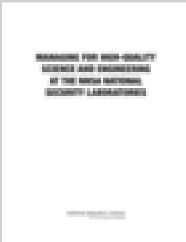

Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories

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Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories

Committee to Review the Quality of the Management and of the Science and Engineering Research at the Department of Energy's National Security Laboratories—Phase I

Laboratory Assessments Board

Division on Engineering and Physical Sciences

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[1] Deceased, July 28, 2011.

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Acknowledgment of Reviewers

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report:

Arden Bement (NAE), Purdue University,
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Will Happer (NAS), Princeton University,
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William C. Ostendorff, U.S. Nuclear Regulatory Commission,
Michael Telson, General Atomics, and
James Trainham (NAE), RTI International.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by Stephen Robinson (NAE), University of Wisconsin. Appointed by the National Research Council, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring board and the institution.

Contents

Summary

The three national security laboratories—Los Alamos National Laboratory (LANL), Sandia National Laboratories (SNL), and Lawrence Livermore National Laboratory (LLNL)—are managed by private sector entities under contract to the National Nuclear Security Administration (NNSA). The fiscal year (FY) 2010 Defense Authorization Act mandated that NNSA task the National Research Council (NRC) to study the quality and management of science and engineering (S&E) at these laboratories. Specifically, NRC was tasked to address for each laboratory:

1. The quality of the scientific research being conducted at the laboratory, including research with respect to weapons science, nonproliferation, energy, and basic science.
2. The quality of the engineering being conducted at the laboratory.
3. The criteria used to assess the quality of scientific research and engineering being conducted at the Laboratory.
4. The relationship between the quality of the science and engineering at the laboratory and the contract for managing and operating the laboratory.
5. The management of work conducted by the laboratory for entities other than the Department of Energy, including academic institutions and other federal agencies, and interactions between the laboratory and such entities.

This study is being conducted in two phases. This report covers the first phase, which addresses tasks (4) and (5) and partially addresses task (3): roughly speaking, how management at all levels affects the quality of the science and engineering (S&E) at the three laboratories. The study's second phase will evaluate the actual quality of S&E in key subject areas.

"Quality of S&E" measures the expertise and accomplishments in those areas of science and engineering that are necessary to accomplish the Laboratories' missions. "Quality of the management of S&E" measures management's capability to build, maintain and nurture S&E expertise for current and future mission needs. The S&E performed by any Laboratory can only be as good as the people employed. Thus, ensuring that high-quality people are attracted to the NNSA national security laboratories, and that they are retained, is a necessary condition for the Laboratories to carry out high-quality S&E. Assuming that foundation is available, high-quality S&E then requires good facilities and adequate resources, and operating processes that do not impede the ability of those scientists and engineers to perform at their highest levels. Management controls these conditions, and this report evaluates the quality of the laboratories' management, at all levels, by its success in providing these prerequisites for high-quality S&E. Management includes government (primarily NNSA and its three site offices), the management and operations (M&O) contractors, and on-site Laboratory management.

Because of this high-level view of management's role with respect to the quality of S&E, the study committee saw no distinction between management of the Laboratories' work for NNSA (roughly, Task 4) and their work for other entities (Task 5). Therefore, the discussion and recommendations in this report generally apply to the Laboratories' S&E work across the board.

Each of these laboratories is a federally funded research and development center (FFRDC) operated for NNSA under a government-owned/contractor-operated (GOCO) relationship. This contracting mechanism allows the government access to the capabilities and knowledge of industry and universities to manage these technically complex institutions. Contracting relationships for some

FFRDCs—in particular LLNL and LANL—have endured for many decades. In 2004, Congress mandated that the long-standing contracts with the University of California to manage LLNL and LANL be re-competed.[1] As a result, these two M&O contracts were awarded to two independent LLCs that both include Bechtel Corporation and the University of California.[2] Subsequently, a number of current and former employees of these Laboratories have expressed concerns about deterioration of morale at the Laboratories along with ongoing or potential declines in the quality of science and engineering. Many of those employees attributed those inferred trends to the new M&O contracts and contractors.

To carry out this study, the study committee met with congressional staffers, senior leadership of NNSA and the Department of Energy, staff from the NNSA site offices that serve as a vital link between NNSA and day-to-day Laboratory management, and a wide variety of former and current employees of the three Laboratories. It held site visits at each of the Laboratories, organized around panel discussions with a large number of employees at different levels, from bench scientists to senior management. The study committee controlled the agendas for all of its meetings and had final say on the list of speakers. At LANL and LLNL, the study committee also held well-advertised public sessions at which anyone was invited to speak and management was voluntarily absent. The study committee also examined past reports on the Laboratories and the language of the current contracts. Details of the study processes are included in Chapter 1 of this report.

While the new contracts at LANL and LLNL clearly produced a noticeable level of staff frustration, staff members with whom the study committee interacted continued to show a strong commitment to their work. Those who testified to the study committee about morale problems spoke primarily of the situation as it existed at the time of the contract transitions, or of the subsequent layoffs at LLNL. When the study committee examined the M&O contracts, it found very little that prescribes the management of S&E. Many of the bureaucratic frustrations raised at all levels appear to be either within the power of the Laboratories to address or driven by governance strategies above the Laboratory level: they are not traceable to the M&O contractor or the contracts themselves. It is indeed true that all three Laboratories have been under cost and funding pressure. In the case of LANL and LLNL that pressure is connected with the contract change; the costs of their re-competed contracts are significantly greater than the previous contracting arrangements. But this is due to the combined effect of increased contractor fees, pension obligations, and, in the case of LANL, a need to now pay New Mexico state taxes. Accounts that attribute the increased cost simply to award fees are not accurate. Some employees and stakeholders have been concerned that M&O contractors pursuing a fee might not act in the public interest, and this is an important issue. Therefore, the study committee discussed incentives with the three Laboratory directors and was convinced that their primary objective remains to manage the Laboratories in the public interest.

An evolution of the Laboratory missions to "national security laboratories" is well underway. The absence of nuclear testing means that experimental validation of much of the S&E performed by the Laboratories is not possible, and thereby lessening the intellectual attractiveness of the work for at least some prospective employees. The expansion of the Laboratories' mission into new non-nuclear areas offers the prospect of increasing the Laboratories' appeal to top-quality scientists and engineers while also serving important national security missions. Thus, the quality of S&E, being preconditioned on attracting high-quality people, depends in the long run on successfully making this transition to national security laboratories. It is for this reason that the study committee was pleased to see that, a governance charter has been established among the Departments of Energy, Homeland Security, and Defense, plus the Office of the Director of National Intelligence.[3] Many of the challenges facing these agencies are synergistic

[1] U.S. Congress, H. Rpt. 108-292, Division C-Energy and Water Appropriations Act, 2005, Sec. 301, p.151, November 2004. The new M&O contractor for LANL took over in 2006, and the new contractor for LLNL began work in 2007.

[2] The parent organizations of Los Alamos National Security (LANS) are the University of California, Bechtel, Babcock and Wilcox, and URS. For Lawrence Livermore National Security (LLNS), the parent organizations consist of the same four plus Battelle.

[3] See Appendix A.

with the capabilities of these NNSA Laboratories, and they can, and do, benefit from the large investments that NNSA and its predecessors have made in S&E capabilities. In a time of constrained budgets, broadening the mandate to a national security mission helps preserve S&E expertise by providing opportunities to work on problems posed by partner agencies. However, while such Work for Others (WFO) is very important for the future of S&E at the Laboratories, all three of the Laboratory directors were very clear that maintenance of the nuclear weapons stockpile remains the core mission of the Labs.

Recommendation 3.1.[4] The study committee recommends that Congress recognize that maintenance of the stockpile remains the core mission of the Labs, and in that context consider endorsing and supporting in some way the evolution of the NNSA laboratories to national security laboratories as described in the July 2010 four-agency Governance Charter for an Interagency Council on the Strategic Capability of DOE national laboratories.

A crucial part of the Laboratories' ability to conduct their missions is derived from Laboratory Directed Research and Development (LDRD), the primary source for internally directed R&D funding. Among its other benefits, LDRD provides a major resource for supporting and training staff at each Laboratory.

Recommendation 3.2. The study committee recommends that Congress and NNSA maintain strong support of the LDRD program as it is an essential component of enabling the long-term viability of the Laboratories.

Historically, Laboratories had another source of discretionary research spending. The weapons program (at each Laboratory) had the flexibility to use part of its budget to fund a robust research program, in support of the core weapons mission. Currently, the weapons program budget is subdivided into so many categories with so many restrictions that this important flexibility is effectively lost. This loss in funding flexibility has significantly reduced the amount of core program research being performed at the Laboratories. This lessens the appeal of the Laboratories when recruiting scientists and engineers.

Recommendation 3.3. The study committee recommends that Congress reduce the number of restrictive budget reporting categories in the Nuclear Weapons Program and permit the use of such funds to support a robust core weapons research program and further develop necessary S&E capability.

In the view of this committee, the relationship between NNSA and its national security laboratories is broken to an extent that very seriously affects the Labs' capability to manage for quality S&E. There has been a breakdown of trust and an erosion of the partnering between the Laboratories and NNSA to solve complex S&E problems; there is conflict and confusion over management roles and responsibilities of organizations and individuals. For example, the study committee heard reports of mid-level issues being elevated to the Laboratory director level because there was no clarity about how to resolve disputes between a Laboratory and an NNSA Site Office. Another example was a recent instance in which NNSA HQ tried to overrule a Laboratory's best scientific judgment about how to carry out a scientific task. Subsequently, language appeared in a congressional report opposing that NNSA order. A better mechanism could be established for resolving technical disputes, without elevating them to top NNSA management and congressional levels. A technical advisory committee, established at the NNSA level, would be a helpful mechanism for filling this gap in S&E management. More generally, such an advisory committee could monitor progress on other aspects of roles and responsibilities, as described next.

[4] The first number refers to the chapter of the report in which the recommendation appears.

Erosion of trust on both sides of the relationship shapes the oversight and operation of the Laboratories, resulting in excessive bureaucracy governing Laboratory activities at a deep level of detail, including the conduct of S&E. The study committee observed widespread perception among Laboratory S&E staff and some managers that NNSA oversight activities were inconsistent with statements by NNSA that oversight is accomplished without being intrusive; i.e., “eyes on, hands off.” The study committee was repeatedly told that oversight officials frequently blur the line between oversight and evaluation and insert themselves in an operational role. This problem was reported to occur in many aspects of Laboratory activities.

This erosion of the trust relationship is prominent with respect to LANL, where past failures in safety, security, and business practices attracted much national attention and public criticism. But it has also spilled over to LLNL and SNL. The loss of trust in the ability of the Laboratories to maintain operational goals such as safety, security, environmental responsibility and fiscal integrity has produced detailed scrutiny by NNSA HQ and site offices and increased aversion to risk. A major byproduct of this has been to create a bias against experimental work, because of the onerous processes sometimes required before running an experiment. The bias is problematic because experimental science is at the very heart of the scientific method.

The FFRDC relationship is based on a partnership between the Federal government and a Laboratory in which the government decides what problems need to be addressed and the contractor determines how best to address those problems. There is a perception among S&E staff and managers at the three Laboratories that NNSA has moved from partnering with the Laboratories to solve scientific and engineering problems, to assigning tasks and specific S&E solutions with detailed implementation instructions. This approach precludes taking full advantage of the intellectual and management skills that taxpayer dollars have purchased. The study committee found similar issues in transactional oversight of safety, business, security and operations. Science and engineering quality is at risk when Laboratory scientists and engineers are not encouraged to bring forth their creative ideas in partnership with NNSA to solve problems vital to our national security.

Recommendation 4.1. The study committee recommends that NNSA and each of the laboratories commit to the goal of rebalancing the managerial and governance relationship to build in a higher level of trust in program execution and laboratory operations in general.

Recommendation 4.2. The study committee recommends that NNSA and the laboratories agree on a set of principles that clearly lay out the boundaries and roles of each management structure, and also that program managers at headquarters, the Site Offices, and in the laboratories be directed to abide by these principles.

For example, the site manager and the director and/or deputy director of each laboratory could establish, in consultation with other laboratory staff, a process to identify and agree on eliminating certain oversight procedures that are not necessary or related to the overall goals of the laboratory. Similarly, some mechanism could be established to filter program taskings at both the headquarters level and at the laboratory senior management level to assure that each tasking is necessary and consistent with the agreed management principles.

Recommendation 4.3. The study committee recommends that the goal of rebalancing the relationship and the set of principles laying out the boundaries and roles of each management structure be memorialized in memoranda of understanding between NNSA and its laboratories. NNSA should assess performance against these understandings on an annual basis over a five-year

period and report these assessments to Congress.[5]

A key to ongoing laboratory success has been a strong focus on the long term and on maintaining deep technical capability. Under the new management structure of the laboratories, industrial and other private sector partners can help assure that this long-term focus is maintained.

Recommendation 5.1. The study committee recommends that the NNSA, Congress, and top management of the laboratories recognize that safety and security systems at the Laboratories have been strengthened to the point where they no longer need special attention. NNSA and laboratory management should explore ways by which the administrative, safety, and security costs can be reduced, so that they not impose an excessive burden on essential S&E activities.

Recommendation 5.2. The study committee recommends that NNSA reduce reporting and administrative burdens on the laboratory directors, and purposely free directors to establish strategic science and engineering direction at the laboratories.

Among other benefits, this may encourage laboratory directors to serve longer terms with the organization.

[5] The committee observes that it is important to design this approach to be self-correcting and to avoid problems such as: (1) adding to a check-list approach to management; (2) enforcing measures that annual assessment shows to be unworkable; and (3) requiring congressional intervention when not needed.

1
Introduction

STATEMENT OF TASK

In the FY2010 National Defense Authorization Act, P.L. 111-84, Congress directed DOE to request the National Academy of Sciences to review the quality of science and engineering research at the three national security laboratories. Specifically, the Congress mandated that

> (a) IN GENERAL.—Not later than 60 days after the date of the enactment of this Act, the Secretary of Energy shall enter into an agreement with the National Academy of Sciences to conduct a study of the following Laboratories:
> (1) The Lawrence Livermore National Laboratory, California.
> (2) The Los Alamos National Laboratory, New Mexico.
> (3) The Sandia National Laboratories, California and New Mexico.
> (b) ELEMENTS—The study required under subsection (a) shall include, with respect to each Laboratory specified in such subsection, an evaluation of the following:
> (1) The quality of the scientific research being conducted at the Laboratory, including research with respect to weapons science, nonproliferation, energy, and basic science.
> (2) The quality of the engineering being conducted at the Laboratory.
> (3) The criteria used to assess the quality of scientific research and engineering being conducted at the Laboratory.
> (4) The relationship between the quality of the science and engineering at the Laboratory and the contract for managing and operating the Laboratory.
> (5) The management of work conducted by the Laboratory for entities other than the Department of Energy, including academic institutions and other Federal agencies, and interactions between the Laboratory and such entities.

The principal motivation of Congress for this study is given in the conference report associated with this Act:[1]

> There is a growing concern about the ability of the Department of Energy to maintain the overall quality of the scientific research and engineering capability at the three Laboratories. This concern was most recently highlighted in the report of the Congressional Commission on the Strategic Posture of the United States. The conferees believe that an even handed, unbiased assessment of the quality of the scientific research and engineering at each of the three Laboratories, with a clear understanding of the criteria used to measure quality and what factors influence quality would be useful in long-term planning for the operations of the Laboratories.

The study was divided into two consecutive phases; the first to look at the management issues and the second to assess the quality of the science and engineering research.[2] This report covers the first phase, which addresses tasks (4) and (5) and partially addresses task (3): roughly speaking, how

[1] U.S. Congress, H. Report 111-288 (2010), p. 910.
[2] This division was largely motivated by security concerns. However, it facilitated appointing two different study committees, one focused on management and one on science and engineering.

management at all levels affects the quality of the science and engineering (S&E) at the three laboratories. The study's second phase will evaluate the quality of S&E in key subject areas.

