONS

Projected Defense Laboratory Funding Mix

Projected changes in the proportional funding mix of the defense laboratories between FY 1991 and FY 1997 include a decrease in Work for Others (WFO) and increases in DOE non-defense programs.

- Funds from the Office of Energy Research (ER) and the Office of Environmental Restoration and Waste Management (EM) are projected to increase the most in relative importance.
- The proportion of Office of Defense Programs (DP) funding is projected to decline somewhat.

Projected Funding by Major Sponsor

Although DP funding is expected to be the largest contributor to funding growth at the defense laboratories, the laboratories project its growth to be slow.

- Constant dollar DP operating funding is forecast to rise \$66 million (4.4%) from FY 1991 and FY 1997.
- LLNL projects an increase in constant dollar DP operating funding, LANL projects it to remain essentially constant, and SNL projects it to decline over the planning period.
- Constant dollar WFO funding is projected to increase just \$6.7 million, compared with the \$385 million increase from FY 1984 to FY 1990.
- The constant dollar decline in DOE-funded civilian R&D that occurred in the 1980s is projected to reverse. A greater than 50% increase in funding is projected.

DEFENSE LABORATORY FUNDING PROJECTIONS

Percentage of
Defense Laboratory Operating Funding
in FY 1991 (Actual)

Percentage of
Defense Laboratory Operating Funding
in FY 1997 (Projected)

Projected Operating Funding
by Major Sponsor
(\$Constant FY 1991)

Office of Energy Research funding is projected to rise substantially in the energy laboratories.

ENERGY LABORATORY FUNDING PROJECTIONS

Percentage of Energy Laboratory Funding

The energy laboratories project their funding mix to become more concentrated in the Office of Energy Research (ER).

- ER funding is projected to compose almost half of total funding by FY 1997.
- Funding from the Office of New Production Reactors (NPR), which currently composes about 3% of energy laboratory operating funding, is projected to be essentially zero by FY 1997.
- EM funding is projected to grow, nearly eclipsing WFO, which as with most other funding sources is projected to decline in relative importance.

Projected Funding by Major Sponsor

- The \$326 million (53%) projected increase in ER constant dollar operating funding by FY 1996 compares with a \$4 million (less than 1%) increase occurring from FY 1984 to FY 1990.
- Work for Others is projected to increase 11% in constant dollars of the period. This compares with a 2% decline from FY 1984 to FY 1990.
- The 22% increase in Other DOE funding which occurred from 1984 to 1990 is projected to be exceeded by a nearly 30% growth from FY 1991 to FY 1997.

ENERGY LABORATORY FUNDING PROJECTIONS

Percentage of Energy Laboratory Funding in FY 1991 (Actual)

Percentage of Energy Laboratory Funding in FY 1997 (Projected)

Projected Operating Funding by Major Sponsor (\$Constant FY 1991)

INDIVIDUAL LABORATORY PROFILES

Argonne National Laboratory

Argonne, Illinois (ANL-East)

Idaho Falls, Idaho (ANL-West)

Cognizant Secretarial Officer

Director of Energy Research

Responsible Operations Office

Chicago (Argonne Area Office)

Operating Contractor

University of Chicago

Major Facilities

Four designated user facilities, including the Intense Pulse Neutron Source. The major planned facility under construction is the Advanced Photon Source (APS).

Funding *

* All data through FY 1991 are actuals. All funding projections represent ANL (not DOE) views.

Missions

- develop and operate national experimental facilities for use by university, industry, and national laboratory groups
- perform experimental and theoretical research on fundamental problems in the physical, life and environmental sciences
- conceptualize, design and test advanced fission reactors and other technologies for power applications in the civilian and defense sectors
- provide support to DOE and, where appropriate, other federal agencies in characterizing and evaluating nationally important technology options
- give highest priority to the health and safety of the public and our workers and to the environment; comply with all Environment, Safety and Health laws, regulations, and orders
- transfer technologies to the private sector for commercialization.

Funding

Both capital and operating funding have increased steadily since FY 1986. However, in real terms, operating funding in FY 1991 was about equal to its FY 1981 level. Projected increases in capital funding are associated with the APS.

Programs

Energy Research (ER) and Nuclear Energy (NE) each accounted for about 30% of ANL operating funding in FY 1991. By FY 1997, ER is projected to contribute over 40% of this funding, with most of the funding growth in the Basic Energy Sciences program.

Most of the NE funding is from the Breeder Reactor program, with a large effort at ANL-West. ER funding is

Programs

FY 1991 Operating Funding Sources

distributed among many programs, with emphasis in materials and chemical R&D.

Work for Others (WFO) has increased 150% since FY 1981, but is projected to increase only slightly over the balance of the planning period. Department of Defense (DOD) funding increased by 11% from FY 1990 to FY 1991. DOD funding increased by almost \$30 million from FY 1985 to FY 1991.

ANL had a major technical support role in the New Production Reactor (NPR) program in FY 1991 that is projected to be phased out by FY 1994.

Personnel

Since FY 1981, total staff has declined by 13%. Because of both accounting changes and reductions in indirect personnel, most of these losses were in indirect staff.

FY 1991 Statistics

TOTAL FUNDING	\$477.8
STAFF (FTEs)	4352
DOE Operating Funding	\$298.8M
WFO Operating Funding	\$57M
Construction Funding	\$91.4M
Capital Equipment Funding	\$26.0M
ANL-East Site Size (acres)	1704
ANL-West Site Size (acres)	809
Building Space	4.2M sq. ft.

Construction

Funding includes construction at both ANL-East and ANL-West sites.

Both program-related and general purpose facility (MGPF) construction funding at ANL increased steadily between FY 1986 and FY 1989. In FY 1990 and FY 1991, program construction increased substantially (primarily due to the APS), while MGPF funding was nearly cut in half compared to FY 1989.

General plant projects (GPP) have averaged only 1.35% of operating funding from FY 1981 through FY 1991.

