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Report to the Secretary of Energy

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DEPARTMENT OF ENERGY

National Laboratories Need Clearer Missions and Better Management

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GAO

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Resources, Community, and
Economic Development Division

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January 27, 1995

The Honorable Hazel R. O'Leary
The Secretary of Energy

Dear Madam Secretary:

This review of the national laboratories is part of our general management review of the Department of Energy. The purpose of this review is to assess the Department's management, analyze problems and determine their underlying causes, and identify ways of improving departmental management processes and structures.

This report contains recommendations to you for improving the effectiveness of the Department's multiprogram national laboratories. As you know, 31 U.S.C. 720 requires the head of a federal agency to submit a written statement of the actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Reform and Oversight not later than 60 days after the date of this letter and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of this letter.

We are sending copies of this report to interested congressional committees and subcommittees; individual Members of Congress; and other interested parties. We will also make copies available to others upon request.

Please contact me on (202) 512-3841 if you have any questions. Major contributors to this report are listed in appendix IV.

Sincerely yours,

Victor S. Rezendes
Director, Energy and
Science Issues

Executive Summary

Purpose

The Department of Energy's (DOE) multiprogram national laboratories have made vital contributions to the nation's defense and civilian science and technology efforts. Now, these laboratories face many changes as the nation redefines its defense requirements at the end of the Cold War and encounters increasing global competition in technology. These changes have raised questions about whether the laboratories are focusing their resources on the most important national priorities and are managed as effectively as possible.

As part of a general management review of DOE, GAO, with assistance from a panel of experts, assessed the laboratories' current and future missions and DOE's management of the laboratories.

Background

DOE's laboratories have combined annual budgets of about $6 billion and over 50,000 employees. DOE estimates that it has invested over $100 billion in the laboratories over the past 20 years. Most of the laboratories were established during or just after World War II as part of the Manhattan Project, which developed the world's first atomic bombs. The laboratories have since expanded their missions to encompass civilian research and development in many disciplines—from high-energy physics to advanced computing—at facilities located throughout the nation. The laboratories support DOE programs and address national needs in science and technology. DOE owns the laboratories but contracts with universities and private-sector organizations for their management and operation.

Results in Brief

DOE's laboratories do not have clearly defined missions that focus their considerable resources on accomplishing the Department's changing objectives and national priorities. As the manager of this important research and technology network, DOE has not coordinated these laboratories' efforts to solve national problems but has managed each laboratory on a program-by-program basis. As a result, DOE has underutilized the laboratories' special talents to tackle complex, cross-cutting issues, and the laboratories may not be prepared to meet future expectations. Although government advisory groups have recommended in the past that DOE redefine the laboratories' missions to meet changes in conditions and national priorities, DOE has not acted on these recommendations. DOE recently developed a Strategic Plan intended to integrate its missions and programs in five major areas, but questions remain about the Department's ability to lead the laboratories into the future.

DOE's day-to-day management of the laboratories—perceived as costly and inefficient by laboratory managers—inhibits the achievement of a productive working relationship between the laboratories and DOE that is necessary if the laboratories are to move successfully into new mission areas. Both laboratory and DOE managers believe that more realistic and consistent priorities are needed to accomplish the growing oversight and administrative requirements placed on the laboratories in recent years.

Principal Findings

Laboratories Need Clear and Coordinated Missions

Over the past decade, several government advisory groups have emphasized the need for DOE to clarify the laboratories' missions. Recent events—including dramatic changes in the nuclear arms race, the demand for technology to solve massive environmental problems, and the growing international competition facing U.S. industry—have brought this need into even sharper focus. Taxpayers have invested heavily in the laboratories, and DOE is responsible for ensuring that this investment is properly focused on national priorities.

The laboratories' missions are set forth as broad goals and activity statements rather than as a coordinated set of objectives with specific implementation strategies for bringing together the individual and collective strengths of the laboratories to meet departmental and national priorities. Faced with a "loss of coherence and focus" at the laboratories, as a 1992 energy advisory group reported, DOE has failed to develop a coordinated and shared "vision" for them. Laboratory managers fear that the lack of proper departmental direction is compromising both their effectiveness in meeting traditional missions and their ability to achieve new national priorities.

Part of the problem is that while DOE manages the laboratories program by program, it does not also manage them as a diversified research system. This approach prevents the laboratories from fully capitalizing on one of their great strengths—combining multidisciplinary talents to solve complex, cross-cutting issues. For example, research on preventing weapons proliferation requires combining expertise in nonproliferation and weapons design—activities that are carried out by different laboratories and managed by different assistant secretaries. The

laboratories believe that better linkages are also needed among the energy conservation, fossil fuel, and nuclear energy research areas.

The need for a mechanism to facilitate cross-program coordination has been cited by past advisory groups and by GAO. DOE did create the Office of Laboratory Management to coordinate the interests of the various program offices that interact with the laboratories. However, the change was not implemented, and the existing office lacks the authority to resolve disputes among program offices and reports through two chains of command below the Secretary—an arrangement that does not promote effective interaction between DOE and the laboratories.

DOE created an Advisory Board Task Force on Alternative Futures for the National Laboratories, giving the Secretary another opportunity to chart a course for the future of the laboratories. The task force, whose report is due in February 1995, could set the foundation for developing clear and coordinated missions for the laboratory network. The success of the task force's efforts will depend, in large measure, on the extent to which DOE's leaders are now able—as they have been unable in the past—to achieve consensus among the laboratories, DOE, and the Congress on future missions for the national laboratories.

DOE's Management Inhibits Accomplishment of the Laboratories' Missions

Laboratory managers view DOE's day-to-day management as costly and unproductive in meeting the laboratories' missions. Tensions between laboratory and DOE executives may also be impeding progress toward reaching a shared vision of the laboratories' future. Laboratory managers have characterized DOE as a micromanager in many areas, especially in overseeing the laboratories' compliance with expanding administrative requirements.

Coping with the new requirements that have accompanied DOE's growing oversight responsibilities is, according to many of the laboratory managers we contacted, a major burden that not only increases the costs of research but also diverts attention from it. Although laboratory managers recognize the importance of meeting environmental, safety, and health goals, they expect DOE to set priorities for their administrative activities and to help them "balance" their responsibilities in the areas of research and administration.

DOE and other agencies conduct as many as 400 reviews annually at some laboratories, according to laboratory sources. One laboratory manager

calculated that there was more than one oversight review a day in his program. Laboratory managers are concerned about the time required to prepare for oversight reviews and the loss of the best researchers' time during reviews. Another manager told GAO that he spends as much as 40 percent of his working time on oversight matters. Many laboratory managers expressed concern because they are held accountable for requirements that do not apply to research laboratories and do not differentiate between generic and specific problems.

Laboratory managers also worry that rising research costs—fueled by the growing costs of complying with administrative requirements—may be limiting the ability of the laboratories to compete for opportunities to conduct research sponsored by industry and other government agencies. This limitation could, in turn, diminish the ability of the laboratories to build partnerships with industry—the key to the success of their commercial technology mission.

DOE has begun to institute contract reform efforts. DOE believes that these efforts, especially the planned use of performance measures to guide and evaluate laboratory activities, will form a basis for a more productive management approach that better integrates the laboratories' mission goals with administrative requirements.

Recommendations

GAO recommends that the Secretary of Energy, on the basis of the management issues raised in this report, evaluate alternatives for managing the laboratories that more fully support the achievement of clear and coordinated missions, including strengthening the Department's Office of Laboratory Management.

Matter for Congressional Consideration

If DOE is unable to refocus the laboratories' missions and develop a management approach consistent with these new missions, the Congress may wish to consider alternatives to the present DOE-laboratory relationship. Such alternatives might include placing the laboratories under the control of different agencies or creating a separate structure for the sole purpose of developing a consensus on the laboratories' missions.