To conduct the first phase, the NRC formed a study committee whose membership was carefully chosen to provide broad and deep applicable expertise and experience in the management of S&E at major research and development laboratories. The study committee members include former directors of major government and industry laboratories, current and former laboratory executives, and others with relevant experience and expertise.

Each of these NNSA national security laboratories is a federally funded research and development center (FFRDC) operated for NNSA under a government-owned/contractor-operated (GOCO) relationship. This contracting mechanism allows the government access to the capabilities and knowledge of industry and universities to manage these technically complex institutions. Contracting relationships for some FFRDCs—in particular, LLNL and LANL—have endured for many decades. In 2004, Congress mandated that the long-standing contracts with the University of California to manage LLNL and LANL be re-competed.[3] As a result, these two management and operations (M&O) contracts were awarded to two independent LLCs that both include Bechtel Corporation and the University of California.[4] Subsequently, a number of current and former employees of these laboratories have expressed concerns about deterioration of morale at the laboratories along with ongoing or potential declines in the quality of science and engineering. Many of those employees attributed those inferred trends to the new M&O contracts and contractors.

CONDUCT OF THE STUDY

To investigate these concerns, the study committee met with congressional staffers, senior leadership of NNSA and DOE, staff from the NNSA site offices that serve as a vital link between NNSA and day-to-day laboratory management, and a wide variety of former and current employees of the three laboratories. It held site visits at each of the laboratories, centered on panel discussions with a large number of employees at different levels, from bench scientists to senior management. At LANL and LLNL, the study committee also held well-advertised public sessions at which anyone was invited to speak with management voluntarily absent. A complete list of those who made presentations or provided testimony to the study committee and/or held discussions with the study committee during open sessions of three study committee meetings and the laboratory visits is contained in Appendix B.

At the SNL site visit, the study committee engaged in extensive discussions with 20 SNL employees. At LANL, the study committee benefited from input from 38 employees, and at LLNL, 42 employees. The public comment sessions did not draw a large number of speakers: only 4 at LANL, and 6 at LLNL. The tone of the public comment sessions was, like that of the interactions with laboratory staff, constructive. The laboratory staff members, raised many points of concern, but on several occasions also offered statements of satisfaction and pride. Appendix 8 lists the questions that were sent ahead of time to each of the panels for these site visits.

As context for its evaluation of the laboratories' management, the study committee identified the high-level ways in which management of any laboratory affects the quality of the S&E. First, the S&E can only be as good as the people employed. Thus, ensuring that high-quality people are attracted to the NNSA national security laboratories, and that they are retained, is a necessary condition for the laboratories to carry out high-quality S&E. Assuming that foundation is available, high-quality S&E then

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[3] U.S. Congress, H. Rpt. 108-292, Division C-Energy and Water Appropriations Act, 2005, Sec. 301, p.151, November 2004. The new M&O contractor for LANL took over in 2006, and the new contractor for LLNL began work in 2007.

[4] The parent organizations of Los Alamos National Security (LANS) are the University of California, Bechtel, Babcock and Wilcox, and URS. For Lawrence Livermore National Security (LLNS), the parent organizations consist of the same four plus Battelle.

requires good facilities and adequate resources, and operating processes that do not impede the ability of those scientists and engineers to perform at their highest levels. Management controls these conditions, and this report evaluates the quality of the laboratories' management, at all levels, by its success in providing these prerequisites for high-quality S&E.

Because of this high-level view of management's role with respect to the quality of S&E, the study committee saw no distinction between management of the laboratories' work for NNSA (roughly, Task 4) and their work for other entities (Task 5). Therefore, the discussion and recommendations in this report generally apply to the laboratories' S&E work across the board.

The study committee examined the substantial body of relevant work that has been undertaken over the past 10-15 years (see Appendix C). The nuclear testing moratorium, the Stockpile Stewardship Program, the operational problems at LANL, and the change in M&O contractors at LANL and LLNL stimulated a number of major studies, some of which are presented and discussed in Appendix C. These studies contain much valuable research and insightful analysis, but each is a product of the specific time and issue(s) that stimulated it and the situation at the laboratories has been evolving. Accordingly, in accordance with the SOT that requested an evaluation of the current situation and in consultation with sponsors (NNSA and congressional committee staff), the study committee took its task to be to take a fresh look at the management of these laboratories in 2011 through the perspectives of the study committee members, and not to extend, critique, or update previous work or to provide a scorecard of the implementation of earlier findings and recommendations.

The study committee also examined the most recent available M&O contracts, performance evaluation plans (PEP), performance evaluation reports (PER), contract management plans, parent organization oversight plans, and other similar documents for each of the three laboratories (see Appendix D).

The study committee assimilated and analyzed this information to develop a detailed understanding of the current state of governance and management, and of the conditions under which science and engineering are conducted at the three laboratories, within the relevant historical context with particular—but not exclusive—emphasis on those matters that have been affected by the changes in M&O contractors at LANL and LLNL. The study committee focused on the interactions among government agencies (especially NNSA and the DOE site offices), the M&O contractor organizations, laboratory management, and research staff at the laboratories.

Portions of each meeting and site visit were devoted to closed sessions, at which its members deliberated on their findings, conclusions, and recommendations, which are presented in this report. In arriving at its findings and recommendations, the study committee applied its collective judgment to determine the consistency, credibility, and implications of the information it had gathered. Based on this process, the study committee developed an informed consensus regarding facts, significant perceptions among staff and management, and problems that are real and significant. Trends and implications that might affect future quality of science and engineering at the laboratories were identified, as was the role of management in these trends. As it identified trends and problems, the study committee strove (in keeping with the study task) to identify the degree to which each of those could be associated with the change in M&O contractors at LANL and LLNL.

OUTLINE OF THE REPORT

Chapter 2 of this report provides a discussion of the effects of the contracts on the management of S&E at LLNL and LANL. Comparisons are made to SNL, which has had the same M&O contractor since 1993.[5] Chapter 3 presents the study committee's assessments of the evolution of the mission of the NNSA laboratories and the management and performance of research in support of the missions, and the relationship between the Laboratory Directed Research and Development (LDRD) program and the

[5] SNL has been managed by the Sandia Corporation, a Lockheed Martin company, since 1993.

ability of the laboratories to fulfill their mission. Chapter 4 provides an analysis of the relationships among the several players in the management of the labs—the NNSA, the site offices, the contractors, and the laboratory managers—and the effect of that relationship on the laboratories' ability to carry out science and engineering research. Finally, Chapter 5 examines the framework for managing science and engineering research at the labs.

In addition, the following appendices are included: Appendix A: Governance Charter for an Interagency Council on the Strategic Capability of DOE National Laboratories as National Security Assets; Appendix B: Presenters and Speakers at Committee Meetings; Appendix C: Review of Relevant Studies and Reports 1995-2010; Appendix D: The Structure of Management Organizations that Govern the NNSA National Security Laboratories; Appendix E: Conduct and Evaluation of Science and Engineering Under the Terms of the Management and Operations (M&O) Contracts; Appendix F: The Investment/Value Returned Framework for Management of S&E; Appendix G: Selected Supporting Information; and Appendix H: Questions Posed to Panels at the Site Visits.

2

Contracts

Throughout their existence, all three of the NNSA laboratories have been operated as government-owned/contractor-operated (GOCO) federally funded research and development centers (FFRDC). In this arrangement the government defines its needs, funds the work, and owns the facilities; while the M&O contractor operates the facilities and works in partnership with the government to create solutions to problems defined by the government needs[1]. One of the reasons the government establishes GOCO relationships is so government can take advantage of the management skills and knowledge of U.S. industry and universities. GOCO relationships have been used by several federal agencies.

Congress expects that NNSA will provide oversight of activities at each of the three laboratories, and will ensure that the work is done safely, in an environmentally sound manner, and with high standards of security and fiscal integrity. To that end NNSA has Site Offices at each of the laboratories that oversee all aspects of laboratory operations. The Los Alamos Site Office (LASO), Livermore Site Office (LSO), and Sandia Site Office (SSO) report to the Deputy NNSA Administrator for Defense Programs (NA-10).

Until the recent contract changes, the University of California had managed the LANL and LLNL since they were formed. Since 1949, SNL has had two contractors. The first contractor was AT&T. When AT&T gave up the contract in 1993, Martin Marietta (later Lockheed Martin) was awarded the contract and remains the contractor today.

Some of the concerns associated with the new contracts at LANL and LLNL are about the much higher management fees contained in the current contracts. When the University of California alone managed these laboratories, the annual fee for each was less than $10 million. NNSA related to the study committee that in order to attract industrial bidders the management fee was significantly increased. As a result, the annual fee for managing LANL and LLNL grew to about $60 million and $40 million, respectively.[2] Moreover, in the case of LANL, private contractors in New Mexico are required to pay a gross receipts tax which the University of California, as a public entity, was not required to pay. These costs—and others associated with the contract changes, in particular the need for the federal government to contribute $30 million to the employee pension funds at each of these two laboratories—had impacts on the budgets of both laboratories, on the order of $100 million per year. These pension costs are contained in separate DOE appropriations accounts from laboratory management costs. A summary of major costs is provided in the Appendix F section, “Costs Associated with LANL and LLNL Contract Changes.” However, it is difficult to create an apples-to-apples comparison of costs before and after these contract changes. For example, then-LLNL Director George Miller told the study committee that he estimated the change at LLNL increased overhead costs by $130 million, in contrast to the study committee’s estimate of $70 million (see the Appendix F section “Costs Associated with LANL and LLNL Contract Changes”). In addition, it is important to compare these changes to the total operating budgets of the two laboratories. In FY2010, LLNL received $1.153 billion and LANL received $1.681

[1] The FFRDC arrangement is specified in the M&O contracts for each of the three laboratories.

[2] The fee at each laboratory varies by year according to a schedule specified in each contract. The fee at SNL is about $25 million per year and has been roughly the same since 1993.

billion from DOE for activities involving S&E.[3][4] Each laboratory also received funds from other federal agencies for work for others. In any case, the increase in fee—about $35 million additional in FY11, according to the Livermore Site Office manager, who also said that 30 percent of the fee is fixed and 70 percent is linked to performance—is a small fraction of the total operating budget of the laboratories and not likely to be the dominant cause of financial changes at the laboratories, contrary to some narratives.

Following competition, the contracts for LANL and LLNL were awarded to two separate Limited Liability Corporations (LLCs). The parent corporations of Los Alamos National Security are the University of California, Bechtel, Babcock and Wilcox, and URS Corporation. The same four, plus Battelle Memorial Institute, are the parents of Lawrence Livermore National Security.

At all three laboratory site visits, and at other open study committee meetings, the study committee heard presentations and discussions of management-related matters that make the conduct of science and engineering more difficult, or at least have the potential to do so. Some presenters (and others) attribute these problems at LANL and LLNL to the new contract. The study committee noted that many of the most significant problems are common to all three laboratories, and for that and other reasons concluded that such problems are not the result of the contract changes (see Chapter 4). In fact, the Livermore Site Office reported to the study committee that at LLNL increased fees and pension costs were offset significantly by reduced costs of government contributions to the University of California pension system under the new contract arrangements.[5]

Some laboratory S&E staff, and former staff and managers have voiced strong concern that the increased fees have and/or will influence management decisions in a way that may be deleterious to the quality of S&E. However, when the study committee asked for details of specific deleterious effects, it did not receive any. When the study committee examined the M&O contracts, it found very little that prescribes the management of S&E. During its site visits with dozens of scientists and engineers at all levels of the three laboratories, the study committee asked again for specific illustrations of such problems but did not receive any data suggesting that the contractor fees are affecting management decisions with respect to S&E. Because this is an important issue that merits continued vigilance, the study committee discussed incentives at length with the three laboratory directors. The study committee was convinced that their primary objective remains to manage the laboratories in the public interest. This view was also asserted by NNSA senior management, who told the study committee that the pursuit of incentive award fee was not a significant motivator for the laboratories.

The study committee concluded, though, that there are serious management issues. It is concerned that the overall management relationship between NNSA and its national security laboratories is becoming dysfunctional. In part, increasing government focus on the details of both operations and technical work is a symptom of declining trust (by government) of laboratory managers and S&E staff, and contributes to increasing aversion to risk in the conduct of S&E. An increasing amount of the available time of both laboratory managers and S&E staff is spent on details of operational and administrative matters—such as gathering approvals to work at home, to remove laboratory computers from the premises, to purchase office supplies and to bring uncleared visitors into the laboratory - thus reducing time available for mission science and engineering. If left unaddressed, this will erode scientific initiative. The study committee also shares the concern, voiced by several presenters at study committee meetings, that these trends and problems may lead to a decline in experimental work. (See more discussion of these matters in Chapter 4.)

Despite hearing concerns about conditions at the labs,[6] the study committee did not find increased turnover of the S&E staff apart from the reduction in force at LLNL after the change in contract. A LANL

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[3] See FY2012 DOE Budget Justification; http://www.mbe.doe.gov/crorg/cf30.htm#Justifications.

[4] Funds were also received from DOE for environmental cleanup.

[5] Private communication to the study director. The savings were to the government, and not shared by the laboratory, because they were matters under the government contract with University of California.

[6] This includes, but is by no means limited to, candid statements to the committee at laboratory visits and elsewhere. There have been blogs (see “LLNL: The True Story” at http://llnlthetruestory.blogspot.com/; “LANL:

Fellow told the study committee that the attrition rate in recent years has been about 4 percent per year; a senior LLNL manager estimated that staff turnover peaked at about 5 percent per year after the contract transition and layoffs, and has now dropped. Meanwhile, the laboratories still seem to be successful in recruiting. The study committee was told that SNL hired on the order of 700 people in 2010 and that the LANL postdoctoral program, which is a primary tool for recruiting new S&Es, is at its largest ever. A LANL Fellow said that the quality of postdocs—as measured by publications and citations—has been increasing in recent years. A senior SNL person who is involved in recruiting provided an anecdote that, where the laboratories might have in the past received 40 applicants in response to a posting, now they might only hear from 10-12, many of who have some past connection to a national laboratory. But that staffer thinks part of the problem is the shrinkage in the U.S.-citizen pipeline. An LLNL manager who recruits primarily for computing expertise still has a success rate of about 80 percent, but it used to be 98 percent (although 80 percent is a more typical historical acceptance rate across the entire laboratory). Some noted competition in recent years from companies like Google, and others observed that the recent pay freeze has made it a bit harder to recruit new people. The study committee also expects that current economic conditions might discourage career changes, and that improving job prospects elsewhere could put pressures on recruitment of new staff and retention of experienced scientists and engineers.

Finding 2.1. The study committee found that the current M&O contracts for LLNL and LANL have significantly increased the cost of operating those laboratories. Specifically, they have added costs that have to be absorbed within the top-line laboratory budgets, thereby decreasing funds available to support science and engineering. However, the study committee has not found evidence that the management of the scientific enterprise has been biased in the pursuit of award fee. If the incentive fee becomes too high, or the criteria upon which the fee is measured discourage experimental science or innovation, however, the scientific enterprise at the laboratories could well deteriorate over time.

Changes associated with the new contracts at LANL and LLNL—including both uncertainties associated with the competition and actual changes in employment conditions and status (e.g., retirement and healthcare benefits)—have had negative effects on laboratory personnel, as has the LLNL reduction in force. While there is a widespread national trend toward less generous pension and healthcare benefits, laboratory personnel underwent an abrupt change in status from employees of the University of California to employees of LANS or LLNS, and the change in benefits was similarly abrupt. There is widespread perception among laboratory personnel that the new contracts are not to their benefit.[7] On the other hand, the study committee found that the staff at LANL and LLNL, as well as SNL, remains highly motivated and enthusiastic about the S&E work at the laboratories.