The change in "landlord" from NE to ER in FY 1984 was accompanied by an increase in GPP funding, and relatively high levels were provided from FY 1988 to FY 1991.

Data for Construction by Decade are for ANL-East and ANL-West combined. ANL-West is less than 13% of the total.

Over 80% of ANL-West was constructed in the 1960s and 1970s, while about 85% of ANL-East was constructed in the 1950s and 1960s.

Equipment

Since 1986, equipment funding from DOE programs has increased by about \$10 million and averaged about 7% of DOE operating funding. This upward trend is expected to continue with construction of the APS.

Cumulative general purpose equipment (GPE) funding for FY 1981-84 was only \$1.5 million, creating a serious backlog of unfulfilled equipment needs. GPE funding has increased substantially since the FY 1984 shift in "landlords" from NE to ER, but still averages less than 1% of total operating funding.

Brookhaven National Laboratory

Brookhaven, New York

Cognizant Secretarial Officer

Director of Energy Research

Responsible Operations Office

Chicago (Brookhaven Area Office)

Operating Contractor

Associated Universities, Inc.

Major Facilities

Seven designated user facilities, including the National Synchrotron Light Source (NSLS). The major planned facility under construction is the Relativistic Heavy Ion Collider (RHIC).

Funding *

* All data through FY 1991 are actuals. All funding projections represent BNL (not DOE) views.

Missions

- conceive, design, build, and operate in a safe and environmentally sound manner large, complex research facilities for fundamental scientific studies
- carry out basic and applied research in energy-related physical, life and environmental sciences - specific R&D areas include high energy and nuclear physics and basic energy sciences
- conduct a broad spectrum of educational programs, including assisting the education of scientists and engineers in universities and industry through cooperative research
- ensure that all useful results and knowledge obtained from BNL research programs are made available to the commercial sector
- when feasible, make available unique facilities and expertise to state and federal agencies and the private sector.

Programs

Assistant Secretaries

Major Programs

Funding

Operating funding grew about 1.4% per year in real terms from FY 1981 to FY 1991. Over half of this growth is attributable to increases in High Energy Physics (HEP), including support to the Superconducting Super Collider (SSC), and Basic Energy Sciences (BES) research.

Capital funding decreased in FY 1983 because of cancellation of the ISABELLE project. Projected increases are due to planned construction of the RHIC.

Programs

Energy Research (ER) currently accounts for over 75% of BNL's funding. This portion is expected to decrease slightly by FY 1997.

BES is the largest single program, accounting for 26% of operating funds in FY 1991. Direct HEP funding declined from FY 1985 to FY 1991. However when support to the

FY 1991 Operating Funding Sources

SSC is included, high energy physics research is BNL's largest single focus area. BES funding growth since FY 1985, has largely been used to support operation of scientific user facilities.

Nuclear Physics (NP) funding increased by over 200% from FY 1985 to FY 1991 and further increases are projected in association with the planned start-up of the RHIC.

Environmental Restoration and Waste Management (EM) is currently BNL's second largest source of DOE program funds. EM funding is projected to more than triple by FY 1997.

Work for the Nuclear Regulatory Commission (NRC), which accounts for almost 40% of all Work for Others (WFO) is expected to grow modestly in the future.

FY 1991 Statistics

TOTAL FUNDING	\$331.7M
STAFF (FTEs)	3344
DOE Operating Funding	\$221.3M
WFO Operating Funding	\$42.2M
Construction Funding	\$49.1M
Capital Equipment Funding	\$19.1M
Site Size (acres)	5321
Building Space	3.5M sq. ft.

Personnel

Total staff size has remained almost constant since FY 1981, and the ratio of direct to indirect personnel has also seen little change.

Personnel is projected to increase 14% by FY 1995, mainly because of the construction of the RHIC.

Construction

Program construction of \$36.7 million in FY 1981 was mainly for ISABELLE. Current program construction at BNL is largely composed of RHIC, improvements to accelerators and development of an x-ray lithography source for DOD.

Multiprogram general purpose facility (MGPF) funding increased substantially from FY 1982 to FY 1987, but has remained constant or declined since FY 1987.

General plant projects (GPP) funding increased by \$2.5 million in FY 1985 in response to large backlogs. Essentially constant funding since FY 1985 represents a 19% decline in real terms. GPP was 2.2% of operating funds in FY 1991.

Fifty-six percent of BNL's building space is over 28 years old; less than 20% has been built in the past 18 years.

Equipment

Increases in program equipment funding, starting in FY 1985, came from BES, NP, and HEP programs. The decline since FY 1989 is also associated with these programs.

In real terms, general purpose equipment (GPE) funding has increased by 5% since FY 1981. GPE was equal to 1.7% of operating funds in FY 1991.

Lawrence Berkeley Laboratory

Berkeley, California

Cognizant Secretarial Officer

Director of Energy Research

Responsible Operations Office

San Francisco, California

Operating Contractor

University of California

Major Facilities

Four designated user facilities, including the 88-Inch Cyclotron. The major planned facility (under construction) is the Advanced Light Source (ALS).

Missions

- perform leading multidisciplinary research in the general, energy, and life sciences
- perform this research in a manner that ensures employee and public safety and the protection of the environment
- develop and operate unique experimental facilities for use by qualified investigators
- educate and train future generations of scientists and engineers
- transfer knowledge and technical innovations and foster productive relationships between laboratory research programs and industry.

Funding

LBL's 50% increase in operating funding from FY 1981 to FY 1991 translates to a 4% increase in real terms. Because personnel levels declined over the period, the data suggests much of the increased funding went to non-labor activities. Projected increases are mainly for construction and operation of the ALS and related facilities and programs that will use its capabilities.