Agency Comments

DOE believes that the new strategic planning process that it put in place in 1994, together with the task force's upcoming report on the future of the laboratories, will address many of the issues raised in this report. The

agency also believes that its new contract reform efforts, emphasizing the use of performance measures to evaluate the laboratories, will result in a more balanced management approach. DOE commented that these initiatives should be better reflected in GAO's report. GAO believes that the initiatives, when implemented, have the potential to substantially strengthen the agency's overall management capabilities. However, GAO also notes that past DOE reforms—including calls by previous task forces for clarifying the laboratories' missions and prior efforts at contract reform—have not always led to significant change. GAO has updated its report to reflect the agency's initiatives.

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Abbreviations

DOE	Department of Energy
GAO	General Accounting Office
R&D	research and development

Introduction

The Department of Energy (DOE) is responsible for some of the nation's largest and most impressive scientific facilities. The agency's nine national multiprogram laboratories employ more than 50,000 people and have annual operating budgets that exceed $6 billion. DOE estimates that more than $100 billion has been invested in the laboratories over the past 20 years.[1] The laboratories' work covers many scientific areas—from high-energy physics to advanced computing—at facilities located throughout the nation. Although DOE owns the laboratories, it contracts with universities and private-sector organizations for their management and operation—a practice that has made the laboratories more attractive to scientists and engineers. The laboratory contractors and DOE form unique partnerships at each site, but the Department remains responsible for providing the laboratories with their missions and overall direction, as well as for giving them specific direction to meet both program and administrative goals.

Laboratories Provide Unique Research and Development Capabilities

The laboratories provide the nation with unique research and development (R&D) capabilities. Specifically, the laboratories

- enable researchers to work on complex, interdisciplinary problems that dominate current science and technology;
- permit the study of large-scale, high-risk problems that would be difficult for industry or universities to undertake; and
- provide unique research facilities for universities and industry to use while serving as focal points for research consortia.

DOE's laboratories have made wide-ranging contributions to defense and civilian technologies. For example, the laboratories have long produced and applied nuclear isotopes now used in thousands of diagnostic medical procedures daily. Safer cars and planes have evolved using computer crash simulation software developed at one laboratory. In 1994, the laboratories' technological achievements received 25 of the 100 prestigious "R&D 100 Awards" given annually by R&D Magazine for the year's most technologically significant products. Appendix I contains information on the staffing and funding, as well as the contractor and programmatic emphases, at each laboratory.

[1]DOE is also responsible for several "single purpose" laboratories. These facilities concentrate in a particular program area or were created to pursue a single issue. Although these smaller laboratories are part of DOE's national laboratory network, we focused our attention on the nine multiprogram laboratories that dominate DOE's science and technology activities and budget resources.

Laboratories' Missions Have Evolved

When DOE was created in 1977, it inherited the national laboratories with a management structure that had evolved from the World War II "Manhattan Project," whose mission was to design and build the world's first atomic bombs. From this national security mission, the laboratories generated expertise that initially developed nuclear power as an energy source. The laboratories' missions broadened in 1967, when the Congress recognized their role in conducting environmental as well as public health and safety-related research and development. In 1971, the Congress again expanded the laboratories' role, permitting them to conduct nonnuclear energy research and development. During the 1980s, the Congress enacted laws to stimulate the transfer of technology from the laboratories to U.S. industry. DOE estimates that over the past 20 years, the nation has invested more than $100 billion in the laboratories.

The 1990s have brought the most dramatic changes affecting the multiprogram laboratories, including the following.

- The Soviet Union's collapse has reduced the nuclear arms race, raising questions about the need to maintain three separate weapons laboratories.
- The weapons laboratories, facing reduced funding in nuclear weapons research, have diversified their work in order to maintain their preeminent talent and facilities.
- Expectations are growing that all laboratories can and should help improve the nation's economic competitiveness by working with industry to develop commercial technologies.
- As the laboratories have aged, concerns have arisen about their ability to maintain their skills in weapons programs. Major investments will be needed to provide up-to-date facilities and attract younger scientists.
- In light of the general budget austerity facing the federal government, a stable funding environment is no longer guaranteed, and the laboratories will increasingly need to show useful results.

These and other forces have accelerated the laboratories' diversification from defense and nuclear research. For example, the nuclear weapons laboratories—Los Alamos, Sandia, and Lawrence Livermore—although created to design, develop, and test nuclear weapons, now devote less than half of their budgets to work on nuclear weapons. While these laboratories have been affected most dramatically by recent geopolitical changes, all DOE laboratories have been influenced by recent events and are redirecting their priorities.

The federal government owns the facilities and grounds of the laboratories and funds the work but has relied on contractors to manage and operate them. These contracts generally run for 5 years; however, some of the laboratories have been run by the same contractor for decades, even since their inception in the early 1940s. The laboratories' history of relative autonomy in daily research and operational management has led to concerns about their business practices as well as their attention to environmental, safety, and health issues.

Objectives, Scope, and Methodology

The objective of this report was to identify and examine the principal issues affecting the laboratories' missions and DOE's approach to laboratory management. The Congress has expressed considerable interest in these topics over the years, and our prior work at the laboratories, as well as other studies, has demonstrated that the laboratories' missions and management are key concerns. This work was carried out as part of our general management review of the Department of Energy.

Our work focused on DOE's nine multiprogram laboratories because of their size and importance as national science and technology resources. We selected laboratory staff to interview by asking each laboratory to identify five programs that best represented its current contributions and future capabilities. (App. II contains the list of programs the laboratories identified.) From these programs, we selected three for assessment. This approach allowed us to examine both the strengths as well as the weaknesses of the laboratories. When collecting information, we strove to identify and assess mission and management issues from the experience of the laboratory managers responsible for directing the programs we had selected. Our work also focused on each laboratory's technology transfer activities because of the increased national emphasis on using the laboratories to enhance U.S. technological competitiveness.

We collected information about the laboratories' missions and management from multiple sources with direct knowledge of these issues. At the laboratories, we interviewed managers who were responsible for the research programs we had chosen. We also held discussions with laboratory directors, senior officials responsible for technology transfer activities, and contractor representatives. At DOE, we interviewed program managers—Washington-based executives responsible for the research programs we had selected at the laboratories—and DOE field office managers, who oversee the Department's contractors at the laboratories.

To validate and refine our findings, we conducted two focus groups. The first group, which met with our staff in Chicago, consisted of one program manager from each of the nine laboratories. A second group, comprising program managers from DOE headquarters, met with our staff in Washington, D.C.

To obtain independent views about the laboratories' missions and management, we interviewed experts and industry representatives who were not associated with the laboratories. In addition, the National Academy of Public Administration assisted us in convening a panel of experts with backgrounds in (1) managing research in government and industry and (2) science and technology policy. Table 1 lists the panelists and their relevant professional experience.

Table 1: GAO's Panel of Energy Experts

Lewis Branscomb, Chair	Albert Pratt Public Service Professor, John F. Kennedy School of Government, Harvard University; Director, Science, Technology, and Public Policy Program. Formerly: Vice President and Chief Scientist, IBM; Director, National Bureau of Standards; Chairman, National Science Board.
Erich Bloch	Distinguished Fellow, Council on Competitiveness. Formerly: Director, National Science Foundation; Member, Committee on Computers in Automated Manufacturing; Vice President, Technical Personnel Development, IBM; Vice President and General Manager, IBM, East Fishkill, N.Y.
Sydney Drell	Deputy Director, Stanford Linear Accelerator. Formerly: Co-Director, Stanford University Center for International Security and Arms Control; Executive Head, Department of Theoretical Physics, Stanford University.
Harry Finger	Consultant. Formerly: President and CEO, U.S. Council for Energy Awareness; Vice President for Strategic Planning and Development Operations, and General Manager, Center for Energy Systems, General Electric Company; Assistant Secretary for Research and Technology, U.S. Department of Housing and Urban Development; Associate Administrator for Management and Director, Space Power and Nuclear Systems, National Aeronautics and Space Administration.
Donald Kerr	Executive Vice President, Science Applications International Corporation. Formerly: President, EG&G; Director, Los Alamos National Laboratory; Assistant Secretary for Energy Programs, Department of Defense.
Roland Schmitt	Consultant. Formerly: President, Rensselaer Polytechnic Institute; Senior Vice President, Science and Technology, General Electric; Senior Vice President, Corporate Research and Development, General Electric.
Robert White	President, National Academy of Engineering; Vice Chairman, National Research Council. Formerly: President, University Corporation for Atmospheric Research; Administrator, National Oceanic and Atmospheric Administration; Chief, U.S. Weather Bureau.