Staff and management at all three of the laboratories expressed concern that, in their view, the managerial relationship between NNSA and the laboratories has lost the FFRDC/GOCO partnership character. They assert that it is now primarily a contractor relationship in which the government specifies tasks rather than making full use of the laboratories' skills in directing and executing S&E. This is in contrast to NNSA's statement that they manage with "eyes on and hands off."

The Real Story" http://www.parrot-farm.net/lanl-the-real-story/), press articles (see "The Assault on Los Alamos National Laboratory: A drama in three acts," *Bulletin of the Atomic Scientists,* by Hugh Gusterson at http://bos.sagepub.com/content/67/6/9.full, and "Analyst Sees Lasting Damage to Los Alamos, Livermore," *The Livermore Independent*, by Jeff Garberson at http://www.independentnews.com/news/article_dcc64e10-1c8b-11e1-b5c0-001871e3ce6c.html), and statements to state and federal representatives and senators (see presentation by UPTE representative Jeff Colvin to the committee at http://www.upte.org/NAStestimony.pdf).

[7] H. Gusterson, 2011, "The Assault on Los Alamos National Laboratory: A Drama in Three Acts," *Bulletin of the Atomic Scientists,* at http://bos.sagepub.com/content/67/6/9; J. Garberson, (2011, "Analyst Sees Lasting Damage To Los Alamos, Livermore Labs"; testimony in meetings at Los Alamos and Lawrence Livermore by staff and presentation by Jeff Colvin.

Appendix D summarizes selected contract provisions related to the quality of science and engineering. Each of the three contracts states that the performance of quality of S&E is important to the laboratory. However, typically 10 percent or less of the performance fee is tied specifically to the quality of S&E.

3

Research Base and Evolution of the Mission

EVOLUTION OF THE NNSA NATIONAL SECURITY LABORATORIES' MISSION

In the early decades of the nuclear weapons program, as the world was moving into the cold war, the basic and applied research activities at LANL, LLNL, and SNL were largely focused on nuclear weapons science and engineering. The pace of weapons development was high, and the resources provided to the program were enough to adequately support all the activity.

By the last quarter of the 20th century, the pace of work slowed to some extent. The resource base was not as robust as it had been, and this was a good reason to look outside the laboratories for opportunities to apply the technology developed at the labs.[8] Some areas that were attractive early on were in the areas of electronic design, such as radar and fuses, in energetic materials and high explosives design for non-nuclear applications, and in hydrodynamics code capabilities applied to areas such as armor penetration studies.

These early moves into mission-related "Work for Others" (WFO) proved advantageous to the laboratories on several fronts. They were able to contribute technical advances in areas that were clearly important to national security. And they were able to support a larger staff working in areas that were directly relevant to nuclear weapons, maintaining a larger in-house talent pool than could be supported solely from the nuclear weapons budget.

The 1992 unilateral nuclear testing moratorium and the beginning of the Stockpile Stewardship Program stabilized the laboratory budgets for a few years, but then the gradual budget deterioration began again. The leadership of the laboratories recognized that they would not be able to sustain the S&E staffing levels that they believed were necessary to steward the nation's nuclear weapon capability in the long term. This was not a sudden discovery, but a growing recognition over some time.

A logical solution was to continue the trend already in place of applying the laboratories' capabilities to other national security problems in a way that would be supportive of the core mission. SNL took the lead in this move, and it is still ahead of the other two laboratories. This sort of diversification has the combined benefits of providing useful contributions to the nation while supporting staff members who have skills that will likely be needed for the nuclear weapons program in the future. Research projects of this kind were available in the broad areas of defense, intelligence, and what is now known as homeland security. This was the real beginning of the transition of these three laboratories from nuclear weapons laboratories to national security laboratories.

As these activities outside the core program began to grow, there were some unexpected benefits and some problems as well. One of the important benefits was the increased diversity of applied programs, which was helpful in recruiting staff. That is because the absence of nuclear testing means that experimental validation of much of the S&E performed by the laboratories is not possible, and this lessens the intellectual attractiveness of the work for at least some prospective employees. The expansion of the laboratories' mission into new non-nuclear areas offers the prospect of expanding the laboratories'

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[8] For example, the Nunn-Warner Blue Ribbon Group made recommendations for closer ties with the DOD in 1984. The "Joint Munitions Program" with the DOD followed and has continued to be successful. See memorandum of understanding between DOD and DOE, December 21, 1984.

appeal to top-quality scientists and engineers while also serving important national missions. Thus, the quality of S&E, being preconditioned on attracting high-quality people, depends in the long run on successfully making this transition to national security laboratories.

It is for this reason that the study committee was pleased to see that a governance charter was established in June 2010 among the Departments of Energy, Homeland Security, and Defense, plus the Office of the Director of National Intelligence[9]. Many of the challenges facing these agencies are synergistic with the capabilities of these NNSA laboratories, and they can, and do, benefit from the large investments that NNSA and its predecessors have made in S&E capabilities. In a time of constrained budgets, broadening the mandate to a national security mission at the NNSA laboratories helps preserve S&E expertise by providing opportunities to work on problems posed by partner agencies. The four-agency charter recognizes the value of the laboratories to broad national security research activities, and that this broader work is synergistic with the laboratories' core nuclear weapons mission. The transition from nuclear-weapons-only laboratories to national security laboratories is well underway.

Finding 3.1. All three laboratories and the NNSA have strongly emphasized that their core mission is to assure a reliable, safe, and secure nuclear weapons stockpile, and that all other research activities contribute to the development and maintenance of the scientific and engineering capabilities required to effectively execute this mission.

Finding 3.2. NNSA leadership has expressed a compelling vision for the laboratories as national security labs, maintaining nuclear weapons as the core mission while also contributing importantly to other national security areas.

Finding 3.3. Work for Others at the three national security laboratories benefits the nation in two ways. It produces valuable research and technology for the national security efforts of the Departments of Defense and Homeland Security, and for the Intelligence Community; and it provides a mechanism to help sustain some of the people and capabilities for the nuclear weapon program. It also strengthens the laboratories' broad S&E capabilities.

Recommendation 3.1. The study committee recommends that Congress recognize that maintenance of the stockpile remains the core mission of the labs, and in that context consider endorsing and supporting in some manner the evolution of the NNSA laboratories to national security laboratories as described in the July 2010 four-agency Governance Charter for an Interagency Council on the Strategic Capability of DOE National Laboratories.

Conducting applied program work outside the nuclear weapons program for agencies other than DOE, however, does not encourage those other sponsoring government agencies to contribute to the long-term institutional support needed to maintain the laboratories. Work for agencies other than DOE (which is referred to as Work for Others, or WFO), is conducted under task-order contracts. The contracts specify and fund specific work and deliverables, but rarely contribute to the construction of facilities and purchase of major equipment. These other agencies are exploiting the infrastructure that has resulted from NNSA's investment, and are by and large not contributing directly to the building and maintenance of that infrastructure. This causes problems not only for NNSA and ultimately for the laboratories, but also for the other agencies, because the NNSA cannot provide long-term institutional support for programmatic work that is not theirs. This situation limits what the laboratories can do for the other agencies, since it limits them to using what they have without acquiring facilities, equipment, and skills specifically to support their work for these other agencies. The four-agency agreement does not solve the

[9] See Appendix A, "Governance Charter for an Interagency Council on the Strategic Capability of DOE National Laboratories as National Security Assets."

long-term problems of resources and institutional support, but it is a good beginning that provides a structure within which a solution may be reached.

SCIENCE AND ENGINEERING SUPPORTING THE MISSION

The national security laboratories maintain S&E research in diverse areas that are broadly related to their mission areas. Some of this S&E, such as plutonium science, is unique to their core mission of nuclear weapons, and it must be supported in these laboratories in order for them to do their mission. The laboratories also conduct research in areas that, while related to their core mission, are not unique to the core. An example is astrophysics, which is directly applicable to some fundamental parts of nuclear weapon explosion codes, but where research is also done in universities. The principal reason given by the laboratories for conducting research in these areas is that it allows them to attract high quality people who then contribute to the programmatic mission areas during their careers in the laboratory.

The quality of the research conducted in the laboratories is clearly an important part of being able to attract good people. Each laboratory maintains post-doctoral research programs that are popular and highly competitive. The laboratories cite their post-doctoral programs as one of the most important sources of permanent S&E staff.

The staff recruited into the laboratories because of the S&E research programs have contributed significantly to the core mission. Laboratory leaders told the study committee that essentially all the people recruited into basic research activities have spent time working on core mission projects. Many transfer to full time participation in the applied programs. Others stay in the research organization and spend part of their time contributing to applied programs.

An example of the latter can be found in the Hydrodynamics Group in the Theoretical Physics Division at LANL. This is primarily a basic research group, but over many years a former group leader and other staff members have made significant contributions to the hydrodynamics portions of the nuclear weapons codes.

There are many examples in each laboratory of staff who were recruited to the laboratory to work in fundamental (basic) research activities, and who have subsequently moved into the core applied programs. In addition, some of these people have taken on major leadership roles in the nuclear weapons program. Specific data on career paths are not available. However, the following examples were provided by senior laboratory management:

- LLNL cites transfers from inertial fusion research into nuclear weapon design, and in at least one case a person has taken on a major leadership responsibility in the weapons program. Other transfers are from chemistry research into the design of insensitive explosives for weapons, and from basic materials research into plutonium metallurgy.
- LANL cites transfers of people from basic materials research into plutonium science, and points out that one of those people served as the director of the laboratory. Notable among the other transfers are people recruited to do research in theoretical astrophysics moving into nuclear weapon design, one of whom is currently a laboratory research fellow.
- Finally, SNL cites transfers from a number of basic research areas. One such transfer is from research and code development in radiation hydrodynamics in to the nuclear weapons program. This individual became vice president and chief engineer. Another started work in chemical kinetics and multiphase fluid dynamics and moved into the weapons program and held several leadership positions including deputy chief engineer.

Finding 3.4. Fundamental S&E activities are critical for the long-term vitality of the weapons laboratories. These activities are also funded from outside the defense community, for example, by the DOE Office of Science, DOE Energy programs, the National Institutes of Health, and NASA.

LABORATORY DIRECTED RESEARCH AND DEVELOPMENT

The Laboratory Directed Research and Development (LDRD) Program carried out at the various DOE national laboratories, including those today reporting to DOE/NNSA, was originally authorized by Congress in 1991, with the aim of allowing laboratory management to guide the funding of leading-edge research and development central to the national laboratories' core missions. This program was initiated during the period when DOE's mission in the nuclear weapons arena was drastically curtailed, with President George H. W. Bush's 27 September 1991 directive to unilaterally reduce the U.S. stockpile and terminate a number of then ongoing weapons development programs.

With this substantial change in mission scope for its defense program laboratories, DOE understood from the outset that the LDRD program could serve as a key strategic element in retaining the 'best and the brightest' at the national laboratories during a period of considerable retrenchment in the weapons program. Indeed, the LDRD program was understood to be not only a way of attracting and retaining top researchers from around the world, but also as a way of fostering collaborations with other prominent scientific and technological institutions, leveraging some of the world's most technologically advanced assets, and cultivating world class laboratory staff and management. Much of the basic research described in the previous section was supported by LDRD.

However, the decline in DOE/NNSA funding directed towards the laboratories over the last few years threatened this intended function of the LDRD program. As early as FY2000, DOE recognized a serious problem:

> The FY 2000 reduction in Laboratory Directed Research and Development (LDRD) funds at the Laboratories has reduced the ability of Laboratory personnel to conduct the types of exploratory research that often results in long-term program benefits. This research is also a large contributor to the Laboratories' scientific vitality and ability to attract and retain personnel. LDRD reductions threaten the funding of post-doctoral scientists who are an important recruiting pipeline for permanent employees.[10]

Since the LDRD programs are traditionally funded as a fixed percentage of the overall parent laboratory budget, the decline in weapons laboratory funding (peaking immediately following the re-competition of the LANL and LLNL M&O contracts) meant a concomitant significant decline in LDRD funding. From FY2006 through FY2010, total funding from DOE for the three laboratories declined by over $300 million or about 7.5 percent in current year dollars.[11] This decline may be arrested with the recent stabilization of funding for the laboratories as a result of congressional calls for increased funding for the nuclear weapons program. However, new stresses have arisen at LANL and LLNL because the LDRD program missions have been skewed to fill a gap left by the cancellation of funding for weapons-related research (WSR). That latter program had been funded through a separate budget line in the weapons programs at LLNL and LANL and targeted for research to advance weapons science in general; i.e., weapons science that was not specifically aligned with particular mission programs. That activity supported a good deal of the kind of "blue sky" research that has in the past been so successful in allowing the best of the young researchers at these laboratories to develop their S&E careers and to build their competences.

[10] Quoted from the joint DOD/DOE Response to the Chiles Commission document (p. 10).

[11] This information is taken from the Laboratory Tables found in the supporting documents for the DOE Budget Justifications for FY2006 to FY2012; at http://www.mbe.doe.gov/crorg/cf30.htm#Justifications.

Until the late 1990s, significant discretionary funding was provided through WSR. For example, WSR at LLNL was more than 8 percent of the budget in 1977, declining more or less steadily to zero in 1997.[12] Similarly, in FY81 WSR accounted for 14 percent of the budget of the LANL Chemistry-Nuclear Chemistry division.[13] When the WSR program was cancelled, the LDRD programs at both LANL and LLNL were partially re-directed to serve this function. As a result, there was a concomitant reduction in LDRD available for projects outside the weapons programs—the traditional focus of LDRD—and an overall reduction in the amount of funding available for "blue sky" research at each laboratory.

A high-quality S&E enterprise requires a base of fundamental research. LDRD programs at the three national security laboratories are important for supporting and maintaining this base. However, LDRD alone is not sufficiently robust to maintain this base.

Finding 3.5. LDRD is critical for attracting and retaining high quality technical staff and thus for assuring long-term viability of the laboratories and their ability to carry out their mission in the future.

Recommendation 3.2. The study committee recommends that Congress and NNSA maintain strong support of the LDRD program as it is an essential component of enabling the long-term viability of the laboratories.

Several laboratory staffers told the study committee about the increase in the number of budget reporting categories in the Nuclear Weapons program, which constrain the flexibility of laboratory managers to direct S&E work. They also add to overhead. A senior manager at SNL said his center used to be able to use about 15 percent of its budget for discretionary investments, and now it has none because the money is managed more closely. For example, one $40 million program is broken into 7 "B&R codes," each of which is tracked by Congress and directed to a particular near-term task. Each of these codes is monitored by a federal program manager who sets specific deliverables and expects quarterly reporting against pre-determined milestones. Another SNL manager is concerned whether the nation is actually getting less value, because there is more overhead work, some taken from the time of the people who could otherwise be producing S&E progress. He estimated that the daily activities of those technical people now include at least twice the overhead burden as in the early 1990s. In addition, more financial managers have been added because of the increased reporting requirements.

Additional B&R codes add more control in the governance structure at the expense of moving control away from the technical staff. Whatever advantages may be derived from having multiple B&R codes, it can impede the ability of laboratory management to develop necessary S&E capability.

Recommendation 3.3. The study committee recommends that Congress consider reducing the number of restrictive budget reporting categories in the Nuclear Weapons Program and permit the use of such funds to support a robust core weapons research program and further develop necessary S&E capability.

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[12] See "Review of the Department of Energy's Laboratory Directed Research and Development Program," DOE Laboratory Operations Board, January 27, 2000.

[13] See "Progress Report: Chemistry-Nuclear Chemistry Division," October 1980-September 1981, at .http://www.osti.gov/bridge/servlets/purl/5067196-cgsI2T/5067196.pdf.

4

Broken Relationship

The National Nuclear Security Agency's (NNSA's) stated mission is to "enhance global security through nuclear deterrence, non-proliferation, counter-terrorism, naval nuclear propulsion, and national leadership in science, technology, and engineering."[1] At the very core of the mission responsibility of the LLNL, LANL, and SNL is the maintenance of a safe, secure and effective nuclear arsenal. In the post-Cold War period—in the absence of nuclear-explosion testing and the production of new weapons—the responsibility to maintain an enduring stockpile requires advanced science, technology and engineering competencies.