Programs

Basic Energy Sciences (BES) became LBL's largest program in FY 1987. Its funding increased 35% from FY 1985 to FY 1991, while Nuclear Physics (NP) funding was constant and High Energy Physics (HEP) funding increased by 22%. LBL projects continued increases in BES activities, mainly as a result of expansion of the Center for Advanced Materials (CAM) and the ALS. Smaller increases in HEP activities, which currently focus on detector development and other collaborative efforts, are forecast. Nuclear Physics funding is projected to decline, primarily as a result of the close-out of the Bevalac program.

Funding *

* All data through FY 1991 are actuals. All funding projections represent LBL (not DOE) views.

Programs

FY 1991 Operating Funding Sources

DC=Work for other DOE contractors

Biological and Environmental Research funding at LBL nearly doubled between FY 1985 and FY 1991, and related work for the National Institutes of Health (within the Dept. of Health and Human Services) also increased. These increases are indicative of LBL's prominent role in life sciences research, including the Human Genome program. LBL projects the 60% share of its budget funded by the Office of Energy Research (ER) to increase even further.

Work for Other DOE Contractors primarily involves work contracted to LBL by other DOE laboratories and the Bonneville Power Administration. LBL had the most Non-Federal Work For Others (WFO) funding among the ER multiprogram laboratories in FY 1991. This work was performed for the Electric Power Research Institute and several other non-federal organizations.

Personnel

Total personnel declined by 15% from FY 1981 to FY 1991. All of the personnel loss occurred from FY 1981 to FY 1987.

Construction

Program construction funding in FY 1985-87 was primarily for the Surface Science/Catalysis and Advanced Materials Laboratories. The funding increases from FY 1988 to FY 1991 were primarily for the Advanced Light Source. As a percentage of operating funding, LBL's construction funding from FY 1985 to FY 1991 was the highest among the multiprogram laboratories.

Since FY 1984, multiprogram general purpose facility (MGPF) funding has primarily been used for utility systems rehabilitation and slope and seismic stabilization/rehabilitation.

In real terms, LBL's general plant projects (GPP) funding declined by 10% from FY 1981 to FY 1991. The ratio of GPP to operating funding averaged less than 1.5%.

Eighty-two percent of LBL space was constructed before the end of the 1960s, when the major growth on the site occurred.

Equipment

ER provides most of the program equipment funding, primarily from the High Energy and Nuclear Physics programs and Basic Energy Sciences. FY 1987, FY 1989, and FY 1991 increases are due to these sponsors.

Although, general purpose equipment (GPE) funding for LBL has increased since 1986, it has remained consistently below 1% of operating funding (averaging 0.7% since FY 1981) resulting in a backlog of needs to update general use scientific and maintenance equipment.

FY 1991 Statistics

TOTAL FUNDING	\$257.7M
STAFF (FTEs)	2503
DOE Operating Funding	\$163.9M
WFO Operating Funding	\$31.0M
Construction Funding	\$38M
Capital Equipment Funding	\$23.7M
Site Size (acres)	130
Building Space	1.3M sq. ft.

Oak Ridge National Laboratory

Oak Ridge, Tennessee

Cognizant Secretarial Officer

Director of Energy Research

Responsible Operations Office

Oak Ridge

Operating Contractor

Martin Marietta Energy Systems, Inc.

Major Facilities

Eleven designated user facilities, including the Holifield Heavy Ion Research Facility. The major planned facility is the Advanced Neutron Source (ANS).

* All data through FY 1991 are actuals. All funding projections represent ORNL (not DOE) views.

Missions

- conduct applied R&D in energy technologies (fission, magnetic fusion, renewables and fossil), conservation, health and environmental protection, and waste management
- perform basic research in the physical, chemical, materials, computational, biomedical, earth, and environmental sciences
- design, build and operate unique user facilities for university, industrial, and national laboratory researchers
- offer learning R&D experiences and establish educational partnerships for students from preschool level through postdoctorates
- transfer science and technology to U.S. industries and universities
- carry out the above missions in compliance with all applicable ES&H regulations.

Funding

Operating funding has increased 3.7% per year since FY 1981. In real terms FY 1991 operating funding is equal to FY 1981 funding. Projected increases in capital funding are primarily related to the ANS and a waste handling plant.

The funding increase in FY 1985 is mainly due to a Department of Defense (DOD) Data Systems R&D project that was transferred in FY 1986 to other components of ORNL's operating contractor.

Programs

Energy Research (ER) accounted for 42% of ORNL's operating funds from DOE sources in FY 1991, compared to 51% in FY 1985. Magnetic Fusion, Basic Energy Sciences (BES), and Biological and Environmental research are the major elements of this funding. ER funding at ORNL has declined since

FY 1987, with the largest decrease (47%) occurring in Magnetic Fusion. Substantial future growth in ER funding is projected, primarily as a result of establishing the ANS.

In FY 1986, BES became the largest single ORNL program. It accounted for 19% of FY 1991 operating funds. Much of this funding is used to operate user facilities.

Conservation and Renewable Energy (CE) funding grew by 48% from FY 1985-91. ORNL has the largest CE funding among the multiprogram laboratories.

Nuclear Energy (NE) funding from FY 1985 to FY 1991 was constant, resulting in a slip-page of NE from ORNL's second largest DOE funding source to its fourth largest. The decline in Defense Programs (DP) funding at ORNL is largely associated with the transfer of defense waste programs to Environmental Restoration/Waste Management (EM).

Personnel

The total FY 1991 personnel level was 4861, down 3% from FY 1981. Direct personnel declined by 84 during the period, while indirects declined by 78.

Construction

Increases in program construction in FY 1981-82 were due to fusion experiments. Major construction projects since FY 1984 included the High Temperature Materials Lab, funded primarily by the CE program.

No major research facilities have been constructed at ORNL since FY 1986.

The increase in program construction funding and decrease in MGPF funding in FY 1991 is primarily due to shifting a major environmental compliance project from the MGPF program to EM.