We also reviewed information and analyses from the laboratories, DOE, the Congress, industry, and independent experts, as well as legislative proposals and testimony, DOE documents, budget materials, and previous studies conducted by government and private organizations.

In analyzing information, we compared and contrasted views about laboratory mission and management issues. We found considerable agreement among all types of respondents on both topics. To give the reader concrete illustrations of how mission and management issues were viewed, we have used quotations from sources we interviewed throughout this report.

We obtained written comments on a draft of this report from DOE. The agency's comments and our evaluation are presented in appendix III and at the end of chapter 5.

We conducted our work from July 1992 through December 1994 in accordance with generally accepted government auditing standards.

The Laboratories Need Their Missions Clarified

As the manager of the laboratories, DOE has not clarified how the laboratory system can and should meet national priorities. Although research programs set laboratory priorities to meet their own goals, DOE has not used the laboratories as a coordinated network of talent and facilities to meet missions that cut across programs. This approach not only inhibits the development of clear and coordinated missions for the multiprogram laboratories but also fails to draw upon the laboratories' expertise in multiple disciplines to solve complex, cross-cutting problems in science and technology.

These concerns are not new. In the past, many advisory groups emphasized the need to clarify and redefine the laboratories' missions. Although DOE recently developed a Strategic Plan and processes intended to integrate the Department's missions and programs in five major areas, questions remain about DOE's overall capacity to lead the national laboratories into new mission areas.

Laboratories' Missions Are Unclear

DOE's multiprogram laboratory system, as well as the individual laboratories, needs missions that are clear and coordinated with DOE's overall program goals in order to organize the system's efforts as effectively as possible. The clearer the mission, experts believe, the better the performance will be. In 1992, the Advisory Board to the former Secretary of Energy expressed the importance of clear missions as follows:

> Each national laboratory must have clearly defined, specific missions which support the over-arching missions of DOE to ensure the best technical and management performance and the greatest value to the nation.[2]

Only with clear missions, experts believe, can implementation strategies or "road maps" be developed that describe how each mission will be accomplished and guide each organization's day-to-day operations.

We found that the multiprogram laboratories—both individually and as a group—do not have either clearly defined missions or specific implementation strategies that bring together laboratory resources to focus on accomplishing departmental objectives and national goals. Although current mission statements for the laboratories describe their ability to conduct research in defense, energy, and environmental cleanup;

[2]Secretary of Energy Advisory Board Task Force on the Department of Energy's National Laboratories, final report, July 1992.

to transfer technology to industry; and to perform basic research, these activities have not been translated into overall missions for the laboratory system and specific missions for each laboratory. For example, one laboratory manager expressed concern to us that all laboratories have "generic" mission statements that tend to look remarkably similar. Laboratory managers frequently made comments to us such as "we don't really have a mission . . ." and "The laboratories must have a vision and goal toward which they can work." An expert we consulted expressed the current situation as follows:

> [We] have not seen crisp, specific mission statements from individual laboratories, nor specific mission statements that would cover all DOE's laboratories. Furthermore, DOE has not been able to describe the mission of the laboratories, nor are the laboratories' missions defined in any piece of legislation. . . .It is not possible to run a $6 billion organization without specific mission statements.

Laboratory managers we spoke with were also concerned that the Congress, DOE, and the laboratories do not share a "common vision" of the laboratories' missions. Such a common vision among the key "stakeholders" is crucial if the laboratories are to use their resources most effectively to support departmental programs and national goals—the main purpose of the laboratories' existence. Developing clear and more coordinated missions is particularly important, given the growing expectation that the laboratories will work together toward achieving national security, energy, environmental, and commercial technology goals. (Ch. 4 contains the opinions of our panel of experts on suitable missions for the national laboratories.)

The responsibility for developing the common vision rests with DOE. However, laboratory managers believed that DOE headquarters and operations offices have divergent views of the laboratories and their goals, and DOE has not been able to develop a consensus with the Congress on the future of the laboratories.

Clear and Coordinated Missions Would Help the Laboratories Address Cross-Cutting Issues

Without a coordinated set of laboratory missions, DOE is unable to address issues that require cooperation and coordination across its many mission areas. This not only inhibits cooperation among research programs but also keeps DOE from using its laboratories to achieve departmental missions.

Laboratory and DOE managers are concerned that DOE has not built on its individual programs to encourage valuable cross-program and cross-laboratory interactions, which are essential to meeting both current and future missions. Both laboratory and DOE program managers describe DOE's management as "fractured" and not particularly adept at combining the expertise of various program areas to tackle cross-disciplinary problems. Laboratory managers cited difficulties DOE has in establishing bridges between its basic science programs and applied science groups. Developing clear and coordinated missions—and strategies to implement them—would provide the necessary bridges between and among the laboratories on cross-cutting projects, according to many laboratory and independent experts.

Many laboratory managers believe that DOE and its laboratories lack effective coordinating mechanisms—among the most serious challenges facing the Department as an organization. One manager described as a "horrible problem" the limited emphasis on cross-program coordination.

To illustrate the difficulties in combining expertise from different programs to achieve core missions, several laboratory managers cited the fragmented research on preventing the proliferation of nuclear weapons. Although solutions to proliferation problems require expertise in identifying the effects of weapons, the nonproliferation and weapons missions are carried out in different laboratories and are managed by different assistant secretaries. Laboratory managers also cited weak links among the energy conservation, fossil fuel, and nuclear energy research programs as having limited DOE's progress in commercializing energy technologies.

When DOE and the laboratories have successfully combined their multidisciplinary resources, impressive results have occurred. For example, laboratory managers attributed the rapid progress toward a coordinated understanding of global environmental change in DOE's Global Studies Program to the use of nine laboratories' diverse capabilities. According to another laboratory manager, cross-laboratory cooperation in the fusion energy program is leading to a long-range strategy to guide research. These examples illustrate the potential for greater collaboration on technical issues that require multidisciplinary talent.

Mission Uncertainty Is a Persistent Problem

Concerns about the need to update and clarify the laboratories' missions are long-standing. Past studies and reviews of the laboratories have all reached the same conclusion, as the following examples show:

- In 1983, the White House Science Council Federal Laboratory Review Panel issued a report (commonly known as the Packard Report) addressing all federal laboratories.[3] The report found that while some of the laboratories, particularly DOE's, had clearly defined missions for parts of their work, most activities were fragmented and unrelated to the laboratories' main responsibilities. This report recommended that all parent agencies review and redefine the missions of their laboratories.
- In 1992, a DOE Secretary of Energy Advisory Board found that the broad missions the laboratories were addressing, coupled with rapidly changing world events, ". . . ha[d] caused a loss of coherence and focus at the laboratories, thereby reducing their overall effectiveness in responding to their traditional missions as well as new national initiatives. . . ." The Board identified the most important cause of the stress between DOE and its laboratories as ". . . the lack of a common vision as to the missions of the laboratories. . . ."[4]
- A 1993 report of an internal DOE task force on laboratory missions reported that the missions "must be updated to support DOE's new directions and to respond to new national imperatives. . . ."[5]

None of these past studies and reviews has resulted in overall consensus about the future missions of the multiprogram laboratory system, raising questions about DOE's capacity to provide a vision for this system. A 1982 DOE Energy Research Advisory Board task force provided some insights into this question.[6] The Advisory Board acknowledged the impressive nature of the research and development conducted throughout the system but noted that certain weaknesses prevented the laboratories from achieving their full potential. The Advisory Board found, for example, that structural problems and fragmented programs required the laboratories to interact with DOE on an excessive number of levels. The Advisory Board recommended that DOE designate a high-level official to focus solely on the laboratories. DOE did not follow the Advisory Board's recommendations. In

[3]Report of the White House Science Council, Federal Laboratory Review Panel, Office of Science and Technology Policy, May 15, 1983.