NNSA headquarters elements provide "policy, priority, and program funding guidance, along with oversight and programs toward defined strategic goals."[2] NNSA Site Offices are located in proximity to the laboratories to provide "direct budget, regulatory and contract oversight, and administrative authority for these laboratories."[3] The NNSA management approach seeks to integrate "leadership, people, and processes to better accomplish [the] goals of a unified National Security Enterprise."[4]

This approach has resulted in an increased centralization of science and technology planning and direction, in which the laboratories have lost some of their historic independence and self-initiative, and which has resulted in top-down tasking to the laboratories. For example, in the weapons area, detailed surveillance and life extension programs of specific weapons systems dictate which of the laboratories does what and when to maintain the safety, security and reliability of the stockpile. If left unchecked, this management approach increasingly takes initiative and control out of the hands of working scientists and engineers, and places it in less expert hands in Washington. While many NNSA officials are experienced scientists with relevant laboratory experience, their headquarters jobs remove them from day-to-day research activity.

A parallel trend has been toward a contractual relationship that is increasingly focused on non-scientific operational matters, such as security, safety, administration, facilities management, financial management, and other such functions. For example, in defining specific criteria for the determination of award fee and award term (in the Performance Evaluation Plans), more of the award depends on meeting operational goals than depends on meeting goals associated with the quality of science and engineering (and other mission-related goals)

The management relationship between the Department of Energy, NNSA, and its national security laboratories is defined by detailed contracts focused on assuring that the work of the laboratory is conducted in an environmentally responsible, safe and secure manner, and that operations of the laboratory maintain fiscal integrity. The current management contracts award substantial financial rewards for contract performance in these areas. At LANL and LLNL, roughly 30 percent of the fee is fixed, and 70 percent is at risk in yearly performance evaluations (6-10 percent of the at-risk fee is based

[1] NNSA 2011 strategic plan.
[2] NNSA 2011 strategic plan.
[3] NNSA 2011 strategic plan.
[4] NNSA 2011 strategic plan.

directly on quality of science and engineering at LANL and LLNL: Appendix D).[5,6] This formula is designed to provide incentives for a high degree of management performance, which can be constructive in many environments. However, in an environment of broken trust, it carries a high risk that management will focus almost entirely on those contractual scoring criteria that account for the majority of the award fee, to the detriment of the science and engineering components of the mission.

A senior staff member at LANL provided some written comments to the study committee that captures the situation very well:

> When I started as a young postdoc and then later in my career as university professor and also here at the laboratory, there was a social contract, which basically said 'You will never get rich in science, but we treat you as adults, respect you for your commitment, and in turn you can pursue science and have fun.' Today, this contract is badly broken . . . an atmosphere of distrust . . . rigorous control and checks.
>
> How else could one explain the fact that today the signatures of [3-4 people] are required if I want to take my laptop home to work from home? I also need to write a half page justification why I want to work from home. If I want to attend the meeting of the division of nuclear physics of the APS, I need signature of [five people] . . . Where academic freedom once reigned . . . we have today a laboratory totally driven by risk averseness. We are drowning in paperwork and regulations. I know of three world-class scientists just in my group, who left . . . because they could not work in this environment anymore. Many more in other groups and divisions also left.

An LLNL employee with over three decades of experience explained the effect that this environment has on high-quality S&E:

> I have seen our efficiency drop by at least a factor of two over the last two decades, and the inefficiency accelerated after the contract change from UC to LLNS. The laboratory is being micro-managed by DOE, and now the new contractor, to the detriment of this country. I worked hard, and I'm sometimes frustrated by the bureaucracy that does not have a long-term view of the lab. It seems that concern about risks overrides scientific progress constantly. Often times, I will not initiate or take on difficult R&D assignments because of the unfunded hoops I have to jump through . . .

An erosion of trust on both sides of the relationship shapes the oversight and operation of the laboratories. This in turn has resulted in excessive reliance on operational formality in important aspects of laboratory operations, including the conduct of science and engineering at the laboratories. Operational formality is the application of specific rules and predetermined procedures to the accomplishment of tasks. This approach derives from industrial practices, where it is often important to assure goals such as safety by specifying exactly how tasks are to be done and then taking measures to ensure that these steps are strictly followed.[7] While the application of "follow the numbers" to ensure safety in selected tasks seems obvious, so does the mismatch of this approach to creative activities such as S&E. This erosion of the trust relationship is prominent with respect to LANL, where past failures attracted much national attention and public criticism. But it has also spilled over to LLNL and SNL, where management relationships also have acquired considerable operational formality.

While some laboratory S&E staff believes the excessive use of operational formality is a choice imposed by the M&O contractors, or by the contracts, the study committee did not see evidence of that.

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[5] At Sandia, where the at-risk fee is much smaller (although the fixed fee is roughly the same), the ratio is reversed.

[6] For example, over $54 million of fee was at risk to performance assessments in FY2010 at LANL, of which $44 million was granted.

[7] See, for example, Defense Nuclear Facilities Safety Board, *Operational Formality for Department of Energy Nuclear Facilities and Activities,* Technical Report DNFSB/TECH-15, March 1997.

When laboratory employees were questioned about heavy-handed bureaucratic processes, they could not point to their origin; that was true even for managers. The contracts and their incentives do not seem to encourage or mandate this. One senior SNL employee suggested that conservatism can accrete when there are layers of rules and processes, with little trust about who is going to take on risk.

Trust can be considered in two different ways: one concerning *reliance*, and the other *confidence*. Reliance means believing in the other party's character and ability: can the other party be believed? Does the other party know what he/she is talking about? Do I have faith in the other party's knowledge and expertise? *Confidence* means believing that I can depend on something in the future regarding another individual or group. Can I rely on the other person to do what they said they would do? Based on extensive discussions, the study committee thinks that if it were to ask NNSA, the laboratory managers, or the scientists and engineers at the laboratories these questions, none would answer in the affirmative. There is a persistent level of mistrust. While some progress has been made in recent years under current NNSA and laboratory leadership, much more is needed to repair the damage that has been done.

Finding 4.1. There is evidence of poor communications and lack of transparency at the highest levels, as illustrated by NNSA and laboratory leadership reporting significantly different assessments of the current management and operational relationship. The degradation of trust—whether *confidence* or *reliance*—is frequently accelerated in an environment of poor communication and lack of transparency. Discussions at study committee meetings indicated a persistent level of mistrust between NNSA staff and the laboratory scientists, particularly at LANL and LLNL.

Finding 4.2. The LANL and LLNL Site Offices are organized and staffed largely for monitoring compliance of the laboratories with extant DOE and other operational regulations. This reflects mistrust of laboratory management and staff to execute its mission responsibilities effectively and with reliable commitment to safety, security, and environmental concerns.

The study committee recognizes the responsibility to follow federal regulations about environment health, safety, and security, but also argues for a balanced approach that maximizes scientific flexibility within those requirements.

THE EFFECT OF OPERATIONAL FORMALITY ON EXPERIMENTAL WORK AT THE LABORATORIES

Experimental science is at the very heart of the scientific method, which relies on gathering empirical and measurable evidence subject to specific principles of reasoning tested through experimentation. Experimentation leads to discovery, and also provides essential validation for modeling and simulation.

The study committee observes that operational formality, which has been the by-product of the loss of trust in the laboratories' ability to maintain fiscal integrity and the safety and security of its work, is not a good basis on which to conduct productive, creative experimental work. Its checklist-based methods are demonstrably valuable for high-risk tasks, but onerous when nimble thinking and innovation are required. S&E staff and some managers at all three laboratories told the study committee that experimentation is becoming more difficult to pursue, and therefore less common, because of burdensome steps that must be completed associated with purchasing, safety checks and certifications, and so on. Thus, there is already some evidence that science and engineering at the laboratories are relying less on experimentation, which has worrisome implications for the S&E.

Finding 4.3. Increasing operational formality contributes to a bias against experimental work. Without a strong experimental program, the quality of scientific and engineering at the laboratories will be at risk, as will the core mission of these laboratories.

NNSA needs to reexamine the roles and responsibilities of federal oversight officials and laboratory management, and a mechanism needs to be devised to resolve differences that occur in executing roles and responsibilities in laboratory operations and programs. Excellent science and engineering is at risk when laboratory scientists and engineers do not perceive that they are in a partnership that encourages them to bring forth their creative ideas to solve problems vital to our national security. In the broader science environment, such conflicts are typically settled through peer review and open discussion. Resolution through back channels sows mistrust. By the very nature of the laboratories' mission, much of the work is done in a closed, classified environment. This adds complexity when trying to resolve scientific conflicts, but does not remove the necessity for doing so.

Successful partnerships, like successful societies, depend upon a high level of trust. Like barnacles on the bottom of a boat, mistrust accretes and accumulates over time until it compromises performance. Broken trust requires repair if the long-term performance of the laboratory missions is not to suffer. Due to the degree of mistrust that has encrusted over time, repairing that broken trust will require considerable time and effort. Mistrust is a highly stable phenomenon and can last for years if not decades. Therefore, attempting to fix things all at once and quickly is naïve and likely to fail.

Recommendation 4.1. The study committee recommends that NNSA and each of the laboratories commit to the goal of rebalancing the managerial and governance relationship to build in a higher level of trust in program execution and laboratory operations in general.

Recommendation 4.2. The study committee recommends that NNSA and the laboratories agree on a set of principles that clearly lay out the boundaries and roles of each management structure, and also that program managers at headquarters, the Site Offices, and in the laboratories be directed to abide by these principles.

For example, the site manager and the director and/or deputy director of each laboratory could establish, in consultation with other laboratory staff, a process to identify and agree on eliminating certain oversight procedures that are not necessary or related to the overall goals of the laboratory. Similarly, some mechanism could be established to filter program tasking at both the headquarters level and at the laboratory senior management level to assure that each tasking is necessary and consistent with the agreed management principles.

Recommendation 4.3. The study committee recommends that the goal of rebalancing the relationship and the set of principles laying out the boundaries and roles of each management structure be memorialized in memoranda of understanding between NNSA and its laboratories. Performance against these understandings should be assessed on an annual basis over a five-year period, and reported to Congress.[8]

One sign of broken trust reported to the study is that mid-level issues were elevated to the laboratory director level because there was no clarity about how to resolve disputes between a laboratory and an NNSA Site Office. Another example was a recent instance in which NNSA HQ tried to overrule a laboratory's best scientific judgment about how to carry out a scientific task. Subsequently, language appeared in a congressional report opposing that NNSA order.

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[8] The committee observes that it is important to design this approach to be self-correcting and to avoid problems such as: (1) adding to a check-list approach to management; (2) enforcing measures that annual assessment shows to be unworkable; and (3) requiring Congressional intervention when not needed.

Finding 4.4. There is no apparent mechanism by which the NNSA and its national security laboratories can negotiate a balance between competing policy, programmatic, and technical demands. In an environment that lacks trust, lack of an effective process for resolving such conflicts leads to situations that can be viewed either as NNSA inserting itself in an inappropriate operational role or the laboratories inappropriately challenging NNSA's role.

A better mechanism could be established for resolving technical disputes, without elevating them to top NNSA management and congressional levels. A technical advisory committee, established at the NNSA level, would be a helpful mechanism for filling this gap in S&E management. More generally, such an advisory committee could monitor progress on other aspects of roles and responsibilities described in this chapter.

5

Management of S&E at the Laboratories

This chapter examines the management of S&E at the three laboratories within the context of a generally accepted framework for managing S&E institutions.[1] This Investment/Value Returned (I/V) framework, and how it facilitates high quality S&E for the present and nurtures high quality S&E for the future, is presented in Appendix E. This framework is based in part on the following best practices, which this chapter applies for evaluating the management of S&E at the laboratories:

1. Management must have a clear view of the *goals* and the value received from investing in S&E;[2]
2. Management must ensure proper *allocation of investment*[3]—both fiscal and personnel—across the S&E portfolio;
3. Management must provide the S&E workforce a *supportive infrastructure and processes*[4] aimed at maximizing the motivation for carrying out S&E and creating and delivering value; and,
4. Management must sustain and grow the S&E capabilities by implementation of *assessment and closed-loop quality improvement processes.*[5]

The responsibility and accountability for assuring high-quality S&E at the laboratories is invested in the laboratory directors who, with the knowledge of the long-term needs of the core programs of the laboratories, are expected to provide overall strategic vision for the S&E activities. The laboratory directors have delegated the details of the S&E activities to subordinate levels of management,[6] including: (1) the chief technical officer (or the chief scientist); (2) associate laboratory director(s) (ALD) and/or principal associate director(s); and (3) the group leaders/division heads who constitute the first level of management from the perspective of the individual scientists and engineers.

The following summarizes what the study committee observed regarding the implementation of this framework within these laboratory management structures. It begins with an examination of the perspectives of the scientists and engineers, and works up the management chain as described above.

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[1] Management, of course, must also consider factors beyond S&E, such as safe and secure operation of the laboratory.

[2] What returns are desired/expected; what is the nature of these returns; how are they categorized; how do they support the NNSA mission(s); what metrics and indicators are available and used to assess value returned, either retrospective, or prospective?

[3] How does management allocate investment within the S&E portfolio to maximize the value created? For S&E it is clear that an optimum allocation methodology will involve both top-down and bottom-up approaches.

[4] Invest in infrastructure to support S&E, and create and use operational processes to measure performance and return on investment: a set of tools and processes to track how much and how well value is being created and delivered; metrics and indicators.

[5] Continuously improve the output, to ensure that technical capabilities are sustained and grown, driving change in each step from portfolio selection to operational processes to infrastructure investment. A key element of this aspect of management is the set of processes which ensure that the highest level of talent is recruited to the institution, nurtured, developed, and retained.

[6] The specific titles of individuals at these levels often vary among laboratories.

Based on presentations and discussions at the study committee's visits to the laboratories,[7] it appears that most individual **scientists and engineers** perceive the laboratory management as having a clear view of S&E *goals,* and as intending to (and succeeding in) *allocating investment* for providing well-planned interesting, cutting-edge, and core work. The management understands the long-term (15-20 years) prospecting phase of major research. In the area of *supportive infrastructure and processes,* the scientists and engineers acknowledge that S&E management has enabled a spectrum of outstanding computational and experimental facilities for performing multidisciplinary research pertinent to addressing important S&E questions. However, deterioration of facilities is an important concern, particularly at LANL (which is the oldest of the three laboratories).

In keeping with changes in federal statute, rules, and regulations, there has been an increasing burden on federal contractors and employees—including staff at all three labs—in matters of safety, security, and general administrative matters. Because this burden increases time spent on things that are not directly S&E, it has adverse effects on the quality of S&E. Some S&E staff expressed the view that their availability for creative work is further reduced by a reduction in support staff, which shifts administrative burden to S&Es. This topic was raised by the study committee at both LANL and LLNL. At LLNL, the study committee was told by several presenters that during the Reduction in Force that took place recently, support staff bore the brunt of the action, in part, to minimize the number of scientists and engineers who would be let go. At both labs, group and division leaders commented on declining numbers of support staff and the consequences for them, including increasing amount of time spent on tasks that had previously been done by support staff.

At all three labs, scientists and engineers voiced strong concerns that increasing daily administrative reporting burdens (e.g., in the purchasing of supplies, preparation of travel orders, etc.) leaves commensurately reduced time for S&E. Furthermore, what they see as an overemphasis on security and safety and associated paperwork relative to mission work adds to the administrative burden and leads to further reductions in the time available for research. Finally, the researchers perceive that the concomitant escalating cost of doing business results in less technical support and often discourages experimental activities, even though appropriate world-class experimental facilities and knowledgeable support personnel exist. However, with regard to *assessment and closed-loop quality improvement processes,* scientists and engineers reported feeling disconnected from a productive bottom-up communication path with senior management, and instead see the communication from their level—where the science really gets done—as consisting of paperwork-intensive milestone reporting, occasionally augmented by formal/confrontational assessment such as major reviews.