Increases in general plant projects (GPP) funding since FY 1984 helped to address the serious backlog, although GPP decreased in FY 1991 to its FY 1984 level. GPP funding was 1.3% of operating funding in FY 1991.

Over 80% of ORNL's building space is over 28 years old, the largest portion of any multiprogram laboratory. About 10% of ORNL's building space was added in the past 8 years.

Equipment

Program funding for equipment was constant in FY 1991, and is well below historical averages.

General purpose equipment (GPE) funding grew from \$3 million in FY 1981 to \$4.8 million in FY 1986, but decreased every year until FY 1991. GPE in FY 1991 was approximately equal to its FY 1981 level, and represented only 0.7% of operating funds.

FY 1991 Statistics

TOTAL FUNDING	\$543M
STAFF (FTEs)	4472
DOE Operating Funding	\$385.6M
WFO Operating Funding	\$100.0M
Construction Funding	\$37.0M
Capital Equipment Funding	\$20.4M
Site Size (acres)	29,266
Building Space	2.8M sq. ft.

Pacific Northwest Laboratory

Richland, Washington

Cognizant Secretarial Officer

Director of Energy Research

Responsible Operations Office

Richland, Washington

Operating Contractor

Battelle Memorial Institute

Major Facilities

One designated user facility—the Hanford Environmental Research Park. The major planned facility (under construction) is the Environmental and Molecular Sciences Laboratory (EMSL).

Missions

- scientific research and rapid development and deployment of technology to meet national needs, with a focus on resolving environmental issues
- conduct fundamental research in molecular science, subsurface contaminant transport, global environmental processes and the life sciences
- conduct applied R&D to characterize and remediate hazardous wastes at Hanford and other DOE sites, develop new energy sources (including energy-efficient methods) and modernize the federal infrastructure
- develop and operate scientific user facilities
- contribute to enhancement of mathematics, science and engineering education
- transfer technology to users in the public and private sectors
- ensure ongoing compliance with environmental, health, and safety requirements and achieve continuous improvement in attaining high standards of excellence in these areas.

Funding

The 135% growth in operating funding from FY 1981 to FY 1991 represents a real annual growth rate of 4.8% per year. Various types of environmental and waste management research, New Production Reactor (NPR) and Department of Defense (DOD) activities account for most of the increase. PNL capital funding is the lowest of all the laboratories, although growth occurred in FY 1991 and is projected to continue until FY 1996 in association with the EMSL.

Programs

The doubling in Biological and Environmental Research funding since 1985 is mainly attributable to growth in global environmental change research. DOD funding more than

Funding *

* All data through FY 1991 are actuals. All funding projections represent PNL (not DOE) views.

Programs

Major Programs

Assistant Secretaries

FY 1991 Operating Funding Sources

DC=Work for other DOE contractors

quadrupled from FY 1985 to FY 1991, while Nuclear Regulatory Commission (NRC) funding declined by 42%. PNL's role in the development of the NPR is focused on the development of a new tritium target and light water reactor technology.

Due to the shift of environmental restoration and waste management R&D activities from other DOE programs, the Office of Environmental Restoration and Waste Management (EM) is currently the largest sponsor of work at PNL. Office of Energy Research (ER) funding at PNL grew by 143% from FY 1985 to FY 1991.

Personnel

Personnel grew by 69% from FY 1981 to FY 1991, although a 10% reduction occurred in FY 1982. The ratio of direct to indirect personnel shifted in FY 1986 and FY 1988 primarily as a result of accounting changes.

FY 1991 Statistics

TOTAL FUNDING \$380.1M
STAFF (FTEs) 3541

DOE Operating Funding \$259.3M
WFO Operating Funding \$88.0M
Construction Funding \$15.4M
Capital Equipment Funding \$17.4M

Site Size (acres) 640
Building Space 0.9M sq. ft.

Construction

Construction design funds for the EMSL were provided in FY 1991, the first DOE program funds provided for a new facility at PNL since 1971. Funds provided in FY 1982 were used for improving existing buildings.

Multiprogram general purpose facility (MGPF) funding after FY 1979 was provided directly to the Richland Operations Office for infrastructure projects at Hanford. Some of these projects indirectly benefited PNL. MGPF funds provided in FY 1989 and 1990 directly supported a PNL building utilities upgrade.

From FY 1981 to FY 1990, funding for general plant projects (GPP) was less than 1% of operating funds. The substantial increase in FY 1991 was mainly due to the provision of additional GPP funds by EM.

PNL facilities are roughly half DOE-owned and half leased from Battelle and other parties. Forty percent of the DOE space was constructed in the 1950s and before. The rest of the lab space was built in the 1960s and 1970s by DOE and Battelle.

Equipment

The FY 1991 increase was mainly due to an increase in ER and EM in program equipment funding. PNL has historically had the lowest ratio of equipment to operating funding of all multiprogram labs.

The average general purpose equipment (GPE) funding for the FY 1981 to FY 1991 period was \$1.3 million. A change in laboratory "landlord" from NE to ER was effected at the end of FY 1984, and GPE funding has increased since FY 1985.

Idaho National Engineering Laboratory

Idaho Falls, Idaho

Cognizant Secretarial Officer

Assist. Secretary for Nuclear Energy

Responsible Operations Office

Idaho Falls, Idaho

Operating Contractor

EG&G Idaho, Inc.; Westinghouse Idaho Nuclear Co., Inc.; Babcock & Wilcox Idaho, Inc.

Major Facilities

One designated user facility—the INEL Environmental Research Park. The major planned facility is the Modular High Temperature Gas Reactor (MHTGR).

MISSIONS

- apply engineering and scientific capabilities to the operation of key defense production and materials testing facilities and in supporting national security through arms control and intelligence technologies
- develop engineering information and approaches relevant to nuclear reactor safety and advance systems
- develop, transfer, and deploy technologies to avoid and/or dispose of hazardous and radioactive waste and for remediation/restoration of previous disposal sites
- engineer and develop advanced energy production and utilization technologies
- conduct activities in a manner consistent with the letter and spirit of applicable DOE environmental, safety and health policies and regulations
- transfer technology through interactions with private industry and encourage improved science education.