[4]Secretary of Energy Advisory Board, Final Report, 1992.

[5]Changes and Challenges at the Department of Energy Laboratories, Final Draft Report of the Missions of the Laboratories Priority Team, 1993.

[6]The Department of Energy Multiprogram Laboratories, A report of the Energy Research Advisory Board to the Department of Energy, Sept. 1982.

early 1993, however, DOE created an Office of Laboratory Management whose purpose was, in part, to coordinate the interests of the various DOE program offices that interact with the laboratories on a program-by-program basis. However, according to DOE officials, the plan was not implemented, and the existing office does not coordinate laboratory activities for all program offices and does not report directly to the Secretary.

We called attention to the limitations of DOE's program-by-program approach to directing its laboratories as early as 1978, after reviewing the laboratories' contributions to nonnuclear energy, a critical policy issue at that time.[7] The laboratories' activities in this area were limited by several factors. First, DOE's organizational alignment created obstacles; specifically, the laboratories reported to three different senior officials. This arrangement focused the efforts of the laboratories on particular programs and eroded their abilities to pursue research on topics cutting across several areas, such as nonnuclear energy. Second, the roles of the laboratories were determined in a piecemeal way so that each laboratory was given small, fragmented responsibilities. We recommended that DOE align the laboratories under a separate high-level office that was not responsible for specific programs.

In the absence of an overall mission strategy for the laboratories, individual research program goals are emphasized, sometimes at the expense of broader DOE and laboratory missions. One laboratory manager noted:

> Most of what we do is determined from the bottom-up . . . in other words, the program level in DOE—and DOE program managers don't [care] about what the [laboratory's] missions are. They want to know where the talent is, and they want to know where the capability is, and that's where they put their work.

A DOE operations office manager said that the Department's program-oriented approach toward the laboratories fails to recognize DOE's "corporate" responsibility for them. Another manager cited the need for DOE to develop a strategic approach to the laboratories. Laboratory managers pointed out that DOE's approach to the laboratories through individual research programs has not effectively linked the laboratory system's collective resources to DOE's missions. A laboratory manager described DOE as increasingly focused on individual programs; its

[7]The Multiprogram Laboratories: A National Resource for Nonnuclear Energy Research, Development and Demonstration (EMD-78-62, Mar. 22, 1978).

management is concentrated at the assistant secretary level, even though many projects do not fall within any one assistant secretary's program responsibilities.

Debate on Developing Missions for the Laboratories Is Growing

How best to develop missions for the laboratories—and how best to manage them—is the subject of growing debate in the scientific community and was discussed by our panel of experts. For example, proposals suggested or debated during our review included the following.

- Convert some laboratories, particularly those working closely with the private sector, into independent entities.
- Transfer the responsibility for one or more laboratories to another agency, whose responsibilities and mission are closely aligned with a particular DOE laboratory.
- Create a "lead lab" arrangement, under which one laboratory is given a leadership role in a mission or technology area and other laboratories are selected to work in that area.
- Consolidate the responsibility for research, development, and testing on nuclear weapons within a single laboratory.

While we have not analyzed these alternatives, each has advantages and disadvantages and needs to be evaluated in light of the laboratories' capabilities for designing nuclear weapons and pursuing other missions of national and strategic importance. Furthermore, the government may still need facilities dedicated to national and defense missions, a factor that would heavily influence any future organizational decisions. Important budgetary considerations also accompany each alternative.

An expert panelist advised caution in restructuring the laboratories, expressing concern that decades of national investment in these facilities have produced important assets that, if dispersed, could take many years and billions of dollars to reassemble.

The Previous Congress Took Some Action on Laboratory Mission and Management Issues

The previous Congress was also active in the debate on the laboratories' missions. For example, a House bill introduced in 1993 defined future missions for DOE's laboratories and suggested methods for measuring progress toward goals, along with incentives for improving the overall quality of research at the laboratories. This proposed legislation also sought to require more rigorous evaluation of the laboratories, articulated several missions for them (such as advancing nuclear science and

technology for national security purposes), and advocated that they work with private industry to develop environmental technology and technology transfer activities. A bill passed by the Senate in 1993 contained similar provisions and was designed to sharpen the laboratories' focus on technology transfer and cooperative research agreements. This bill would have required the laboratories to allocate 20 percent of their budgets to partnerships with industry and academia.

Further Efforts Are Under Way to Clarify the Laboratories' Missions

Recognizing the important role that the multiprogram laboratories should play in accomplishing departmental goals and national priorities, DOE is making another attempt to define the laboratories' missions. In February 1994, the Secretary commissioned an independent task force to address the appropriate roles of DOE's laboratories. Chaired by the former chief executive officer of Motorola Corporation, this task force—the Secretary of Energy Advisory Board Task Force on Alternative Futures for the Department of Energy National Laboratories—is charged with, among other things, examining "alternative scenarios for future utilization of these laboratories for meeting national missions." The task force's charter encompasses examining the future roles and responsibilities of the national laboratories, including questions about their accountability and consolidation. The task force's report to the Secretary is expected by February 1995.

DOE has also initiated a strategic planning process that it believes will form a framework for coordinating the laboratories' missions with the agency's goals and objectives.[8] DOE's Strategic Plan will focus the agency's efforts on five main areas: preserving national security, conserving energy resources, promoting environmental protection, applying science and technology to national needs, and encouraging industrial competitiveness. Strategic plans have also been developed for each of these areas. In addition, DOE has begun a major reorganization effort, which is designed to follow the structure of its new Strategic Plan. Reorienting existing programs and the laboratories to best address these areas remains the Department's challenge.

[8]Strategic Plan: Fueling a Competitive Economy. U.S. Department of Energy, DOE/0108, Apr. 1994.

A More Effective Management Approach Will Promote Mission Success

Laboratory managers see DOE's management of the multiprogram laboratories as costly and inefficient, creating tensions that impede the development of clear and coordinated missions for the laboratories and action steps that lead toward achieving these missions. According to laboratory managers, DOE micromanages the laboratories, particularly in overseeing their compliance with growing numbers of administrative requirements. Laboratory managers fault DOE for failing to set priorities or provide guidance about how to satisfy both research goals and administrative requirements.

Experts we consulted, as well as many laboratory and DOE managers, expressed concern that without a more effective management relationship between DOE and the laboratories, rising research costs may price the laboratories out of collaborative research with industry—a new mission area in which the laboratories are expected to make major contributions.

DOE does Not Balance Research and Administrative Objectives

In addition to meeting their research and technology objectives, laboratory managers are responsible for satisfying a wide variety of administrative requirements in areas such as procurement; travel; human resources; and environment, safety, and health. Prompted by criticism of its business practices and past inattention to environment, safety, and health issues, DOE has greatly increased its oversight of the laboratories during recent years.

Coping with the new requirements that have accompanied DOE's expanded oversight is, according to a consensus of laboratory managers, a major burden that not only increases research costs but also diverts attention from basic research. Although laboratory managers recognize the importance of meeting administrative goals—particularly in the area of environment, safety, and health—they want DOE to set priorities for their administrative activities and help them balance research and administration.