Group leaders/division heads were seen by the study committee to be striving to the utmost to allocate resources needed to perform the subscribed work, and to motivate the work *goals*. However, many Group Leaders/ Division Heads told the study committee that they are inundated by safety and security forms for even simple experiments. They asserted that the amount of administrative work leaves little time for brainstorming scientific ideas and planning the future. Effective implementation of *closed-loop quality improvement processes* suffers from bureaucratic overload.

The **associate laboratory directors or principal associate directors**[8] generally attend to the *goals* and the *associated allocation of investment* by ensuring that: (1) correct work is delivered appropriately and on schedule; (2) work can be accomplished safely, securely, and efficiently; (3) work is performed to standard and delivered on schedule; (4) that to the extent feasible the organization avoids negative press.

The **laboratory director** is the ultimate overseer of the *goals* and associated *allocation of investment* by being an interface between management of the M&O Contractor[9] and NNSA management. Safety, security and other operational matters, and delivery of long-term expectations of the labs, come

[7] See Appendix B for lists of presenters and discussants.

[8] The three laboratories are not organized identically at this level.

[9] Under the current contracts, all three laboratory directors are officers of the management corporations (Sandia Corporation, LANS, and LLNS).

together at the level of the laboratory director. This confluence seriously impacts the amount of time available for the laboratory directors and their staffs to do long-term planning. These problems appear to be tied to the breakdown of trust as discussed in previous chapters; closer scrutiny and more intense reporting are a burden.

Regarding the *assessment and closed-loop quality improvement process,* the study committee was told about some quantitative assessment measures used to evaluate S&E, but not about any qualitative measures. While quantitative measures, such as number of publications, patents, citations, etc. can provide a short-term measure of the effectiveness of S&E investments, qualitative assessment is necessary to judge the long-term value and impact of S&E, which may not become evident for many years.

Finding 5.1. Directions from NNSA and Congress—in some cases—constrain the laboratory directors' ability to allocate resources appropriately for S&E.

Finding 5.2. As indicated by anecdotal evidence presented in Chapter 4, the study committee did not find data indicating that the laboratories have suffered any significant lack of young, talented scientists and engineers who want to find careers in these laboratories. However, the study committee is not convinced that the basis for this is strong and will remain so. The laboratories may be benefiting from reduced employment prospects caused by the current recession. If so, this may be a temporary situation that will change as the national economy improves and jobs are created in the private sector for these scientists and engineers. The same concerns apply to the retention of senior scientists and engineers. Improving economic conditions could increase their incentives to leave for jobs in academia or the private sector. The laboratories should not be complacent about their ability to attract and retain staff.

Finding 5.3. Each of the laboratory directors (two of whom have since retired) had a clear view of the goals for S&E needed to accomplish his job. However, the tenure of laboratory directors has tended to be too short to permit them to develop and implement, with their teams, long-term strategic planning of science and engineering.

Unless steps are taken to promote longer tenures for laboratory directors, long-term planning, implementation, mid-course correction (if necessary), and evaluation of S&E are subject to discontinuities that may reduce the quality of S&E.

Recommendation 5.1. The study committee recommends that the NNSA, Congress, and top management of the laboratories recognize that safety and security systems at the laboratories have been strengthened to the point where they no longer need special attention. NNSA and laboratory management should explore ways by which the administrative, safety, and security costs can be reduced, so that they not impose an excessive burden on essential S&E activities.

Recommendation 5.2. The study committee recommends that NNSA reduce reporting and administrative burden on the laboratory directors and purposely free directors to establish strategic S&E direction at the laboratories.

Appendixes

A

Governance Charter for an Interagency Council on the Strategic Capability of DOE National Laboratories as National Security Assets

GOVERNANCE CHARTER FOR AN INTERAGENCY COUNCIL ON THE STRATEGIC CAPABILITY OF DOE NATIONAL LABORATORIES AS NATIONAL SECURITY ASSETS

1) PURPOSE

The purpose of this Charter is to provide a framework for the participating agencies to coordinate shared, long-term planning for the science, technology, and engineering (ST&E) capabilities resident in the U.S. Department of Energy's (DOE's) National Laboratories and other DOE sites (hereinafter, National Laboratories), and other ST&E capabilities of the Parties, that are of cross-cutting strategic national security interest.

2) BACKGROUND

The National Laboratories have the requisite expertise and facilities that uniquely position them to provide a wide range of ST&E capabilities critical to meeting a rapidly expanding and evolving array of national security challenges. Given an uncertain future and the increasing pull on the same resources by many Federal agencies, an executive-level forum is needed to ensure integrated planning for the utilization, through DOE, of the National Laboratory capabilities, encouraging optimal alignment with the highest priority national security needs. This Governance Charter is intended to provide a mechanism for the Parties to engage in interagency long-term strategic planning for capabilities that are unique to the National Laboratories. This will ensure that certain national security priorities can be supported by these unique capabilities in a coordinated, effective, and efficient manner.

3) OBJECTIVES

The objectives of this Governance Charter are to:

- Provide a forum for the Parties' leadership to identify and plan strategic ST&E collaboration of common interest in the area of national security;
- Examine critical strategic mission needs requiring the ST&E capabilities unique to the National Laboratories;
- Develop a mechanism for two or more of the Parties to undertake long-term strategic planning of common interest to develop and sustain strategic capabilities of inter-agency interest at the National Laboratories; and
- Create an interagency framework for two or more Parties to consider making collaborative national security investment decisions.

4) PARTIES
The initial signatories to this Charter are DOE, the U.S. Department of Homeland Security (DHS), the Office of the Director of National Intelligence (ODNI), and the U.S. Department of Defense (DoD), collectively referred to (together with any future participants in this Charter) as the "Parties." Additional government agencies may become Parties to this Charter.

5) AUTHORITY
This Charter is authorized under the provisions of the following authorities:

- For DOE, including NNSA, Section 646 of the Department of Energy Organization Act (Pub. L. 95-91, as amended; 42 U.S.C. § 7256); Title XXXII of the National Defense Authorization Act for Fiscal Year 2000, Public Law 106-65.
- For DoD, 10 U.S.C. 113, "Secretary of Defense."
- For DHS, 6 U.S.C. § 112, "Secretary; functions."
- For ODNI, the Intelligence Reform and Terrorism Prevention Act of 2004, Public Law 108-458.

6) ORGANIZATION

a) Mission Executive Council
The Parties each agree to appoint two senior executives to serve as members of the Mission Executive Council (hereinafter "Council"). The Council will be led by two Co-Chairs, the Mission Co-Chair and the Capabilities Co-Chair. The Director, National Counterproliferation Center, representing the DNI, will serve as the Mission Co-Chair, with the understanding that the role may rotate among the parties each year, as the Council decides. The DOE Under Secretary for Nuclear Security (NNSA Administrator), representing DOE as the sponsor and contracting authority for the National Laboratories, will serve as the Capabilities Co-Chair. Council meetings will be scheduled at least quarterly, with reports of Council meetings being provided to all Parties by the Staff Secretary.

The Council will serve as an inter-agency forum for discussion and coordination on developing priorities among the Parties regarding long-term strategic ST&E capabilities at the National Laboratories. On at least an annual basis, and more often as may be deemed necessary, the Council will: (1) review and assess the adequacy of national security ST&E capabilities at the National Laboratories in identified crosscutting areas; (2) identify and consider candidate ST&E capabilities needing interagency attention; (3) consider the Subcommittee's recommendations on the development or sustainment of capabilities required to close identified gaps; and (4) take such actions as may be necessary and appropriate. Each Party will bring to the discussions of the Council those ST&E requirements that might impact the execution of the mission of any of the Parties.

The primary responsibility of the Mission Co-Chair is to coordinate and document the strategic capability ST&E needs brought by the Parties for consideration. The Capabilities Co-Chair has the primary responsibility to ensure that relevant National Laboratories are engaged for each strategic capability need identified and to coordinate, as determined appropriate, with the National Laboratory Directors regarding the work of the Council. Subcommittee members are responsible for considering the resulting gaps and opportunities and recommending steps in collaboration with other member agencies to address them.

b) Staff Secretary
The Council will appoint a Staff Secretary from one of the Parties who will facilitate communications among the members of the Council. The position of Staff Secretary will rotate annually among the Parties.

The Staff Secretary will work under the oversight of the Co-Chairs, and undertake all administrative functions necessary to operate the Council.

c) National Laboratories
When the capabilities of strategic interest to the Parties are compiled by the Council, the Capabilities Co-Chair will engage the directors of the relevant National Laboratories. The specific laboratories included in the strategic capabilities assessment process will evolve based on the stated needs of the Council members.

The National Laboratories' Directors engaged by the Capabilities Co-Chair will be responsible for providing the long-term planning status for the ST&E capabilities identified by the Council. This input will be coordinated through the Capabilities Co-Chair.

d) Mission Executive Council Subcommittees
The council may establish Government-only subcommittees. Subcommittees may be used to perform one or more of the following activities: (1) identify mission needs that may require the development or enhancement of an ST&E capability need for consideration by the Council; (2) develop specific proposed plans to address ST&E capability gaps agreed to by the Council, and (3) foster coordination of individual investments at the National Laboratories that are the products of strategies agreed to by the Council.

7) FUNDING
This Charter creates no financial or operational commitment or obligation for any of the participating agencies. Any financial transactions that may be undertaken by one or more of the signatories will be under the auspices of an agreement independent of this Charter and reflect the interests of the agencies involved.

8) MODIFICATION
This Charter will be reviewed annually and may be modified in writing with the

consent of the Parties at any time. The Parties intend this partnership to expand, as appropriate.

9) EFFECTIVE DATE
The terms of this Charter will become effective upon signature of the initial Parties and will remain in effect until rescinded.

Steven Chu
Secretary of Energy

Dennis Blair
Director of National Intelligence

Jane Holl Lute
Deputy Secretary
Department of Homeland Security

Robert Gates
Secretary of Defense

JUL 6 2010

B

Presenters and Speakers at Committee Meetings

JANUARY 23-25, 2011
NATIONAL ACADEMIES KECK CENTER
WASHINGTON, D.C.

NNSA/DOE Leaders

Steven Koonin, Undersecretary for Science, Department of Energy (DOE)
Thomas D'Agostino, Under Secretary and Administrator for Nuclear Security, NNSA

Other NNSA Speakers

Roger Lewis, Director of Integration and Operations, NNSA
Joseph Waddell, Director, Office of Acquisition and Supply Management, NNSA
Shelley Turner, Deputy General Counsel for Procurement, NNSA
Donald Cook, Deputy Administrator for Defense Programs, NNSA
Jamileh Mogan, Director of the Office of Institutional Programs, NNSA

Congressional Staffers

Madelyn Creedon, Majority Counsel, Senate Armed Services Committee
Jonathan Epstein, Staff Member, Office of Senator Bingaman and Senate Committee on Energy and Natural Resources
Leonor Tomero, Counsel, House Armed Services Committee

Employee Union LANL and LLNL

Jeffrey Colvin, University Professional and Technical Employees (UPTE), LLNL

FEBRUARY 28-MARCH 1, 2011
NATIONAL ACADEMIES KECK CENTER
WASHINGTON, D.C.

Philip E. Coyle, Associate Director for National Security and International Affairs, Office of Science and Technology Policy (OSTP)
Neile Miller, Principal Deputy Administrator, NNSA
Phillip E. DePoy, Board of Directors, Center for Naval Analyses

MARCH 22-23, 2011
SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NEW MEXICO

Discussion with SNL Director

Paul Hommert, President and Laboratory Director

Discussion with Senior Management

Jerry McDowell, Deputy Laboratory Director and EVP, National Security Programs
Stephen Rottler, VP, Science and Technology and Research Foundations
Jill Hruby, VP, Energy, Non-Proliferation and High-Consequence Security
Mike Vahle, Acting VP, Defense Systems and Assessments

Discussion with Level 1 and Level 2 Managers

Marcey Hoover
Michael Knoll
Keith Matzen
Neal Shinn
Jerry Simmons
Marianne Walck
Randall Watkins

Discussion with Selected Senior Scientists and Engineers

Mary Crawford
Stewart Griffiths
Jack Loui
Tina Nenoff
Gregory Nielson
Leslie Phinney
William Tedeschi
Jeffrey Tsao

Discussion with Sandia Site Office (SSO)

M. Patrice Wagner, Site Office Manager
Kimberly A. Davis, Deputy Manager
Lloyd DeSerisy, Assistant Manager, Contract Administration and Business Management
JoAnn Wright, Contracting Officer

Discussion with Former SNL Director

Thomas O. Hunter, Former President and Director
Charlie Nakhleh, Manager, ICF Target Design

APRIL 11-12, 2011
LOS ALAMOS NATIONAL LABORATORY
LOS ALAMOS, NEW MEXICO

Discussion with LANL Director

Michael R. Anastasio, Laboratory Director

Discussion with Senior Management

Terry Wallace, Principal Associate Director, Science, Technology, and Engineering
Charles McMillan, Principal Associate Director, Weapons Programs
William Rees, Jr., Principal Associate Director, Global Security

Discussion with Division Level Managers

Steven Black
Mark Chadwick
David Funk
Eugene Peterson
Kevin Saeger
Elaine Santantonio
Kurt Schoenberg
Jack Shlachter
Tammy Taylor

Discussion with Group Level Managers

Kent Abney
Carol Burns
Bruce Carlsten
Andrew Dattelbaum
David Morris
Amy Regan
Pradap Sadasivan
Mark Schraad
Kimberly Scott

Discussion with Senior Scientists, Engineers, and LANL Fellows

George Erickson (Andy)
Michelle Espy
Herbert Funsten
Bryan Henson
Jeffrey Paisner
David Teter
Robert Weaver
Beth Wingate

LANL Fellows

Joseph Carlson
Pat Colestock
Quanxi Jia
Paul Johnson
Albert Migliori
William Priedhorsky
James Smith
Antoinette (Toni) Taylor

Discussion with Los Alamos Site Office (LASO)

Kevin Smith, Site Office Manager
Roger Snyder, Deputy Site Office Manager
Juan Griego, Assistant Manager, Nuclear Security Missions
Robert Poole, Lead Contracting Officer
Charles Keilers, Assistant Manager, Field Operations

Public Comment Speakers

David Carroll, LANL Maintenance Engineer
Manual Trujillo, UPTE representative
Greg Swift, LANL employee (retired)
Andreas Klein, LANL scientist

APRIL 26-27, 2011
LAWRENCE LIVERMORE NATIONAL LABORATORY
LIVERMORE, CALIFORNIA

Discussion with LLNL Director

George Miller, Laboratory Director

Discussion with Senior Managers

Tomas Diaz de la Rubia, Deputy Director, Science and Technology
Penrose “Parney” Albright, Principal Associate Director, Global Security
Edward Moses, Principal Associate Director for the National Ignition Facility (NIF) and Photon Science
Charlie Verdon, Principal Deputy Principal Associate Director, Weapons and Complex Integration

Discussion with Associate Directors for Science and Technology and Mission Area Program Directors

Jeff Atherton
Dona Crawford
Reggie Gaylord
Bill Goldstein
Stephanie Goodwin
Monya Lane

Wes Spain
Derek Wapman
Bruce Warner
Jeff Wisoff

Discussion with Division and Group Leaders

Tom Arsenlis
Cindy Atkins-Duffin
Gina Bonanno
Kim Budil
Diane Chinn
Lori Diachin
Glenn Fox
Julio Friedmann
Denise Hinkel
Anantha Krishnan
Dave McCallen
Fred Streitz
Jim Trebes

Discussion with Selected Senior Scientists and Engineers

Jeff Bude
Debbie Callahan
Bruce Cohen
Rip Collins
Joe Farmer
Jim Hammer
Juliana Hsu
Omar Hurricane
Nino Landen
John Lindl
Brian Lopez
Mordi Rosen
Ben Santer
Jeff Stewart

Discussion with Livermore Site Office (LSO)

Alice Williams, Site Office Manager
Sam Brinker, Assistant Manager for National Security Implementation
Phillip Hill, Technical Deputy Manager for Safety and Environmental Programs
Janis Parenti, Assistant Manager for Contract Administration and Resource Management
Homer Williamson, Contracting Officer
Ronna Promani, Contracting Officer

Livermore Valley Open Campus (LVOC) Speakers

Rick Stulen, VP of Sandia National Laboratories
Buck Koonce, Principal Lead of Livermore Valley Open Campus

Board of Governors Speaker

Bruce Darling, Vice President, University of California

Public Comment Speakers

Roger Logan, LLNL employee (retired)
Jim Wolford, LLNL scientist
Neal Ely, Dean of Math, Science, and Engineering at Los Positas College, Livermore, California
Joe Requa, LLNL employee (retired)
Marylia Kelley, Tri-Valley Cares representative
Felicie Albert, LLNL employee

JULY 18-19, 2011
NATIONAL ACADEMIES KECK CENTER
WASHINGTON, D.C.