FUNDING

Operating funds have grown 10% per year since FY 1981. This represents a 5.9% real annual growth and is due largely to increases in defense waste and Department of Defense (DOD) program activities. The decline in total operating funds in FY 1991 was caused by a \$99 million decrease in DOD funding from FY 1990 to FY 1991.

Capital funding increased substantially in FY 1991 primarily due to the construction of new waste management and fuel processing facilities. Construction is expected (by INEL) to remain at relatively high levels, primarily associated with environmental restoration and waste management projects.

PROGRAMS

Environmental Restoration and Waste Management (EM) became the largest INEL funding source since FY 1990 with the transfer of DP defense waste activities to EM. INEL has the highest percentage of total

operating funds provided by EM of all the multiprogram laboratories. EM and Materials Production activities are projected (by INEL) to increase substantially over the planning period. INEL's Materials Production work is primarily processing fuel for the Navy.

Nuclear Regulatory Commission (NRC) funding, INEL's largest program in FY 1982, dropped by over 70% by FY 1991.

Funding for the naval reactors program grew by 68% from FY 1985 to FY 1991. Over 75% of INEL's work for the Office of Nuclear Energy (NE) is naval reactors program work.

DOD funding rose by \$65 million from FY 1985 to FY 1991, a nearly 10-fold increase.

PERSONNEL

Employment rose 47% from FY 1981 to FY 1991 in association with an 80% increase in real operating funds over this same period. Subcontracting was less important in INEL's funding allocations over the period than at the defense laboratories.

The large change in indirect personnel versus direct personnel in FY 1991 was mainly due to an accounting change.

CONSTRUCTION

DP Materials Production accounts for the majority of program construction from FY 1980 to FY 1990. However, in FY 1991, EM provided the most construction funds.

INEL received nearly \$35 million in multi-program general purpose facility (MGPF) funds for projects initiated in FY 1981 to FY 1984. No new projects have been started since FY 1984. Funding continued until FY 1991 for ongoing projects.

General plant projects (GPP) funding more than doubled between FY 1981 and FY 1991. In FY 1991, GPP funds represented 2.7% of operating funds, and were mainly provided by EM.

Over 35% of INEL's building space has been added in the past 10 years. Less than 45% of INEL's building space is over 30 years old.

EQUIPMENT

NE and DP provided most of the equipment funding for INEL prior to FY 1986.

Reductions in equipment funding in FY 1986 through FY 1988 are due to declines in NE support. Increases in FY 1989 and FY 1990 are associated with increased funding from the Materials Production program. The FY 1991 increase was due to NE and EM increases.

General purpose equipment (GPE) funds grew substantially in FY 1985 and FY 1986, but were relatively constant until FY 1991. EM now has responsibility for INEL's GPE needs, and GPE increased substantially in FY 1991. In FY 1991, GPE was equal to 1.4% of operating funds.

PERSONNEL *

* All data through FY 1991 are actuals. All personnel projections represent INEL (not DOE) views.

FY 1991 STATISTICS

TOTAL FUNDING \$882.8M
STAFF (FTEs) 7390

DOE Operating Funding \$493.1M
WFO Operating Funding \$120.3M
Construction Funding \$236.7M
Capital Equipment Funding \$32.4M

Site Size (acres) 569,821
Building Space 3.1M sq. ft.

CONSTRUCTION

Major Construction

General Plant Projects

Construction by Decade

EQUIPMENT

Program Equipment Funding

General Purpose Equipment

Lawrence Livermore National Laboratory

Livermore, California

Cognizant Secretarial Officer

Assist. Secretary for Defense Programs

Responsible Operations Office

San Francisco, California

Operating Contractor

University of California

Major Facilities

Two designated user facilities, including the Magnetic Fusion Energy Computer Center. The major planned facility is a Contained Firing Facility.

MISSIONS

- provide research, development, test activities, and related tasks associated with all phases of the nuclear weapons life cycle
- conduct strategic defense research emphasizing kinetic- and directed-energy weapons
- conduct research and development on magnetic fusion and inertial confinement fusion, emphasizing lasers as the drivers
- perform other energy research in basic energy sciences, atmospheric sciences, fossil energy, and commercial nuclear waste
- conduct research in the biological, geophysical, ecological, and atmospheric sciences relevant to weapons, energy, health and environmental issues
- facilitate technology transfer and encourage science education through a variety of means
- conduct work with a commitment to preserving the environment, ensuring the health and safety of laboratory staff and the community, and complying with applicable ES&H regulations.

FUNDING

LLNL operating funding increased 150% between FY 1981 and FY 1991. In real terms, the increase is 72%. About 38% of the increase is from Department of Defense (DOD) work, 16% is from DOE weapons activities, and 16% is from the DOE Isotopes Separations program.

PROGRAMS

DOE weapons activities programs are projected by LLNL to increase by \$203 million from FY 1991 to FY 1997, compared to the \$11 million decrease that occurred from FY 1985 to FY 1991.

The tripling in work for the DOD from FY 1985 to FY 1991 made it the second largest area of laboratory activity. Research and development on conventional explosives,

* All data through FY 1991 are actuals. All funding projections represent LLNL (not DOE) views.

FY 1991 Operating Funding Sources

armor, computer database networks, computer gaming, and directed energy systems composes much of the DOD effort.

Work in support of the Isotopes Separations program grew by 65% from FY 1985 to FY 1991. Now the third largest program at LLNL, it is in the pilot plant stage.

Work in support of weapons materials production is projected to phase out over the planning period as the Special Isotope Separation program is completed.

Magnetic Fusion is the largest nondefense-related program in the laboratory. Tokamak experiments are major components of this program. Magnetic Fusion and other Energy Research funding is projected (by LLNL) to double from FY 1991 to FY 1997.