Administrative Requirements Have Proliferated

Administrative requirements increased under the former Secretary of Energy, largely in response to the well-publicized call for greater attention to the environment, safety, and health throughout the nuclear weapons complex. Thus, over 70 percent of the requirements listed in DOE's 1993 Directives Checklist are new or have been revised since 1989. A DOE operations office manager estimated that DOE has about 8,400 environment, safety, and health requirements. Directives define required

actions to meet certain objectives; these actions range from preparing reports to conducting inspections. Both laboratory and DOE operations office managers who administer directives told us they were "numb" from the proliferation of requirements. According to a consensus of both laboratory and DOE managers, the laboratories have been overwhelmed, not only by the volume of new requirements but also by their detail and by inconsistent guidance for implementing them.

Closely related to the proliferation of administrative requirements has been the equally aggressive expansion of oversight activity. Oversight—or the assessment of how well managers handle the programs and requirements for which they are accountable—is critical to the operation of federal programs and is a key management responsibility. Despite its vital role, laboratory managers, the experts on our panel, and DOE managers agreed that sharply increased oversight in recent years has not been an effective management approach for DOE.

DOE and other agencies conduct as many as 400 reviews annually at each laboratory. One laboratory manager calculated that his program was reviewed more than once a day in 1992. Laboratory managers deplored the enormous amount of time required to prepare for oversight reviews, adding that the impact of losing the best researchers' time during reviews is difficult to quantify. Many scientists have become discouraged by administrative chores. One manager complained that administrative oversight consumed as much as 40 percent of his working time, and many managers questioned whether DOE's expanded oversight has produced benefits commensurate with its costs.

Oversight reviews of the laboratories have been particularly burdensome because they have been inconsistent. Laboratory managers deal with three large bureaucracies—DOE headquarters, DOE operations offices, and contractors. Each interprets DOE's oversight requirements, which, in turn, sometimes conflict. One manager expressed the problem this way:

> There are myriad rules and regulations that require a substantial amount of interpretation. In the absence of a single environment, safety, and health oversight organization, every laboratory will have a different level of compliance because each field office has a different interpretation of environment, safety, and health rules.

Requirements Do Not Reflect Laboratory Conditions

Both laboratory and DOE managers say they are held accountable for requirements that do not reflect problems in research laboratories or do not differentiate between general and isolated problems. According to the

managers, many environment, safety, and health requirements are appropriate for problems and operations at weapons production facilities, not at laboratories. A laboratory manager explained the effect of inappropriate requirements on research:

> We end up treating very simple chemical experiments as if people were working with commercial nuclear reactors. . . our costs have gone right through the roof and our staff's ability to turn out the volume has decreased dramatically.

Many laboratory managers also said that they had been held accountable for problems that occurred at another location—experiencing what a DOE operations office manager described as "battalion punishment." For example, frozen pipes at one facility resulted in a directive to all laboratories, including those in warm climates. A laboratory manager explained:

> If lab A screws up—say environmental health or quality assurance—[DOE] headquarters decides that everybody's guilty and we're then overrun with sieges and inspections. Instead of going back to that laboratory and trying to understand why that went bad, we're all condemned by the same punishment.

Meeting all of these responsibilities presents a significant challenge, especially as budgets decline. Yet laboratory managers maintained that DOE has provided little guidance or assistance in setting priorities to help them balance their responsibilities.

Part of the problem, according to many laboratory managers, stems from the existence within DOE of parallel research and administrative reporting and oversight systems. Decisions are made about requirements in one area without assessing their impact on the other, and research and administrative compliance programs each have different reward structures. A laboratory manager also noted that no one takes responsibility for resolving conflicts between the two systems. As one senior laboratory manager explained to us:

> There is a split in DOE between the people who run programs and those who issue regulations. . . .Funds tend to come in at the bottom to scientists, while regulations tend to come in at the top of the organization . . . often the scientists do not understand the rationale for regulations.

Costs Present a Major Issue

Managers at the laboratories, in DOE programs, and at DOE operations offices were troubled by the costs associated with achieving the

Department's administrative goals. Although little information or analysis has been completed on this issue, DOE's administrative compliance approach has had two results, according to both DOE and laboratory managers. First, it has been costly. Second, it has raised research costs and reduced the laboratories' ability to compete with universities for research sponsored by industry and other government agencies.

For example, a laboratory manager told us that operating a reactor costs significantly more under DOE's safety regulations than under the Nuclear Regulatory Commission's regulations for non-DOE reactors. A DOE operations office manager added that it would cost billions more than is currently spent to be in full compliance with all rules and regulations at several laboratories, even though these laboratories have lower-priority problems. Laboratory and DOE managers agreed that DOE has not provided the funding required to achieve compliance, particularly with environment, safety, and health regulations. A DOE operations office manager noted that no additional funds had been received at one laboratory where expenditures of more than $1 billion would be required to correct environment, safety, and health problems.

Managers also expressed considerable concern that DOE's administrative compliance approach has raised research costs, limiting the laboratories' ability to compete for research funded by industry and other government agencies. For example, one research organization reported that renewing its contract with a laboratory would cost up to 3 times more than its previous contract. Laboratory and DOE managers and experts agreed that universities—the laboratories' main competitors for research—need not meet many of the requirements that DOE imposes. An expert expressed concern that increases in the costs of research could adversely affect the laboratories' commercial technology mission, pointing out that

> There is a trend toward imposing the full range of government procurement requirements on the laboratories, and this could kill government-industry cooperation. . . .For industry to find cooperative research agreements with laboratories a viable option, laboratory costs must be fully competitive.

Laboratory and DOE managers and an expert on our panel believe that administrative programs should be cost-effective and have priorities for compliance so that resources can be concentrated on the most significant risks. However, DOE has not systematically set priorities for its administrative requirements, and cost-benefit analyses have not been used to assess risks.

DOE Has Begun to Address Oversight Issues

DOE has begun to streamline the directives system and correct other oversight problems. Also, the Department is now seeking to avoid duplicative or unnecessary oversight reviews and is more careful about overloading laboratories with such reviews. In addition, DOE has begun to implement "total quality management" and is developing performance measures to guide its evaluation of the laboratories' management. DOE believes that these efforts should help both it and the laboratories balance their research and administrative goals more effectively in the future.

DOE's Contractual Relationships Inhibit Change

DOE's "management and operating" contracts with the academic institutions that operate most of the multiprogram laboratories pose a further stumbling block both to a more favorable relationship between the Department and the laboratories and to a reduction in DOE's oversight. Under these contracts, a contractor assumes responsibility for managing and operating a facility but incurs only limited liability. DOE pays virtually all of the contractor's costs except those resulting from willful misconduct or bad faith by top management or those designated as unallowable. Furthermore, under its contracts with the laboratory contractors, most of which are nonprofit or academic institutions, DOE has limited financial incentives for influencing the contractor's actions: It cannot adjust the fee that it pays to these contractors because it has historically negotiated a fixed fee with them that is not tied to their performance. In contrast, DOE pays its for-profit contractors a fee, called an "award fee," that is based on its assessment of their performance. The tensions created by the arrangements between DOE and its nonprofit contractors have raised questions about whether DOE's current contracting approach is effective for managing the laboratories. DOE and various oversight groups, including GAO, have expressed concerns about the laboratories' past business practices and have called for changes in contracts that better reflect the needs of the laboratories and the requirements of DOE.

DOE is changing its relationship with contractors. Under its contract reform initiative, contractors will be evaluated on the basis of performance measures—a process that DOE believes will better enable it to hold contractors accountable for results.[9] In addition, according to DOE staff, the use of performance measures will lead to a more rational, risk-based approach toward compliance with the increased number of requirements placed on the laboratories in recent years.

[9]We have reported on performance-based contracting in Department of Energy: Challenges to Implementing Contract Reform (GAO/RCED-94-150, Mar. 21, 1994).