NNSA/DOE Speakers

Linton Brooks, Former Administrator for NNSA (2003-2007)
Tyler Przybylek, Former Chief Operating Officer and General Counsel of NNSA
Victor Reis, Former Assistant Secretary for Defense Programs, DOE

Discussion with Former LANL Management

Siegfried Hecker, LANL Director (1986-1997)
William Press, Deputy Laboratory Director for Science and Technology, LANL (1997-2004)

Congressional Staffer

Kari Bingen, Strategic Forces Subcommittee, House Armed Services Committee

C

Review of Relevant Studies and Reports 1995-2010

As part of this study, the study committee reviewed a number of relevant studies that were done in the period 1995-2010. These are listed at the end of this appendix. This appendix summarizes what those studies said about issues that are relevant to this report. This appendix is not an exhaustive analysis in that: (1) it does not review all matters addressed in the referenced reports, just those that were directly relevant to the work of the study committee; and (2) the list of major reports as reviewed does not include every study of possible relevance.

This appendix first summarizes the four major issues that emerged consistently from the reviewed studies. Then it discusses each of these issues in greater detail.

EVOLVING AND PERSISTING ISSUES IN THE MANAGEMENT OF THE NUCLEAR WEAPONS LABORATORIES

Several issues have persisted and evolved in the management of the nuclear weapons laboratories since the mid-to-late 1990s. These issues have one theme in common: the absence of an effective governance structure. Four issues involving laboratory management, of which advisory groups continue to find evidence of, pervade the weapons complex:

1. An unclear commitment to, and view of, the laboratory mission;
2. An unstable workforce and lack of adequate plan to maintain core competencies;
3. Unclear roles and responsibilities assigned to DOE/NNSA headquarters and to the offices and programs included within the laboratory governance structure, ill-defined and duplicated lines of authority and oversight, including the failure of NNSA to achieve its intended independence; and
4. Excessive number of reviews and oversight by external organizations, particularly by the Defense Nuclear Facilities Safety Board.

Issue 1: An unclear commitment to, and view of, the laboratory mission.

It is evident from reports published in the mid-to-late 1990s that this time was a hectic and disorganized period for the laboratories. The testing of nuclear weapons ended in 1992, and with the establishment of the Stockpile Stewardship Program, national priorities and the mission of the laboratories were changing due to the ban on nuclear testing (GAO, 1995). During this period, there was confusion on the part of the laboratories as to which priorities should be deemed ones of national importance and commitment. Many reports cite the Department of Energy's (DOE's) lack of direction as a cause. A 1995 GAO advisory group tasked with examining the labs' missions stated that the laboratories lacked clearly defined missions, failing to adapt them to changing national priorities and evolving Department objectives, despite recommendations from advisory groups to redefine the laboratory missions.

The 1995 Task Force on Alternative Futures (a.k.a. the "Galvin Task Force"), believed it was not appropriate or resourceful for the laboratories to acquire new mission areas outside of their traditional ones, including developing technologies for the private sector (DOE, 1995). The Task Force observed "excessive scrambling" on the part of the laboratories in acquiring new mission areas outside of their traditional ones. While they approved of utilizing the laboratories capabilities such as "high performance computation, advanced materials, energy technologies, and systems engineering" to solve other national priorities,

> These activities should be carefully managed, are not likely to evolve into "new missions" *per se*, and should not be a license to expand into areas of science and technology which already are being addressed effectively or more appropriately by other Research and Development (R&D) performers in government, academia and the private sector (DOE, 1995).

The Galvin Task Force expressed concern that expanding the laboratories' roles to serve the needs of private industry was likely to distract them from their public missions, diverting both intellectual and material resources away from it. The Task Force described these activities as "add-ons;" managed on a case-by-case basis. They stated that "the laboratories might be more likely to propose industrial programs merely based on 'make work' criteria," if their work expanded outside DOE mission areas. In addition, laboratory work performed for the private industry was unfocused. It was unclear to the Task Force how large and broad-ranging these activities should be, how they should be funded, and how they should relate to the primary mission areas the laboratories were involved in- "in particular, whether industrial competitiveness should be viewed as a primary or a derivative function."

In the early 2000s, several reports, including the Report of the Commission on Maintaining United States *Nuclear Weapons Expertise* (a.k.a. the "Chiles Commission Report) and the *FY 2000 Report to Congress of the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile* (a.k.a. the "Foster Report") stressed the need to revamp the strength of the national commitment to the stockpile stewardship mission or risk the loss of recruiting and retaining highly qualified scientists (Chiles et al., 1999; Foster et al., 2001). The 2000 Foster Panel noted that the stockpile stewardship mission was different than other nuclear weapons missions the laboratories had been accustomed to, thus requiring taking a different approach than "the continuation of past technical activities:"

> It is not possible to attract or retain a world-class staff absent clear articulation of this new stewardship mission and its national importance, and without a credible multi-year program. NNSA, working with DOE leadership, DOD, the President, and Congress must restore the sense of mission, rationalize the work program, and demonstrate commitment to stockpile stewardship (Foster et al., 2001).

The Secretary of Energy Advisory Board's (SEAB's) 2005 *Nuclear Weapons Complex Infrastructure Task Force* also observed a lack of integrated and coordinated set of missions, citing DOE's lack of policy guidance and the lack of uniformity among design laboratories about requirements and regulations for the weapons development. For example, the Nuclear Weapons Complex Infrastructure Task Force noted several occasions where a laboratory would justify the building of a new facility based on requirements that they themselves created, in order to appear superior to another laboratory. This resulted in the laboratories "competing for programmatic funds and priorities rather than relying upon their divergent and complementary strengths and thereby operating as a truly interdependent team, with shared success and rewards." (DOE, 2005).

The 2009 Stimson Center's Task Force Report on *Leveraging Science for Security: A Strategy for the Nuclear Weapons Laboratories in the 21st Century* echoed the 2005 SEAB Task Force's concern about the lack of a unified mission. The Stimson Center Task Force found the laboratories' research areas had expanded to the point that the laboratories appeared "to have evolved from multipurpose to all-purpose," resulting in a lack of a clearly defined set of missions (Townsend et al., 2009).

The Stimson Center Task Force and the *2009 Congressional Commission on the Strategic Posture of the United States* stressed the related issue that work performed by the laboratories needed to support the long-term growth of the science and engineering enterprise underlying the mission. This meant that the laboratories should only participate in those agency partnerships committed to the long-term vitality of the laboratories. Agency partnerships should involve:

> Capital investment, annual funding commitments, and participation in the long-term strategic focus of the laboratories. This requires creating a structure for multi-agency decision-making and investment and eliminating "primary" versus "secondary" access to the labs' capabilities. This "investment" will require commitment and support by the Office of Management and Budget (OMB), the agencies, and the Congress. This multi-agency support should reduce costs for all agency clients, while preserving these national resources and maximizing their service to the nation," (Townsend et al., 2009).[1]

In August of 2009, the Laboratories Management and Operations (M&O) contractors laid out several recommendations to the Department of Energy at the request of Secretary Chu (DOE National Laboratory Contractors Group, 2009). In particular, the recommendation to "focus on mission outcomes, not process" was made. This recommendation entailed several actions, including:

> *Assign full responsibility and accountability for both laboratory programmatic accomplishment and operational performance to DOE's mission organizations*, with DOE's functional organizations providing advice and support to the mission organizations (as opposed to independently exercising authority to impose requirements on the laboratories or oversee laboratory performance).
>
> *Focus laboratory performance appraisals on delivery of the mission outcomes specific to each laboratory*, as well as stewardship of laboratory assets and achievement of appropriate operational standards, as opposed to process compliance or other "how" measures.

The recommendation to "provide laboratory contractors with increased flexibility in employment practices, partnership formation, technology transfer, and other area" was also made, which included action to:

> *Provide increased flexibility for engaging collaborators and other federal agency and private sector sponsors*. Decreased transactional oversight or review and increased flexibility in contract terms in Work for Others and CRADAs will enable the laboratories to better meet DOE mission goals, and to engage with private industry on more commercial time scales and terms.

It is unclear the impact that these recommendations have made.

Issue 2: An unstable workforce and lack of adequate plan to maintain core competencies.

Several factors attribute to the unstable workforce experienced by the laboratories over the years. Poor morale, as a result of excessive safety and security requirements and downsizing; the changing workforce demographics; and the opportunities available outside of the laboratories are a few examples. The maintenance of the nuclear weapons "critical skills" and core competencies is also a major concern.

[1] Regarding work for others (WFO) and memorandums of understanding (MOUs), the Stimson Center Task Force Report stated that partnerships involving these activities were "too limited and too ad hoc" to aid in the laboratories long-term planning of the S&T foundation.

Low morale is one reason attributed to rates of departure at the laboratories. The 1995 Galvin Task Force observed that the excessive number of laboratory audits, and the time and effort scientists spent interacting with auditors when they could have conducted research decreased workforce morale and led to the departure of a higher number of employees. The 1999 Chiles Commission and the 2000 Foster Panel both cited poor morale as an impediment in recruiting and retaining highly qualified scientists. The Chiles Commission found that low morale was due to uncertainty and frustration in the strength of the national commitment to stockpile stewardship, as well as a feeling of insecurity for whether the downsizing that had occurred in the past decade would continue in the future (Chiles et al., 1999). The 2000 Foster Panel cited that the highly publicized security breaches and ensuing incriminations were responsible for high departure rates and low job acceptance rates (Foster et al., 2001).

MAINTAINING CORE COMPETENCIES

Many reports, including the SEAB's 2005 *Nuclear Weapons Complex Infrastructure Task Force* Report, the Defense Science Board's 2008 *Report on Nuclear Deterrence Skills,* the 2009 Stimson Center's Task Force Report on *Leveraging Science for Security: A Strategy for the Nuclear Weapons Laboratories in the 21st Century*, and *American's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* expressed concerns that the NNSA lacks an adequate plan for the future recruiting of scientists who possess the core capabilities needed to maintain the nuclear weapons program, and that scientists are not given the ability to exercise and strengthen these essential skills, threatening the safety and reliability of the stockpile (Townsend et al., 2009; Defense Science Board, 2008; Perry and Schlesinger, 2009). "Core competencies" are the skills and capabilities needed to support and foster the nuclear weapons program, which are used to address other areas of national security, including "nonproliferation, threat reduction, and nuclear counterterrorism; including stabilization, assessment of terrorist nuclear devices, and nuclear forensics" (Townsend et al., 2009.) The design and development of nuclear weapons involve incorporating a diverse and unique set of skills from a variety of scientific fields (Perry and Schlesinger, 2009). In order to maintain the weapons program, an appropriate number of scientists need to be employed from each desired field (however, employing too many scientists would be a waste of money), who each need to posses the skill set necessary to fulfill each of their numerous responsibilities. Reports indicated that the NNSA lacks a plan for ensuring that the number of scientists recruited and the fields they are recruited from align with the criteria needed to fuel the nuclear weapons program and maintain its high-quality. The Strategic Posture Commission in 2009 noted, for example, that "NNSA expects to reduce the number of laboratory personnel funded by the weapons program by 20-30 percent. It is doing so without any understanding of what types of expertise to seek to retain or reduce."

In addition to systematically recognizing the number and types of experts the laboratories should recruit, reports indicated that scientists are not given the needed "hands-on experience" in weapons development and design that is necessary in maintaining the nuclear weapons program. Fine-tuning these skills using computer simulations is not adequate (Townsend et al., 2009; Perry and Schlesinger, 2009).

Due to the absence of a systematic plan in the recruitment and training of scientists, the design, development, and testing capabilities of the laboratory workforce are threatened and will continue to be unless further action is taken.

Issue 3: Unclear roles and responsibilities assigned to DOE/NNSA Headquarters and to the offices and programs included within the laboratory governance structure; ill-defined and duplicated lines of authority and oversight.

The role of headquarters should be to provide guidance, policy, and oversight. It should "focus on areas crucial for success of the organization, and should delegate operations and any activities that can be done elsewhere (Richanbach et al., 1997). Evidence from numerous reports demonstrates this has not been the case. DOE headquarters and NNSA have tended to perform tasks and responsibilities that field and operation offices should be responsible for. The Government-Owned, Contractor-Operated (GOCO) model that the laboratories are supposed to operate under has not been put into practice. The system resembles a "Government-Owned, Government-Operated" model (DOE, 1995). The *2009 Commission on the Strategic Posture of the United States* stated that the NNSA and DOE failed to distinguish between "what to do (a government function) and how to do it (a contractor responsibility). There is uncertainty in determining where policy and oversight end and where implementation begins. The lack of defined roles and responsibilities within the management structure of the complex has resulted in multiple layers of oversight and compliance requirements, excessive overhead costs, and productivity losses: all of which avert attention from S&E research.

The 1995 Galvin Task Force observed many instances of the inappropriate role that DOE played in the day-to-day operations and management of the laboratories. The following are just a few of that Task Force's observations:

- Department of Energy orders to the laboratories range from a few to a few hundred pages in length and are prescriptive to detail processes; there are some 30 thousand individual requirements embodied in these orders to certain major laboratories. . . .
- DOE Headquarters has insisted that copies of DOE terms and conditions be attached to all file copies of literally thousands of small purchase orders in order to document that these terms and conditions had been transmitted to vendors. . . .
- Each laboratory acknowledges that it has more people than it needs because of the Federal prescriptions and the inability to add the flexibility of assigning people in the manner that would be most productive. . . .
- There are at least 12 principal layers of management between the assistant secretary for defense programs down through the layers of DOE and the laboratory program management to the bench scientist working of a project financed through defense programs. There are additional oversight and administrative chain of commands through the field offices which probably add two or three more layers (DOE, 1995).

The Galvin Task Force stressed the need to "de-federalize" the labs. Groups prior to this one observed similar findings and recommendations, but the Department has done little to make improvements. The Task Force noted that although excerpts from DOE's Strategic Plan at the time stated that "communications, trust, and human resources" were vital for success, its tendency to over regulate was detrimental to the cultivating of these factors. "The activities that it is obliged to direct and order are a countervention of the value of trust" (DOE, 1995).

A 1997 IDA study was commissioned to examine the management processes and structures of the DOE's Defense Programs (DP), which are responsible for ensuring the safety, security, and reliability of the nation's nuclear weapons stockpile (Richanbach et al., 1997). The DP's workforce oversees the contractors who manage the weapons complex (which includes the laboratories.) The role of the field operations offices, area offices, and site offices is to implement the guidance provided by headquarters and to oversee the work carried out by the management and operating (M&O) contractors (IDA, 1997). Operations office managers are the formal contracting officers responsible for administering the M&O contracts. Site, or area offices, provide day-to-day interactions with the contractor, and maintain awareness of operations and issues within the government's facilities (Richanbach et al., 1997).