FY 1991 STATISTICS

TOTAL FUNDING	\$1170.0M
STAFF (FTEs)	7897
DOE Operating Funding	\$790.5M
WFO Operating Funding	\$273M
Construction Funding	\$49.5M
Capital Equipment Funding	\$49.7M
Site Size (acres)	813
Building Space	4.4M sq. ft.

PERSONNEL

LLNL's 9.4% growth in personnel between FY 1981 and FY 1991 did not nearly keep pace with real operating funding increases, which indicates substantial increases in subcontracting. LLNL projects little personnel growth in the future. Total personnel declined by 231 from FY 1990 to FY 1991. Indirect personnel comprised 50% of total personnel in FY 1991.

CONSTRUCTION

A large part of the construction funding in FY 1982 and FY 1983 was for the Nova Laser experiment in inertial confinement fusion.

Almost 75% of the program construction funding for FY 1988 and FY 1990 was provided by the weapons programs. All program construction in FY 1991 was supported by the weapons program.

Since FY 1981, general plant projects (GPP) funding has remained close to 1% of operating funding. However, in FY 1991, it was less than 0.7%, the lowest percentage among the multiprogram laboratories. LLNL projects a continuing increase in the backlog of projects at this level of GPP funding.

The space constructed in the 1940s was originally part of a naval air station.

Construction in the last two decades has provided about 43% of the laboratory space. LLNL added more new space in the 1980s than any other laboratory.

EQUIPMENT

The ratio of equipment to operating funds has traditionally been larger than for other defense laboratories. Fusion, isotope separation, and weapons activities are the major users of equipment. Equipment funding in FY 1991 represented a 23% decline from its FY 1988 peak.

Los Alamos National Laboratory

Los Alamos, New Mexico

Cognizant Secretarial Officer

Assist. Secretary for Defense Programs

Responsible Operations Office

Albuquerque, New Mexico

Operating Contractor

University of California

Major Facilities

Six designated user facilities, including the Los Alamos Meson Physics Facility. The major planned facility is the Special Nuclear Materials R&D Laboratory.

MISSIONS

- apply scientific and engineering capabilities to ensure the nation's nuclear weapons deterrent
- conduct applied programs in support of defense missions, including development of nuclear warheads, new concepts for defending against nuclear attack, conventional weapons technology, and arms control technology
- support basic research in selected disciplines to help maintain an outstanding science and technology base
- conduct other applied programs, primarily in defense and energy, that complement the primary mission
- maintain a safe and healthy workplace and protect the environment
- transfer LANL's science and technology base to private companies and support education at all levels.

FUNDING

Operating funds have grown 102% from FY 1981 to FY 1991 due largely to expansion of the Department of Defense (DOD) and Weapons Activities programs. This translates to 7.3% annual growth and 3.3% real annual growth. Operating funds declined in FY 1991 for the first time in over 12 years.

PROGRAMS

Defense Programs (DP) provided over half of LANL's annual operating funds every year from FY 1981 to FY 1989. The proportion fell below 50% (to 47%) in FY 1990 and FY 1991, primarily due to the transfer of defense waste activities to the Office of Environmental Restoration and Waste Management (EM).

FUNDING *

* All data through FY 1991 are actuals. All funding projections represent LANL (not DOE) views.

PROGRAMS

FY 1991 Operating Funding Sources

DOD funding increases have caused Work For Others (WFO) to climb from 21% of operating funds in FY 1985 to 23% in FY 1991. DOD funding in FY 1991 is 46% higher than in FY 1985, but has declined by \$78.6 million (32%) since its peak in FY 1988. DOD was the only major program at LANL to grow by more than \$5 million from FY 1985 to FY 1991, with all other major programs showing little change or declining.

EM funding (\$65 million in FY 1991) represented the third largest source of DOE funds. By FY 1997, LANL projects EM will pass ER to become the second largest DOE funding source.

PERSONNEL

The 5% increase in staff at LANL did not keep pace with the 38% real funding increase from FY 1981 to FY 1991, indicating that increased subcontracting and outside purchases occurred.

Personnel levels peaked in FY 1986. They are forecast to continue to decline through FY 1993.

CONSTRUCTION

Program construction nearly doubled in FY 1982 because of several Weapons Activities construction projects. Most of the programmatic construction at LANL has been funded by DP Weapons Activities, although ER funded over \$16 million in program construction at LANL in FY 1987 and FY 1988.

LANL received no multiprogram general purpose facility (MGPF) funds from FY 1981 to FY 1985. MGPF funds were discontinued again in FY 1988.

General plant projects (GPP) varied considerably from FY 1981 to FY 1991.

In FY 1991, GPP funding was 1.2% of operating funds.

About 60% of LANL's building space was built before 1970. However, about 20% of LANL's building space has been added in the past 10 years.

EQUIPMENT

Equipment funding increases at LANL have not kept pace with operating funding increases. Funding reductions in FY 1987 and FY 1988 primarily occurred in the Weapons Activities program. FY 1991 equipment funding was 5.9% of operating funding.

FY 1991 STATISTICS

TOTAL FUNDING	\$1036.3M
STAFF (FTEs)	7566
DOE Operating Funding	\$751.6M
WFO Operating Funding	\$212.7M
Construction Funding	\$38.0M
Capital Equipment Funding	\$42.9M
Site Size (acres)	27,820
Building Space	6.7M sq. ft.

Sandia National Laboratories

Albuquerque, New Mexico

Livermore, California

Cognizant Secretarial Officer

Asst. Secretary for Defense Programs

Responsible Operations Office

Albuquerque, New Mexico

Operating Contractor

AT&T Technologies, Inc.

Major Facilities

Two designated user facilities, including the Combustion Research Facility. The major planned facility is the Micro Technologies Laboratory.