We support DOE's contract reform efforts and believe that, once implemented, they offer opportunities for substantially improving the way the agency does business with its contractors, including its laboratory contractors. We are concerned, however, that the scope of DOE's current contract reform may not address all the major management problems that characterize the agency's relationship with the laboratories. For example, it is uncertain how contract reform will resolve the proliferation of laboratory oversight activities, which poses a major problem for laboratory managers. Furthermore, it could take many years for contract reform to take effect, given the multiyear time frame for existing contracts.

Experts See Future Missions as Extensions of Current Missions

Our panel of experts and other experts believe that, with proper mission focus and management direction, the multiprogram laboratories can make vital contributions in many areas important to DOE and the nation. According to the panel, the highest-priority missions for the laboratories are national defense, energy, the environment, and commercial technology. While the laboratories have already made contributions in these areas—such as effective weapons systems, energy conservation programs, environmental cleanup techniques, and commercialized technologies—our panel concluded that clarifying and, in some cases, redefining the current missions for the laboratory system as a whole would enhance the value of the laboratories.

National Security Work Will Continue to Be Important

Our panel of experts agreed that the laboratories' national security work will continue to be important. Until the Department of Defense has decided whether to support defense work at the laboratories and DOE's missions are clear, the defense roles of Los Alamos, Sandia, and Lawrence Livermore are unclear. However, several panelists anticipated a defense mission with new and continuing objectives that would use these three laboratories' nuclear weapons competence and other laboratories' experience.

In nuclear weapons technologies, several of the experts on our panel predicted that the laboratories' missions would continue to shift from designing weapons to overseeing and dismantling the nuclear stockpile, verifying international nuclear treaties, and conducting research on nonproliferation. Because the Department is substantially responsible for overseeing the weapons stockpile, it will require the laboratories' unique competencies. Ensuring that stockpiled nuclear weapons are reliable and safe is a major responsibility that will persist as long as the nation needs to sustain a nuclear stockpile, a panelist pointed out.

The defense mission also makes the laboratories responsible for overseeing the dismantling of nuclear weapons in accordance with the nation's international treaty obligations—a task that will take decades to complete at the current pace, a laboratory director pointed out. According to a laboratory director, the United States and Russia each estimate that they can dismantle only 2,000 weapons a year. The current U.S. stockpile contains many thousands of weapons.

The proliferation of nuclear technology and materials will be an increasingly important national concern. As a DOE manager noted, a

growing number of nations are now able to make nuclear weapons, and more have the political will to develop them. Our panel of experts concurred that the laboratories have unique knowledge to address these issues. For example, the laboratories already have experience in detecting clandestine nuclear weapons programs, locating terrorists' weapons, responding to nuclear weapons emergencies, and identifying the origin of nuclear materials and weapons.

Links Between Energy and Environmental Missions Are Needed

Energy and the environment are areas in which the laboratories have already made useful contributions. However, our panel of experts suggested that the laboratories could enhance their contributions by linking their missions in these areas to focus on energy-related environmental problems—an increasingly important issue, according to a DOE secretarial advisory board. This linkage would demonstrate the effect of research in one area on work in another, an important consideration because energy development and use underlie most of the nation's serious environmental problems. For example, the use of electric vehicles would reduce emissions of hydrocarbons but create problems in disposing of batteries. Similarly, the production of commercial nuclear power reduces some air quality problems but creates a need for technologies to dispose of radioactive wastes. As a panelist pointed out, linking energy and environmental research would draw upon the laboratories' ability to address cross-disciplinary problems. This linkage would benefit research in both areas and enhance the ability of DOE and the laboratories to set research and policy priorities.

Our panel of experts agreed that the laboratories have an important energy research mission. One panelist described it as perhaps their principal mission because developing energy sources and efficient uses of energy is vital to the nation's economy. However, another panelist maintained that although the laboratories' energy mission is broad, it has become fuzzy. Panelists also noted that despite substantial investment, the laboratories' energy research has been disappointing. One panelist noted that the nation has been unable to decide on an energy policy to guide the laboratories' work. DOE has produced several different national energy strategies over the years, each with different priorities, making long-term planning for the laboratories difficult. Despite these conditions, however, panelists agreed that a redirected energy mission would serve the United States very well and provide opportunities for large-scale interactions between industry and government. One panelist urged DOE to consider the laboratories' experience, encourage closer laboratory-industry interactions to define

priorities, and focus on path-breaking, high-risk, cross-industry research with the potential for major payback in 10 to 20 years.

The laboratories' environmental mission has been more implicit than explicit, according to one panelist. Although the laboratories have been developing environmental technologies, the scope of their environmental mission has not been clear. However, several of the panelists envisioned that the laboratories could make unique contributions, particularly in environmental technology—an area where other federal agencies have limited experience—and in nuclear waste disposal. Significant contributions may also stem from the laboratories' ability to model environmental impacts with their advanced computing facilities. Several panelists believed that greater coordination between DOE and the Environmental Protection Agency would be needed to maximize the value of this type of laboratory work.

A laboratory director emphasized to us that through their basic research competencies the laboratories can make a major contribution to solving environmental challenges, but their strengths have been underutilized. According to the director, "Waste remediation cannot continue on its present course without 'bankrupting the country' because it is being done without a knowledge base."

As a laboratory manager noted, developing a basic understanding of underlying problems before developing waste cleanup technologies is important. If the basic science is not understood, environmental remediation problems may elude solution, just as efforts to cure cancer during the 1970s were unsuccessful because not enough was then known about basic cancer virology.

Laboratories Can Contribute to Commercial Technology Mission

Our panel of experts agreed that a commercial technology mission for the laboratories is legitimate and important. However, several panelists and other experts we consulted maintained that this mission should be broadly conceived—that is, it should emphasize research and development that can benefit all U.S. industries and should be integrated with other laboratory missions rather than become a central mission.

According to panelists, the principal reason for enlisting the laboratories in improving the nation's global competitive position is that they are building the intellectual foundation that allows the nation's economy to prosper. A laboratory director pointed out that U.S. industry has

sometimes been at a disadvantage because public-private research is better coordinated in other countries.

There was considerable agreement among both the experts on our panel and other experts we consulted about the need to change the laboratories' current focus on transferring existing technology to industry on a project-by-project basis. Industry, expert, and government sources concurred that the technology mission would be more productive if it supported

- nonproprietary research that could help all industries compete;
- technology research as an integral part of the national security, energy, and environmental missions;
- long-term cooperative research relationships between the laboratories and industry; and
- training in science for future progress in technology.

According to a panelist, nonproprietary research that can benefit all industries is important but has been underfunded and conducted without focus. The panelist emphasized that the government can usefully and appropriately support research that underpins a broad array of specific technology applications in many different industries, stopping short of supporting proprietary technology that companies themselves should fund. For example, experts noted that laboratory research to improve the U.S. transportation system could enhance U.S. manufacturers' ability to compete. Similarly, a panelist noted that laboratory work on advanced computer-aided design tools could improve productivity throughout the U.S. manufacturing sector.

Although a commercial technology mission is important, laboratory managers, industry representatives, and experts cautioned that developing technology should not become the laboratories' primary mission or reason for existence. The officials described the challenge as defining a broad technology mission that supports long-term relationships between the laboratories and industry while sustaining the laboratories' other missions and abilities. For example, the laboratories develop technology through other missions that have technological needs of their own. Sustaining the laboratories' basic research is also important. Laboratory managers observed that a balance is needed between basic and applied research in order to avoid "eating the seed corn" that leads to new technologies. In addition, not all programs—such as high-energy physics—lend themselves to cooperation with industry. A laboratory manager said that with only a

technology transfer mission, the laboratories would be out of business in 5 years.

Several of the experts on our panel encouraged laboratories and industry to develop long-term cooperative research relationships that can allow each party to better understand the other's needs and increase the potential for results.