The IDA study identified areas where potential overlap exists in the roles played by headquarters, operations offices, and site/area offices. Examples of potential for overlap in responsibilities and corresponding duties are listed in Table C.1. (The asterisk indicates where potential overlap occurs).

TABLE C.1 Examples of Potential for Overlap in Responsibilities and Corresponding Duties Between Headquarters, Operations Offices, and Site/Area Offices

Major Responsibilities	Selected Duties
Headquarters Defense Programs	
Help formulate and apply corporate policy for support functions	*Interpret ES&H policies and ensure programs apply
Operations Office	
Serve as contracting officer for M&O contract	*Integrate and coordinate funding, program direction, functional policy direction, and guidance from multiple DOE offices and non-DOE customers
	*Review and approve facility safety framework
	*Consider site-wide institutional issues, health of contractual relationship
Execute programs on behalf of DOE program offices	*Develop performance measures and performance expectations for determining
	*Coordinate and approve HQ's work authorization
	Provide planning input and support budget formulation and execution
	*Provide matrix technical support to programs (and area offices), including ES&H and business operations
Area Office	
Ensure compliance with ES&H orders	*Provide program direction and oversight for nuclear facility safety
	*Maintain operational oversight awareness and perform independent management oversight of DOE facilities through Facility Representative program
	*Conduct performance-based assessments of ES&H, safeguards and security

SOURCE: Adapted from Richanbach et al. (1997), Table I-2.

The IDA study concluded that although there was agreement that providing oversight and guidance is headquarters' responsibility and program execution should be done by the field, the difference between the two major responsibilities or on the specific tasks that should be delineated to one and not the other is not clearly articulated.

The chains of command existing in the laboratory management structure are also ill-defined. The IDA Task Force found that the reporting chain of command parallels the chains of command for programmatic requirements; environmental, safety, and health activities; and administrative practices. Each of these management processes has their own formal as well as informal chains of command (where offices receive direction from another office outside of its formal chain.) These chains of command are ill-defined, creating confusing lines of authority and accountability within the management structure, and fostering an environment where poorly established boundaries and redundant regulations are the norm.

The 1999 Chiles Commission and the 2000 Foster Panel observed similar confusing chains of command, emphasizing that parallel chains created "day-to-day frustration among those in the field performing hands-on stewardship tasks" and "inefficiency due to diffusion of authority and conflicting objectives. Unfunded mandates to meet functional requirements undermine program budget, plans, and milestones" (Foster et al., 2001).

In 2000, several security breaches led to the establishment by Congress of the NNSA. Congress cited "poor organization and failure of accountability" as causes for these security incidents (National Defense Authorization Act, 2000). The NNSA Act lays out the agency's mission and organization.[2] The NNSA took on several challenges that had yet to be resolved in the complex. This included the need for defining the roles and responsibilities of the laboratories, NNSA headquarters, and field organization units (Foster et al., 2001). The 2000 Foster Panel report emphasized that in order to overcome the challenges faced by NNSA, headquarters must:

> Provide leadership and perform top management tasks, including: setting objectives; developing strategies, programs, priorities and budgets; providing guidance concerning milestones and objectives; setting measurable goals and appraising performance against these goals; and adjudicating differences among operating entities. Except for selected programs managed from headquarters, NNSA should not focus on the details of task execution. Achieving this goal will require simplifying, clarifying, and disciplining lines of command, communication, and authority with NNSA. Duplication of responsibilities should be eliminated and layers of headquarters and field management or oversight should be consolidated (Foster et al., 2001).

The 2001 Foster Panel report reiterated the points it made in its previous report, emphasizing that the Secretary of Energy must remove the unnecessary duplication of staff in such areas as security, environmental oversight, safety, and resource management. It also stated that NNSA had done little to resolve the management issues existing within the complex, creating even more bureaucratic issues (Foster et al., 2002).

To help align responsibility and management, the 2005 SEAB's Task Force on Nuclear Weapons recommended that Site Office Managers report to the Deputy Administrator for Defense Programs (NA-10) rather than the Administrator in order to "redirect the contractors' focus on the Complex."

An issue stemming from the ill-defined roles and responsibilities of DOE and NNSA is that NNSA failed to gain the level of authority and flexibility that its creators intended it to have. Although the Agency has authority over a range of operations, putting this authority into practice has been difficult.

The SEAB's 2005 Nuclear Weapons Task Force discussed in its report that because NNSA's mission is vastly different, its management system must be tailored to its priorities. However, it found this was not the case, citing that "the DOE has burdened the Complex with rules and regulations that focus on process rather than mission safety. Cost/benefit analysis and risk informed decisions are absent, resulting in a risk-averse posture at all management levels." The Task Force specifically noted:

> Many administrative orders and procedures designed for the DOE civilian research and science laboratories are not well suited to the product-oriented Complex. The NNSA mission requires clear deliverables and requirements for the nuclear weapons life cycle, achieved by design, testing, manufacturing, and production with materials that by their very nature embody risk. The current DOE-NNSA structure should permit NNSA to apply appropriate rules and regulations to the NNSA Complex in a graded fashion (DOE, 2005).

The 2009 Strategic Posture Commission and the 2009 Stimson Center Task Force both support the premise that NNSA has failed to achieve its intended autonomy. The Stimson Task Force noted that due to NNSA not achieving the independence it was meant to have, "the laboratories now function under a complicated set of DOE and NNSA regulations, guidelines, and oversight." The laboratories need better

[2] The National Nuclear Security Administration Act was created as a provision under the National Defense Authorization Act for Fiscal Year 2000. For additional information about the NNSA Act, see http://www.gpo.gov/fdsys/pkg/BILLS-106s1059enr/pdf/BILLS-106s1059enr.pdf.

strategic direction from NNSA, without the risk of losing their flexibility and authority. The excessive oversight does not allow for laboratory leadership to sufficiently manage the labs, hampering NNSA's ability to perform national security missions (Townsend et al., 2009). The 2009 Strategic Posture Commission gave notable examples in their report:

> During the first term of the Bush Administration, the DOE General Counsel effectively prevented any NNSA actions exempting the NNSA from any DOE regulations, arguing any such action required DOE staff concurrence."
>
> In 2005, a Defense Science Board Task Force examined production at the Pantex plant and concluded that excessive regulation originating outside the NNSA in a risk-averse DOE was raising costs and hampering production. Although the Task Force specifically attributed the problem to non-NNSA DOE staff, the department limited its response to an intensive review of NNSA procedures (Perry and Schlesinger, 2009).

In August of 2009, the laboratories M&O contractors laid out several recommendations to the Department of Energy at the request of Secretary Chu. Recommendations and subsequent actions issued by the M&O contractors are listed below.

> Recommendation 2: "Restore the principles of the GOCO model to the DOE national laboratories." This entails to:
>
> *Reestablish the principle that DOE's role is to set and assign program objectives and roles and to establish performance goals and that it is the contractor's role to determine the most effective means for their accomplishment.*
>
> *Implement a competition policy that is conducive to long-term partnership between DOE and its M&O contractors.* In particular we recommend that the Department compete laboratory contracts when, in its judgment, it is in the national interest to do so, but not on the basis of arbitrary time limits.
>
> *Eliminate orders and contract requirements that instruct the contractors on "how" work is to be conducted to the maximum extent practical*. As noted above, the past few years have seen a steady proliferation of DOE orders, other requirements, and "guidance" documents directing contractors in great detail how to perform work at the laboratories.
>
> Recommendation 3: "accept performance and operational risk," including the following actions:
>
> *Establish a culture that balances risk avoidance with mission accomplishment, accepting and managing appropriate risk.*
>
> *Respond to unfavorable events by holding contractors accountable for performance, rather than by issuing new requirements.*

It is unclear the impact that these recommendations have made.

Issue 4: Excessive number of reviews and oversight by external organizations (particularly by the Defense Nuclear Facilities Safety Board).

It was evident since the mid 1990s that numerous DOE and external organizations influenced (in the form of oversight reviews), the environmental, safety, and security practices of the weapons complex. A lack of consensus among these organizations on an agreed-upon definition of safety and a formal mechanism for coordinating and evaluating the reviews by these organizations is evident (Richanbach et al., 1997). Organizations review a program, believing that their view on how the laboratories be regulated should be made the standard. This has resulted in an excessive number of uncoordinated, often conflicted reviews. The 1997 IDA study stated: "At any time during what could be a multi-year process, the area office or contractor might, for example, receive a hundred pages of comments from just about anyone that must then be addressed. When conflicts arise between two or more reviewers, there is no formal method for resolving them" (Richanbach et al., 1997). The recommendations formulated by these organizations are developed without a cost/benefit analysis, and have resulted in extreme losses to productivity and unnecessary spending (DOE, 1995). The 1995 Galvin Task Force described the effect of the excessive amount of audits on the laboratories:

> Everyone wants in on the act—headquarters, the DOE area office, the DOE field office, program offices of the DOE, the Defense Nuclear Facilities Safety Board (DNFSB), the Department of Labor's office of Federal Contract Compliance, the EPA, the General Accounting Office (GAO) and the state where the laboratory is located. Each has oversight entities and each thinks their audit is the most important. There are also increased costs and productivity loss of those individuals, who are mostly scientists, interacting with the auditors (DOE, 1995).

The role that non-regulatory agencies (particularly the Defense Nuclear Facilities Safety Board) have had on the laboratories is excessive. Although the Board lacks independent regulatory enforcement authority, it has issued more than 30 formal recommendations to the Secretary of Energy since 1990 (DOE, 1995). Its mission was to move the DOE from its conventional "expert-based safety system" to a "standards-based system," and disagreement ensued in how standardized and rigorous these standards should be. In the past, the Board was "too inflexibly committed to ES&H approaches," adopting approaches too disproportionate and insufficient to address all safety requirements (Richanbach et al., 1997). The standard-based system resulted in increased formalities and regulations involved in the procedures for evaluating hazards.

The 2003 SEAB's Blue Ribbon Commission Report on *Competing the Management and Operations Contracts for the Department of Energy Labs* also observed an excessive number of external reviews of laboratory program and safety performance. They noted that laboratories spend a great deal of time and overhead in trying to fulfill a multitude of requirements in preparation for reviews. The table below, excerpted from the 2003 Blue Ribbon Commission Report, provides a summary of the number of peer reviews given by various organizations for LLNL's Defense and Nuclear Technologies (DNT) Directorate:

TABLE C.2 Number of Peer Reviews of the LLNL Defense & Nuclear Technologies Directorate

Review Type	Number	Number of Requiring Reports
External Program Peer Review	17	14
University of California (UC) Peer Review of S&T Supporting DNT Program	5	Not indicated
UC-Based Review Panels and Councils	17	17
Joint Lab, UC, NNSA Reviews of Contract Performance	4	Reports and briefings
NNSA Headquarters-Based Program Reviews	38	Not indicated
DNT External Safety Inspections, Assignments and Reviews	35	Number of reports not indicated. Included 11 audits, 6 assessments, 3 analyses of fire hazards, 5 inspections, 6 reviews, 1 survey, and 3 miscellaneous

The Blue Ribbon Commission stated that DOE attempted to change their reviewing procedures to fix the problem of excessive reviews, but the Commission was under the impression that their revisions did not result in enough change (DOE, 2003).

The SEAB's 2005 Task Force on Nuclear Weapons observed that the invasive role played by the Defense Nuclear Facilities Safety Board (DNFSB) and the DOE Office of Independent Oversight and Performance Assurance in security matters have contributed to the "multiple layers of oversight and responsibilities for compliance within the NNSA and in the parent DOE structure" (DOE, 2005). Although the DNFSB only issues recommendations and not requirements, "their recommendations have the implicit status of requirements because of the current lack of a specific mechanism for implementation assessment." The SEAB Task Force highly emphasized that an analysis of the costs of implementation, safety benefits, and risks of an idea should drive every decision and recommendation made to and within the Complex, and suggested the DNFSB use this mechanism every time they make recommendations to the laboratories.

In 2009, the Strategic Posture Commission continued to highlight the excessive oversight of external agencies on the Complex, stating that "the regulatory burden on NNSA facilities is increased significantly by the on-going audits and reviews by the DOE Inspector General, the Defense Nuclear Facilities Safety Board, and the Government Accountability Office. These burdens are not under the control of either the Secretary of Energy or the NNSA administrator" (Perry and Schlesinger, 2009).

In August of 2009, the laboratories M&O contractors laid out several recommendations to the Department of Energy at the request of Secretary Chu. One recommendation issued was to "accept appropriate performance and operational risk." The actions set forth by the contractors pertaining to the excessive amount of external oversight on the laboratories are below:

> *DOE oversight of functions that are already regulated by other entities (such as OSHA, the NRC, or state environmental regulators) should be replaced with oversight provided by those entities.*
>
> *Consider consolidating DOE oversight and audit activities.*

To date, it is unclear the impact these recommendations have made on laboratory management.

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D

The Structure of the Management Organizations that Govern the NNSA National Security Laboratories

GOVERNMENT (PRIMARILY DOE/NNSA, INCLUDING SITE OFFICES)

These three laboratories are overseen primarily by NNSA, located in DOE. The primary responsibility lies with the Deputy (NNSA) Administrator for Defense Programs (NA-10), who is responsible both for management/administration of the labs, and for the core programs. The organization of NNSA is shown in Figure D.1. Day-to-day matters are handled through the site office at each location: Sandia Site Office (SSO); Los Alamos Site Office (LASO); and Livermore Site Office (LSO). The site managers report to the Deputy Administrator for Defense Programs (NA-10). The laboratory directors also communicate with (report to) the NNSA Administrator (who is also the Under Secretary of Energy for Nuclear Security), and the Principal Deputy Administrator, and to the Secretary of Energy. On matters related to the stockpile stewardship program, the laboratory directors are responsible to the President, the Secretary of Energy, the Secretary of Defense, and to the Congress.

In addition to NA-10, other NNSA Deputy Administrators deal with the laboratories on substantive matters. The laboratories also do work for the DOE Office of Science, and for other major government entities, primarily DoD, DHS, and DNI. However, only NNSA (particularly NA-10) is directly involved directly in the health and management of the laboratories.

The DOE site offices are important because they are the primary interface between DOE and the laboratories, and the initial point of contact for most matters managerial, contractual, and administrative. The site offices are organizations of significant size (~100 officers are each site office), and somewhat complex organization. Each site manager reports directly to NA-10. However, within each site office some of the officers have other reporting chains in addition to reporting to the site manager. Within each site office, the contract manager is responsible for ensuring that the M&O contractor follows all the terms of the contract, and for evaluating performance under the terms of the contract. This includes the development of performance evaluations plans (PEPs), and the yearly performance evaluation reports (PERs). The yearly award fee, as specified in the contract, depends on the yearly evaluation. While final sign-off on the evaluation and award rests with the NNSA Administrator and Principal Deputy, most of this is worked through the reporting chain that begins with the contract manager at the site office.

Two important indicators of the factors of major importance in the management of the laboratories—at least from the NNSA/DOE perspective—are the organization of the site offices, and the list of factors for evaluation as specified in the M&O contracts and elaborated in the PEPs. The structures of the site offices are reviewed below; the contacts and PEPs are discussed in Appendix D.

Figure D.2 shows the major offices within SSO, LASO, and LSO as listed in the DOE (on-line) telephone directory (http://phonebook.doe.gov/fieldorg.pdf).[1] Table D.1 compares these by function.

[1] These listings are current as of September 15, 2011.