MISSIONS

- provide research, development, and engineering associated with advancing nuclear explosives to integrated functional weapons for the Department of Defense (DOD) delivery system
- support other DOE-defense-related programs, including development of verification and control technologies for arms reduction agreements/foreign intelligence concepts/systems for the safeguarding and security of nuclear materials
- conduct research, development, and engineering of technologies for the safe storage, processing, transport, and disposal of hazardous wastes
- support implementation of the National Energy Strategy through research and development of concepts for increasing energy efficiency, securing future energy supplies, and fortifying our foundations through scientific research, and encouraging mathematics and science education
- transfer federally owned and originated technologies to private industry and other external organizations
- protect the environment, safety, and health of all Sandians and the community.

FUNDING

SNL's operating funding has historically been the largest of the DOE laboratories. It exceeded \$1.1 billion in FY 1991. The laboratory's operating funding growth rate since FY 1981 has averaged about 6.4% annually. Real annual growth is about 2.5%. Operating funding was relatively flat from FY 1988 to FY 1991, and declined in real terms.

FUNDING *

All data through FY 1991 are actuals. All funding projections represent SNL (not DOE) views.

PROGRAMS

Major Programs

Assistant Secretaries

FY 1991 Operating Funding Sources

PROGRAMS

DOE weapons activities provided an average of 53% of SNL's operating funding from FY 1981 to FY 1991.

Since 1985, work for the DOD has nearly doubled, representing 22% of laboratory effort in FY 1991 and becoming the second largest source of program funding. Projects are conducted for the service branches of DOD and DARPA. SNL projects increases in both weapons activities and DOD work over the planning period.

The portion of funding from all DOE sources other than Defense Programs (DP), was relatively constant from FY 1985 to FY 1991.

In FY 1991 SNL did more Work for Others (WFO) than any other DOE multiprogram laboratory, accomplishing 25% of the total WFO work placed in the laboratories.

PERSONNEL

In contrast with the 2.5% annual growth in real operating funding, personnel growth has averaged less than 1% annually from FY 1981 to FY 1991, implying increased sub-contracting. The radical change in the ratio of indirect staff to total staff in FY 1982 reflects changes made to the SNL accounting system.

CONSTRUCTION

The bulk of the multiprogram general purpose facility (MGPF) funding shown from FY 1984-87 is for the equipment and facilities restoration program.

Program construction funding is almost entirely from DP in the period shown. Almost all DP construction is for weapons-related facilities.

SNL traditionally has had less general plant projects (GPP) funding as a percent of its operating funding than any other multiprogram laboratory. In FY 1991, it was 0.9%.

Almost 50% of SNL's facilities were constructed before 1960. However, almost 30% of SNL's space was added in the last 10 years.

EQUIPMENT

In absolute terms, SNL's \$59 million in equipment funding in FY 1991 was the highest among the multiprogram laboratories. Seventy-eight percent of SNL equipment funding was provided by Weapons Activities funding in FY 1991.

PERSONNEL *

* All data through FY 1991 are actuals. All personnel projections represent SNL (not DOE) views.

FY 1991 STATISTICS

TOTAL FUNDING	\$1253.4M
STAFF (FTEs)	8600
DOE Operating Funding	\$839.1M
WFO Operating Funding	\$308.8M
Construction Funding	\$46.2M
Capital Equipment Funding	\$59.3M
Site Size (acres)	3066
Building Space	3.8M sq. ft.

CONSTRUCTION

Major Construction

General Plant Projects

Construction by Decade

EQUIPMENT

Program Equipment Funding

General Purpose Equipment

* SNL stopped differentiating between program and general purpose equipment in 1993. Thus, the program equipment funding chart for FY 1983 to FY 1991 represents total equipment funding for the laboratory. This funding increased modestly in current dollars and declined in real terms since FY 1985.

MULTIPROGRAM LABORATORY ORGANIZATION AND OVERSIGHT

The DOE multiprogram laboratories operate within a unique organization and oversight structure that facilitates continuing excellence of performance within their mission areas.

ORGANIZATION AND MANAGEMENT

The multiprogram laboratory system's management structure involves DOE Headquarters, DOE Operations Offices and the contractors operating the laboratories and implementing R&D programs for the Department. This unique "Government-Owned, Contractor-Operated" (GOCO) structure is designed to balance a requirement for government oversight with a need for flexibility in the conduct of laboratory activities. DOE is incorporating a set of common provisions into new contracts to ensure that the laboratories are on an equal footing to support the DOE mission.

The GOCO Structure

Under the GOCO structure, a laboratory's staff work in buildings and use equipment owned by the government, but are employees of a contractor. DOE maintains responsibility for overall program guidance and technical direction. DOE also assumes most of the financial risk for laboratory activities and is ultimately responsible for security, health and safety. The laboratories carry out activities in all of the major program areas of DOE, and work for other federal agencies and the private sector in appropriate areas. They also advise DOE in program planning and on national security policies. Most of the management and operating (M&O) contracts under which the laboratories operate are cost-reimbursement contracts which are normally extended in 5-year increments.

Advantages of the GOCO arrangement include:

- flexibility in contracting
- flexibility in the hiring and firing of personnel
- ability to pay competitive wages for scientific/technical personnel
- reduced administrative requirements
- development of a long-term partnership in managing R&D.

By using the skills of the private sector to meet the mission needs of the Department, the GOCO concept has allowed for the recruitment of scientific personnel and the performance of "cutting edge" research that have served the nation well.

The DOE Headquarters Role

Headquarters' management of multiprogram laboratory activities is promulgated through two primary mechanisms:

- management of the specific programs conducted at the laboratories
- oversight responsibilities of the new Office of Laboratory Management.

Program managers at Headquarters provide financial and technical direction for work conducted at the laboratories in their programmatic areas. They conduct various types of programmatic reviews, and in many cases, solicit input on laboratory programs within their area of responsibility from external advisory committees. They also provide reviews of work conducted in their areas for use in laboratory appraisals and institutional plans.