Panelists and other experts we consulted agreed that training in science and mathematics is essential to the nation's future competitiveness in high-technology products and services and that helping train students is important to a commercial technology mission. Several panelists also urged that, to enhance industry's ability to produce marketable innovations, the laboratories expand their training programs to include mid-career technical retraining for industry personnel.

Implementing a Commercial Technology Mission Poses Special Problems

Working with industry on a commercial technology mission at the laboratories presents special challenges for DOE and laboratory management. Although some laboratories have considerable experience in working with industry, broad-scale cooperation represents a new venture for the laboratories. DOE has begun to work with the laboratories and industry to develop a strategic plan for technology partnerships. However, successful implementation of this new mission requires clearly defined roles for the laboratories and DOE, realistic expectations about the laboratories' potential to improve U.S. competitiveness, encouragement to experiment, well-defined mission objectives, and closer links between the laboratories and industry to ensure that the laboratories' work reflects the market's needs.

Conclusions and Recommendations

U.S. taxpayers have a significant investment in the national laboratory network. DOE has a major responsibility to ensure that work at the laboratories is properly focused and intelligently managed so that the laboratories can make maximum contributions to national priorities. Achieving these goals requires two efforts: First, senior leadership needs to develop clear missions and implementation strategies that treat the laboratories as a coordinated set of facilities; second, DOE needs to adopt a management approach that supports the laboratories' achievement of their research missions and administrative responsibilities.

DOE has not been able to develop a consensus among laboratory and government leaders on appropriate missions for the national laboratories, even though past studies and special task forces have called for such action. Furthermore, the Department's management approach impedes progress toward current goals, raising questions about DOE's overall capacity to achieve these important objectives.

The results from the Secretary's Advisory Board Task Force on Alternative Futures for the National Laboratories could set the foundation for developing clear and coordinated missions for the national laboratory network. The success of these results can best be measured by the extent to which they help shape a consensus among key stakeholders: the Congress, DOE, and the laboratories. Such a consensus on the future missions for the national laboratories has not resulted from past advisory board recommendations.

DOE's ongoing contract reform efforts—especially the planned use of performance measures to guide and evaluate the laboratories' activities—could form a solid basis for an improved management approach that supports the laboratories' mission goals and administrative requirements. These goals will be difficult to achieve, however, given current management practices and the contracting constraints under which both DOE and the laboratories operate. For these and other reasons, experts are beginning to question where alternative forms of laboratory management should be considered.

As public debate on the future of the laboratories grows—for example, the Congress, in a previous session, proposed legislation setting specific missions for the laboratories—DOE's leaders cannot afford to delay efforts to define clear and coordinated missions and to implement a management approach that supports these missions.

Indeed, if the laboratories do not begin to function more as a system, it may be necessary to consider alternatives to the present DOE-laboratory relationship. Above all, strong DOE leadership is needed to establish a shared vision about the laboratories' expected contributions. DOE leadership is especially important to implementing the new commercial technology mission. There are encouraging signs that DOE is committed to involving industry in this implementation and improving its access to the laboratories.

Recommendations

We recommend that the Secretary of Energy evaluate alternatives for managing the laboratories that more fully support clear missions, achieve results by linking the laboratories' activities to DOE's missions, and maximize the laboratories' resources. Such a strategy could start by addressing the many management issues raised in this report and should be consistent with DOE's major efforts to reform contract management. The strategy must also support goals for DOE and the laboratories to comply with environment, safety, and health initiatives. To help achieve this goal, the Secretary should strengthen the Office of Laboratory Management by providing it with sufficient resources and authority to facilitate cooperation with the laboratories and resolution of management issues across all DOE program areas.

Matter for Congressional Consideration

If DOE is unable to refocus the laboratories' missions and develop a management approach consistent with these new missions, the Congress may wish to consider alternatives to the present DOE-laboratory relationship. Such alternatives might include placing the laboratories under the control of different agencies or creating a separate structure for the sole purpose of developing a consensus on the laboratories' missions.

Agency Comments and Our Evaluation

DOE officials believe that they are taking a number of actions that address our concern about DOE's leadership in providing mission focus for the national laboratories. Specifically, in its letter to GAO, and in discussions with us, DOE cited its new strategic planning process, which resulted in a Strategic Plan that, in turn, is supported by five separate plans covering each of the Department's core "business lines." DOE anticipates that this process, together with the upcoming report expected from the Secretary's Energy Advisory Board Task Force on Alternative Futures for the Laboratories, will provide the means through which the Department will exercise new leadership for its national laboratories.

GAO is encouraged by these initiatives. Coupled with the Department's contract reform efforts, they should, once fully in place, strengthen DOE's ability to improve its own management as well as provide a foundation for refocusing the laboratories' missions. The outcome of these efforts bears close monitoring by the Congress. Our optimism is tempered, however, by DOE's having reorganized before and having had planning efforts in the past. Furthermore, DOE has not used the recommendations of past advisory groups to refocus the laboratories or improve its management of them.

DOE expressed concern that our report would force "tight mission-driven parameters" for the laboratories, which would inhibit the laboratories' flexibility in conducting fundamental research. We are not suggesting that DOE narrow the laboratories' missions. Instead, we believe that DOE should clarify mission-focused research and development within its laboratories and coordinate these activities among them. The need to clarify and focus the laboratories' missions reflected a widespread consensus among the laboratory and DOE managers, as well as among the experts, with whom we spoke.

Profiles of DOE's National Laboratories

Dollars in millions

Laboratory/location	Actual budget (FY 1994)	Staff (FY 1994)	Program emphases	Contractor
Argonne/ Argonne, Illinois	$614	5,083	Basic energy sciences, nuclear engineering, environmental science and technology	University of Chicago
Brookhaven/ Upton, New York	$408	3,417	High-energy and nuclear physics, basic energy sciences	Associated Universities, Inc.
Idaho Engineering/ Idaho Falls, Idaho	$911	7,823	Reactors, environmental restoration, waste management	Lockheed Idaho Technologies Company
Lawrence Berkeley/ Berkeley, California	$282	3,129	Basic energy sciences, nuclear and high-energy physics, biological and environmental research	University of California
Lawrence Livermore/ Livermore, California	$965	7,321	Defense, energy, high-performance computing, lasers	University of California
Los Alamos/ Los Alamos, New Mexico	$1,075	7,024	Defense, applied research in nuclear deterrence and security	University of California
Oak Ridge/ Oak Ridge, Tennessee	$577	4,714	Basic energy sciences, conservation, renewable energy	Martin Marietta Energy Systems
Pacific Northwest/ Richland, Washington	$532	4,383	Environmental restoration, waste management, energy research	Battelle Memorial Institute
Sandia/ Albuquerque, New Mexico	$1,304	8,494	Defense, nuclear weapons and safety	Martin Marietta Corporation

Note: The information for this appendix was supplied by DOE operations offices and the national laboratories.