The cognizant Secretarial officer for each laboratory is responsible for a number of cross-cutting management activities including:

- participating in the laboratory appraisal process, including providing input on laboratory management performance
- managing institutional planning and approving institutional plans
- reviewing non-DOE laboratory work (Work for Others) and approving a level for such work
- reviewing and approving a level for laboratory exploratory R&D programs
- participating in decisions regarding extending/competing of M&O contracts
- providing management and funding support for general infrastructure needs at the laboratories.

The Director of Energy Research performs these functions for five multiprogram laboratories (ANL, BNL, LBL, ORNL and

PNL), while the Assistant Secretary for Defense Programs is responsible for these functions in the three other laboratories (LANL, LLNL and SNL) while the Assistant Secretary for Nuclear Energy has this responsibility for INEL.

The Office of Laboratory Management coordinates institutional planning for DOE and develops annual policy guidance for the laboratories. The senior management of DOE reviews this guidance, addresses major cross-cutting and financial issues affecting the laboratories, and participates in decisions about whether to extend or compete the laboratory M&O contracts.

The DOE Operations Office Role

The Operations Offices have the major responsibility for day-to-day government oversight of laboratory activities. Their responsibilities include:

- performing contract management, administrative, and oversight functions
- reviewing and approving program financial plans for all work conducted under the M&O contract
- conducting laboratory appraisals and reporting on laboratory performance
- overseeing and approving non-DOE work at the laboratories and reporting results to the cognizant Secretarial officer
- recommending approval or modification of the institutional plans and Laboratory-Directed R&D levels
- independently reviewing laboratory issues and initiatives
- providing initial recommendations on extending/competing of M&O contracts.

As of FY 1988, the Offices were assigned responsibility for the multiprogram laboratories as follows:

The institutional planning, appraisal and work authorization processes are key elements in DOE's oversight of the laboratories.

Operations Office	Laboratory
Albuquerque, NM	LANL, SNL
Chicago, IL	ANL, BNL
Idaho Falls, ID	INEL
Oak Ridge, TN	ORNL
Richland, WA	PNL
San Francisco, CA	LBL, LLNL

The Laboratory/Contractor Role

The laboratories and their operating contractors are granted substantial flexibility in their operational decisions, subject to oversight from DOE. Their major responsibilities include:

- to manage and perform, in an environmentally and healthy, safe and responsible manner, multidisciplinary research and development and other contracted activities that are consistent with their missions
- to plan for the laboratory's future using the institutional planning process
- to be responsive to DOE's direction provided through input from program managers, laboratory appraisals, and DOE management orders and directives.

The Laboratory Institutional Planning Process

The institutional planning process is an important tool used by DOE and the laboratories in managing laboratory activities. It defines, in broad terms, the current and future direction, missions and programmatic areas of each laboratory. The institutional planning process involves several steps that facilitate strategic thinking and two-way communication on the part of DOE and the laboratories. These steps typically include those shown in the diagram above.

The information communicated in the process includes the following:

- The Secretary's planning guidance outlines departmental policy.
- The draft plan presents laboratory issues, proposed initiatives and programs for DOE review.
- The onsite reviews provide face-to-face communications among Headquarters, Operations Offices and laboratory management on issues, initiatives and programs.

- Program and Operations Office comments on draft plans provide guidance to the laboratories.
- Institutional plans publicly communicate approved laboratory missions, 20 year strategic plan proposed initiatives, long-range plans, and current activities in support of science, education, and technology transfer.

The Laboratory Appraisal Process

The annual laboratory performance appraisal is another management tool used by DOE. The appraisals measure laboratory performance in a number of different areas (see Performance Factors in Multiprogram Laboratory Appraisals). Information developed in the appraisals provides:

- an information source on which to base decisions on extending or competing M&O contracts
- a means of attaining laboratory management accountability
- a means of ensuring that areas of needed improvement are identified and a review of steps taken to correct previously identified deficiencies is obtained.

Performance Factors in Multiprogram Laboratory Appraisals*

I. Institutional

- Planning
- Staffing
- Cooperation

II. Programmatic

- Quality of Work
- Timeliness/Costs
- R&D Achievements

III. Operations

- Facilities Management
- Quality Assurance
- Safeguards & Security
- Environment, Safety & Health

IV. Administrative

- Resource Management
- Auditing
- Procurement

* Per DOE Order 5000-2A

Five levels of uniform descriptors, ranging from outstanding to unsatisfactory, are generally used to measure laboratory performance in laboratory appraisals.

The Work Authorization Process

The work authorization process is a third management tool used by DOE for assigning and controlling work performed by M&O contractors.

In brief, it requires that:

- work assignments be aggregated at the cost and obligations level
- the program and Operations Office be assigned specific tasks for determining appropriate work assignments and monitoring performance

- work assignments are consistent with the program mix approved in the institutional plan
- contractor performance is monitored in terms of work accomplishment.

Major responsibilities assigned by the authorization process are illustrated below.

U.S. Department of Energy Work Authorization Process Responsibilities

Cognizant Secretarial Officers:

- Provide guidelines for approval of new work at the laboratories.
- Recommend changes in work authorization policies.
- Inform DOE elements concerning laboratory facility constraints.

Program Offices:

- Provide general approval of work to be conducted by the laboratories.
- Prepare work authorizations and aggregate work assignments
- Ensure that work is appropriate, consistent with mission and non-duplicative.
- Ensure that agreement is reached with the Operations Office for any areas of delegated responsibility.
- Monitor work and costs for conformance with work authorization.

Operations Offices:

- Ensure that work does not violate facility constraints and limitations.
- Ensure that laboratories can meet work authorization requirements.
- Review work authorizations to ensure they are appropriate, within the laboratory's mission, and consistent with the institutional plan.
- Authorize work in accordance with approved funding program guidance and fund controls procedures.
- Review Field Work Proposals.
- Monitor work and costs for conformance with work authorization.

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