Laboratory Programs We Reviewed

Laboratory	Programs submitted by laboratory
Argonne	•Integral Fast Reactor[a] •Operation and Research at the Tandem Linac Accelerator System •Electrochemical Dezincing of Scrap Galvanized Steel •Atmospheric Radiation Measurement[a] •Advanced Photon Source[a]
Brookhaven	•High-Energy Physics[a] •National Synchrotron Light Source[a] •Relativistic Heavy Ion Physics •Structural Biology[a] •High Flux Beam Reactor
Idaho National Engineering Laboratory	•Buried Waste Integrated Demonstration Program[a] •ICPP Spent Fuel and Waste Management Technology Development[a] •Power Reactors[a] •Biotechnology •Space Nuclear Power and Propulsion
Lawrence Berkeley	•Advanced Light Source[a] •Advanced Battery Consortium[a] •Solenoidal Tracker at RHIC •Human Genome Center •Center for Advanced Materials[a]
Lawrence Livermore	•Nuclear Weapons Research, Development, and Testing[a] •Nonproliferation, Arms Control, and International Security[a] •Fusion[a] •AVLIS •Environmental Technologies
Los Alamos	•Waste Treatment •Above Ground Experiments[a] •Human Genome Center[a] •High Temperature Superconductors •High Performance Computing and Communications[a]
Oak Ridge	•Basic Energy Sciences[a] •Conservation and Renewables[a] •Fusion[a] •Biology and Environmental Research •Advanced Neutron Source
Pacific Northwest	•Environmental Restoration and Waste Management[a] •National Security and Defense Technology[a] •Energy •Scientific Research[a] •Technology Transfer

(continued)

Laboratory	Programs submitted by laboratory
Sandia	•Complex 21 •Nonproliferation and Verification[a] •Microelectronics and Photonics Center[a] •Environmental Programs[a] •Combustion Research

[a]We discussed these programs with managers and staff. We selected these programs from those that each laboratory identified as best representing its future direction.

Comments From the Department of Energy

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

Department of Energy
Washington, DC 20585

January 24, 1995

Mr. Victor Rezendes
Director, Energy and Sciences Issues
Resources, Community, and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20585

Dear Mr. Rezendes:

See comment 1.

Thank you for the opportunity to comment on your draft report entitled Department of Energy: Clear Missions and More Effective DOE Management Can Enhance the Value of the National Laboratories (GAO/RCED-95-10).

The primary finding of your report is that the Department of Energy has not delineated specific missions for its laboratories, and that a more precise allocation and integration of missions across the DOE laboratory system would enhance the contributions of these institutions. Your report correctly observes that previous reports on the DOE laboratories have contained similar conclusions, yet your draft fails to recognize the historic actions which the Department is undertaking to reduce costs, reform business practices, and redirect its resources--including the DOE laboratories--toward the major areas of national need within the DOE mission areas. These actions, described below, demonstrate the Clinton Administration's seriousness in reinventing government organizations and services.

One prior report on the DOE laboratories to which your draft refers, the July 1992 Secretary of Energy Advisory Board (SEAB) Report on the DOE National Laboratories, contained a fundamental truism:

> "A strategic vision of the future missions of the national laboratories cannot be developed until the Department and Nation have developed a similarly clear vision of their role in the future multipolar world."

The 1992 SEAB report recommended that the Department and the national laboratories do their part in addressing this problem by developing a strategic plan which would serve as a guide for decisions regarding the missions of both the Department and the laboratories.

During her first few months in office, Secretary O'Leary and senior departmental officials responded to this recommendation by initiating the development of a strategic plan for the Department. Through a lengthy and unprecedented process involving hundreds of DOE and

laboratory employees, a strategic plan was developed which establishes priorities and a strategic vision for the Department in five areas: energy, environment, national security, science and technology, and industrial competitiveness.

Once the strategic plan was finalized, the Department had a tool which could be used to better focus Departmental resources, including the DOE laboratories. As the DOE strategic plan was being completed in early 1994, the Secretary established an independent task force--the Task Force on Alternative Futures for the Department of Energy National Laboratories, chaired by Robert Galvin, Chairman of the Motorola Executive Board--to provide recommendations on how best to align the DOE national laboratories with the energy, environmental, national security, scientific, and economic needs of the nation. The first meeting of the Task Force involved a briefing on the Department's strategic plan.

Over the past year, the Galvin Task Force has examined the capabilities of the DOE national laboratories in light of the DOE strategic plan. The Department appropriately has not instituted any drastic restructuring actions within the laboratory system, pending completion of the Galvin Task Force report. However, the Department in December 1994 announced its Strategic Alignment initiative as the means by which it would achieve alignment of the Department with the strategic plan and as one mechanism for implementing recommendations of the Galvin Task Force.

The Strategic Alignment project represents Phase-II of our strategic planning process, and is expected to result in the most dramatic changes in the way the Department conducts its business since the DOE was established in 1977. This intensive 120-day effort will culminate in recommendations on how to eliminate management inefficiencies, restructure the Department, and reduce the cost of DOE programs.

Throughout the past two years, the Department also has been working with Congress to adopt legislation that would clarify the missions for the DOE laboratories. In addition, we have pursued a major contract reform initiative which has been aimed, in part, at implementing performance-based contracts for the DOE's management and operations contractors. The contract reform initiative is expected to secure $2 billion in savings over a five year period.

We also have adopted a new institutional planning process for the laboratories which, for the first time, presents each laboratory's activities within the context of the five core business areas of the DOE strategic plan. More specifically, the defense-related R&D activities of the DOE weapons laboratories have been tightly linked with the specific requirements of our science-based stockpile stewardship program.

Your draft report is essentially silent on all of these initiatives, yet collectively they represent dramatic departures from the past and the basis for historic change in the future. In addition, we believe that your report's treatment of the question of laboratory missions misses some extremely important points.

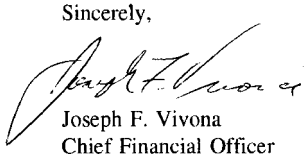
See comment 2.

The Department shares your observation that there is value to be gained from enhanced strategic focus at each of the DOE laboratories. However, we must note that it is important not to oversimplify this approach to laboratory management or to overestimate the potential benefits. For DOE's program-dedicated laboratories, the development of focussed missions is not an issue. For DOE's nine multi-program laboratories, however, the problem is far more complex. The distinctive value of these institutions stems to a significant degree from their multi-program, multi-disciplinary character. Forcing these labs to focus only within tight mission-driven parameters could sacrifice the unique versatility of these institutions to address large, complex problems in a way that more narrowly-focussed institutions cannot. Additionally, it is important to recognize the difficulty in trying to impose goal-oriented missions to areas of fundamental research--which is one of the major areas of DOE laboratory activity. In areas of fundamental science, new insights and discoveries cannot be predicted or scheduled according to a mission statement.

In summary, we believe that the Department of Energy has taken enormous strides in addressing problems--and symptoms of problems--identified in your report, and we feel that your report should have provided more direct attention to these actions.

Development of a new national consensus regarding the focus and management of the DOE national laboratories is a major challenge. Following the release of both your report and that of the Galvin Task Force, we hope to discuss further with you the inherent complexities in coordinating scientific and technical work over the very diverse set of R&D areas with which the Department and its laboratories operate.

Sincerely,



Joseph F. Vivona
Chief Financial Officer

The following are GAO's comments on the Department of Energy's letter dated January 24, 1995.

GAO's Comments

1. While we discussed most of these initiatives in the draft report, we updated the final report to reflect DOE's progress in these areas. We generally agree that DOE's initiatives, especially those in strategic planning and contract reform, will strengthen the Department's capacity to manage. We also agree that the initiatives have potential for helping DOE refocus the missions and improve the management of its laboratories. However, these initiatives have not yet been implemented. Furthermore, many of the contract reforms will take years to be fully implemented. Thus, the outcome of the initiatives, while promising, is very uncertain. We also caution that DOE has had planning systems in the past, has reorganized many times, and has tried to institute reforms in prior years—all without significant success. Additionally, as we discussed extensively in the report, prior advisory groups recommended that DOE refocus its laboratory missions and improve its management of them, yet DOE failed to take significant action.

2. We agree that one of the strengths of the multiprogram laboratories is their ability, as discussed in our report, to combine their multidisciplinary talents toward tackling large, complex problems. Our discussion of the need for more clarity in mission focus aims to facilitate, not hinder, more laboratory interactions in complex activities. We are not suggesting "forcing" the laboratories into "tight mission-driven parameters." Rather, we urge that DOE improve and expand its ability to integrate mission-focused research and development within and among its laboratories. The need for more mission clarity and focus reflected a widespread consensus among laboratory and DOE managers, as well as experts with whom we consulted.

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