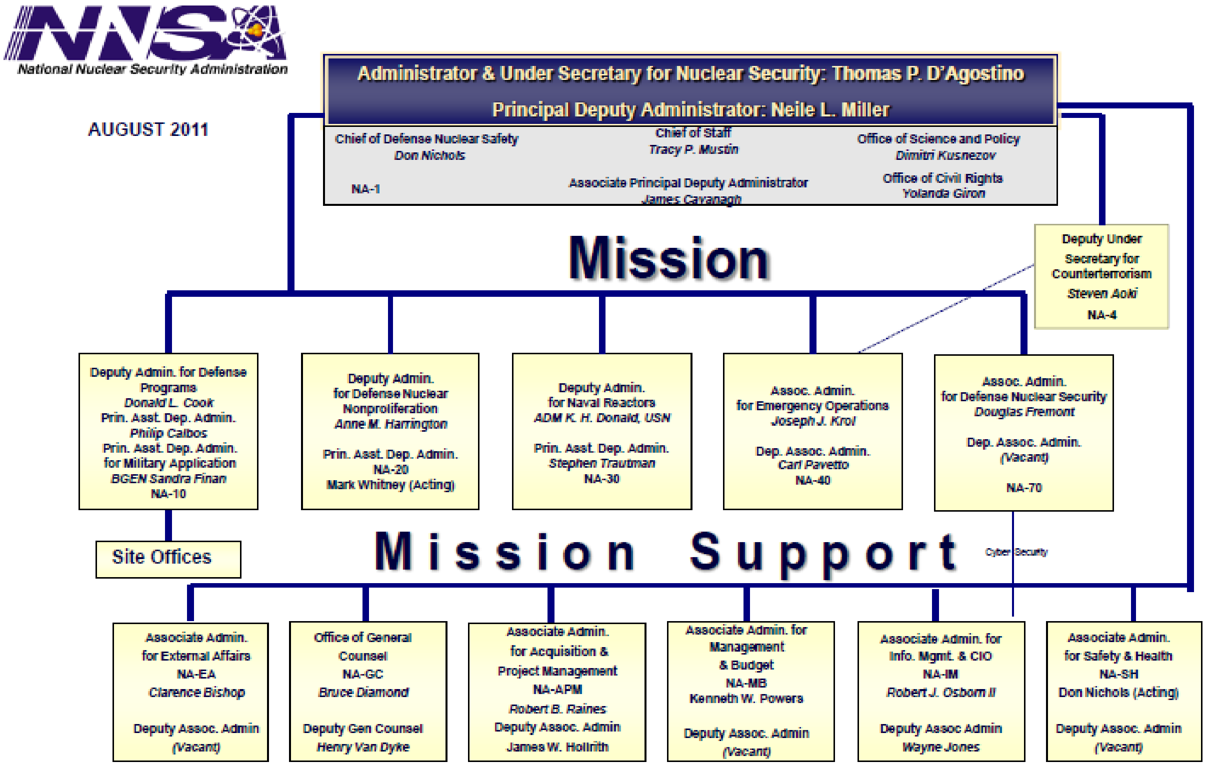


FIGURE D.1 NNSA organizational chart. SOURCE: See http://nnsa.energy.gov/sites/default/files/nnsa/inlinefiles/NNSA%20HQ%20org%20chart%20-%20with%20names%208-11_1.pdf. August 2011.

Sandia Site Office	Los Alamos Site Office	Livermore Site Office
Director (Site Office Manager)	Site Office Manager	Site Office Manager
Deputy Manager	CMRR Project Office Director	Assistant Manager for Contract Administration and Resource Management
Assistant Manager for Contract Administration and Business Management	Quality Assurance Staff Director	Assistant Manager for Safeguards and Security
Assistant Manager for Safeguards and Security	Chief Counsel Staff Director	Assistant Manager for National Security Implementation
Assistant Manager for Programs	Contract Administration Staff Director	Assistant Manager for Operations Management
Assistant Manager Nuclear Operations	Environmental Projects Office Director	Assistant Manager for Technical Services
Assistant Manager for Facilities and Projects	Assistant Manager for National Security Missions	Assistant Manager for Environmental Stewardship
Assistant Manager for Environment, Safety, and Health	Assistant Manager for Safety Operations	
Assistant Manager for Performance and Quality Assurance	Assistant Manager for Safeguards and Security	
	Assistant Manager for Field Operations	

FIGURE D.2 Major Officers at the three site offices.

TABLE D.1 Comparison of Major Offices at the three Site Offices

Function	SSO	LASO	LSO
Contract administration	Contract Administration and Business Management	Contract Administration	Contract Administration and Resource Management
Safeguards and security	Safeguards and Security	Safeguards and Security	Safeguards and Security
Environment and health	Environment, Safety, and Health	Environmental Projects	Environmental Stewardship
Safety	Environment, Safety, and Health	Safety Operations	
Performance and quality assurance	Performance and Quality Assurance	Quality Assurance	
Operations	Nuclear Operations	Field Operations	Operations Management
National security		National Security Missions	National Security Implementation
Other	Programs	CMRR Project	Technical Services
	Facilities and Projects		

Based on Table D.1, we can observe the following:

1. The three site offices are organized similarly, but not identically.
2. None of the three has a senior officer who is explicitly responsible for scientific/technical quality.
3. Most of the organization at each site office appears to be concerned with overseeing contract management, operations, safety, security, environment, and business matters.

In the course of discussions at site visits—including discussions with the three site managers and other site office officers—and at meetings with other NNSA officials, the committee was told that the site offices are concerned with mission performance and the underlying scientific work, but that is not their primary focus. Moreover, the expertise of most site office officers is in operational and support areas (and in business practices and contract performance), not in science and engineering.

Interagency Oversight

The "Governance Charter for an Interagency Council on the Strategic Capabilities of DOE National Laboratories as National Security Assets" (see Appendix A) creates a mechanism for agencies other than NNSA to participate in the planning, evaluation, and maintenance of ST&E (science, technology, and engineering) at the laboratories. This does not supplant the role of DOE/NNSA as the owner of the laboratories, but it brings organizations that had heretofore been users of the capabilities at the laboratories into a more active role of sustaining the ST&E capabilities.

The charter provides for the creation of a mission executive council consisting of two senior executives from each of the signatory agencies (DOE, DoD, DHS, and DNI). Among other things, the executive council will: (1) review and assess the adequacy of ST&E in areas of cross-cutting interest; (2) identify areas of ST&E needing attention; (3) consider recommendations to close identified gaps; and (4) take actions as necessary and appropriate. This charter does not replace NNSA's authority, and it does not void or replace any contractual obligations. However, it does provide another, broader, government forum within which to evaluate scientific quality at the laboratories and the relevance of that scientific quality to a broad range of national security missions. It also provides a basis for major government agencies beyond DOE/NNSA to develop a stake in—and therefore a basis for investing in—ST&E at the labs.

This interagency review process is an official review process, but it does not supplant or replace the existing NNSA review process under the terms of the M&O contracts. This interagency process explicitly focuses on ST&E, and not on the much broader range of management issues addressed in the yearly reviews and evaluations under the terms of the M&O contracts as conducted through the site offices.

MANAGEMENT ORGANIZATIONS AT THE LABORATORIES (SNL, LANL, LLNL)

The organizations of the three laboratories are shown in Figures D.3, D.4, and D.5.

M&O Contractors (Sandia Corp., LANS, LLNS)

Each of the three laboratories is managed by a corporation established for the sole purpose of managing that laboratory: Sandia Corporation; Los Alamos National Security, LLC (LANS); and Lawrence Livermore National Security, LLC (LLNS). Each laboratory director is an officer of the respective management corporation. The director of SNL is the president of the Sandia Corporation. The director of LANL is the president of LANS, LLC. The director of LLNL is president of LLNS, LLC. In each case, the director is responsible to a corporate board of governors/board of directors.

Sandia Corporation is a wholly owned subsidiary of Lockheed Martin Corporation. The names of the Sandia Corporation board of directors are not generally publically available.

LANS is owned/governed by four parent corporations: Bechtel National, Inc.; University of California; Babcock & Wilcox Company; URS Energy & Construction, Inc.

LLNS is owned/governed by five parent corporations: Bechtel National, Inc.; University of California; Babcock & Wilcox Company; URS Energy & Construction, Inc.; and Battelle. LLNS is also affiliated with the Texas A&M University system.

LANS and LLNS have the same board chairman and vice chairman and share most of their other governors.

All three organizations include substantive review committees that provide periodic reviews to laboratory management. laboratory management may use some of that review material in preparing its self-evaluation (in preparation for the Performance Evaluation Report as specified by the contract), but these internal reviews are considered confidential "insider" critique, and are generally not shared with NNSA.

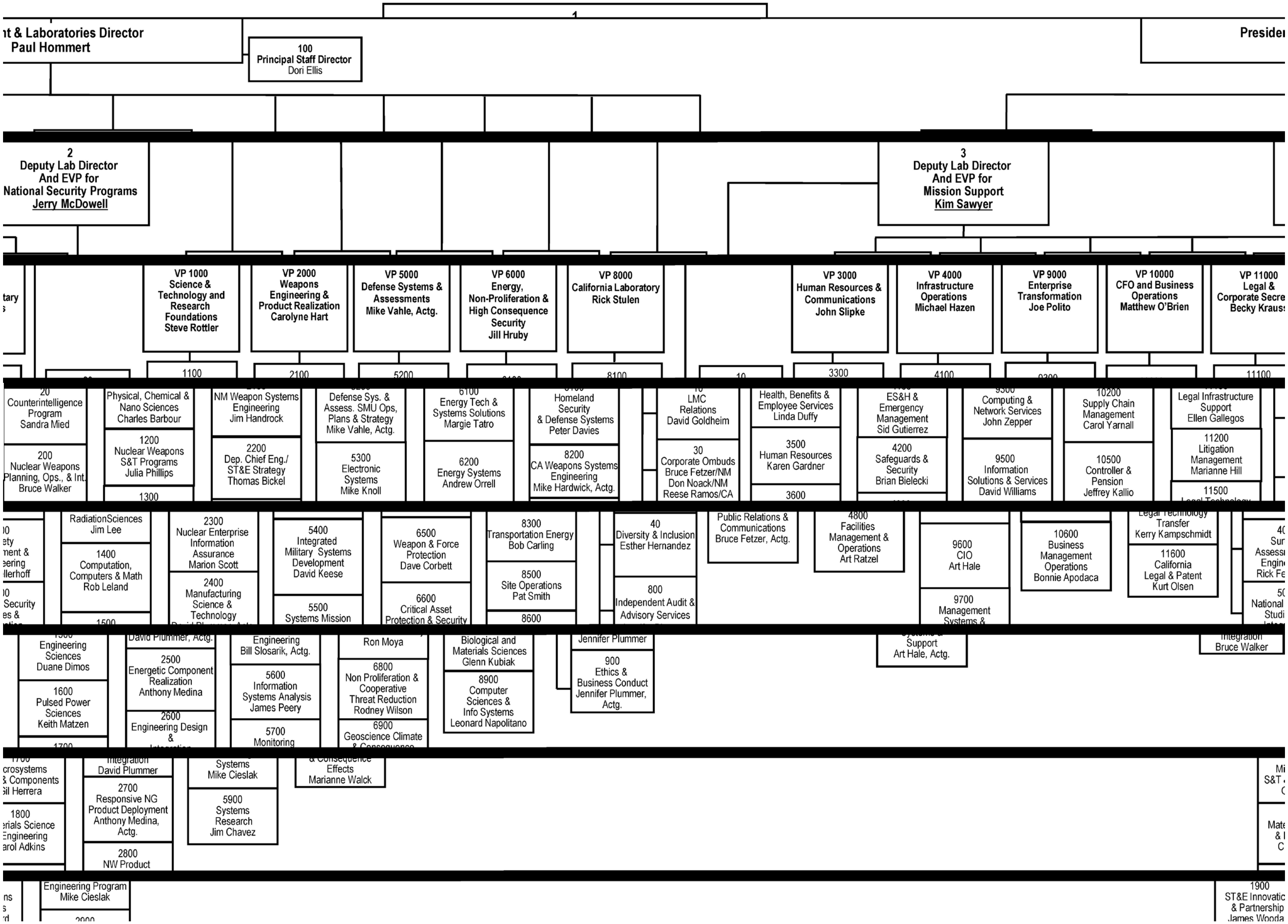


FIGURE D.3 Sandia National Laboratory. SOURCE: SNL current organizational chart as of February 2011.

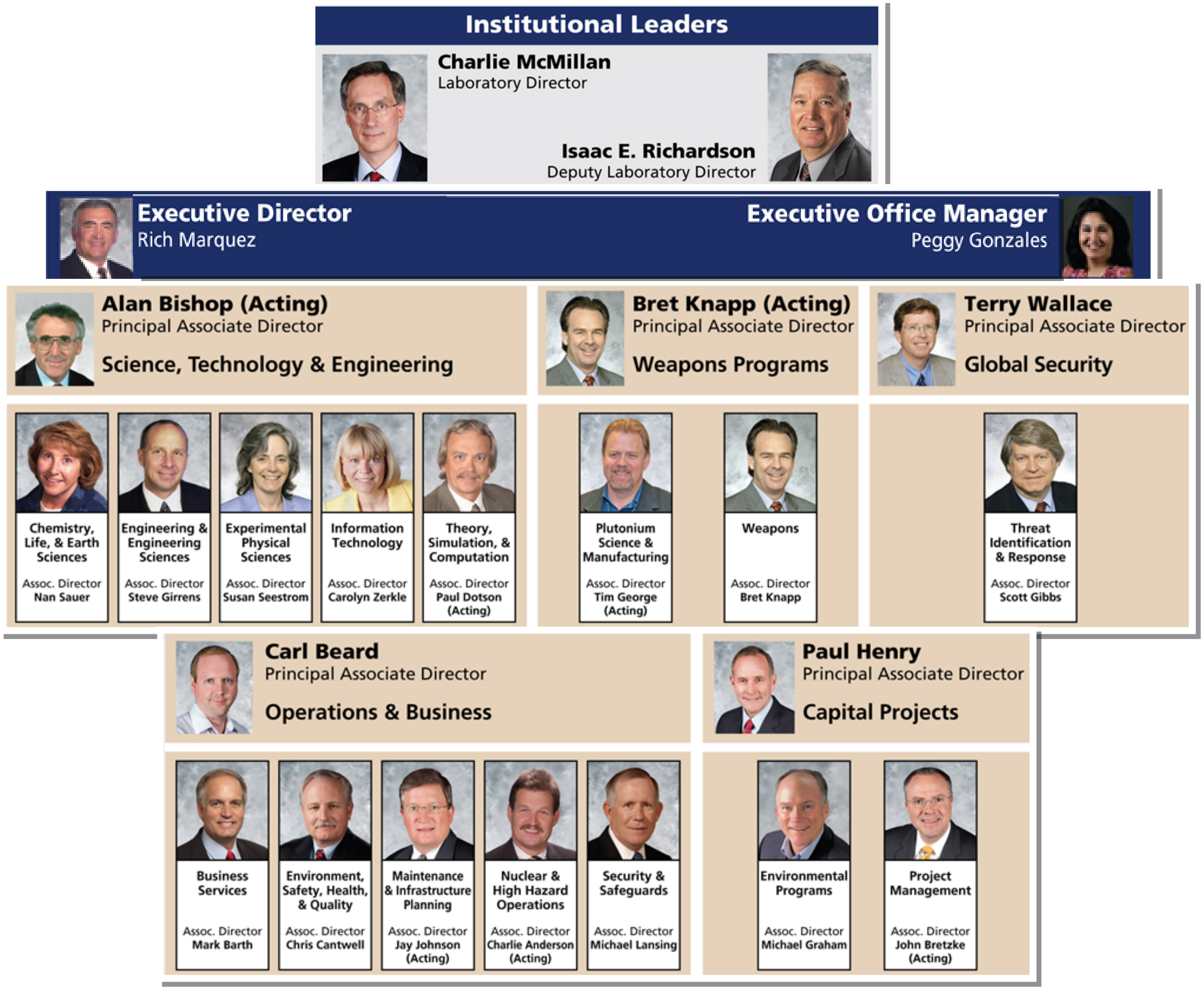


FIGURE D.4 Los Alamos National Laboratory. SOURCE: LANL current organizational chart as of June 2011, available at http://www.lanl.gov/organization/docs/current/org_chart.jpg.

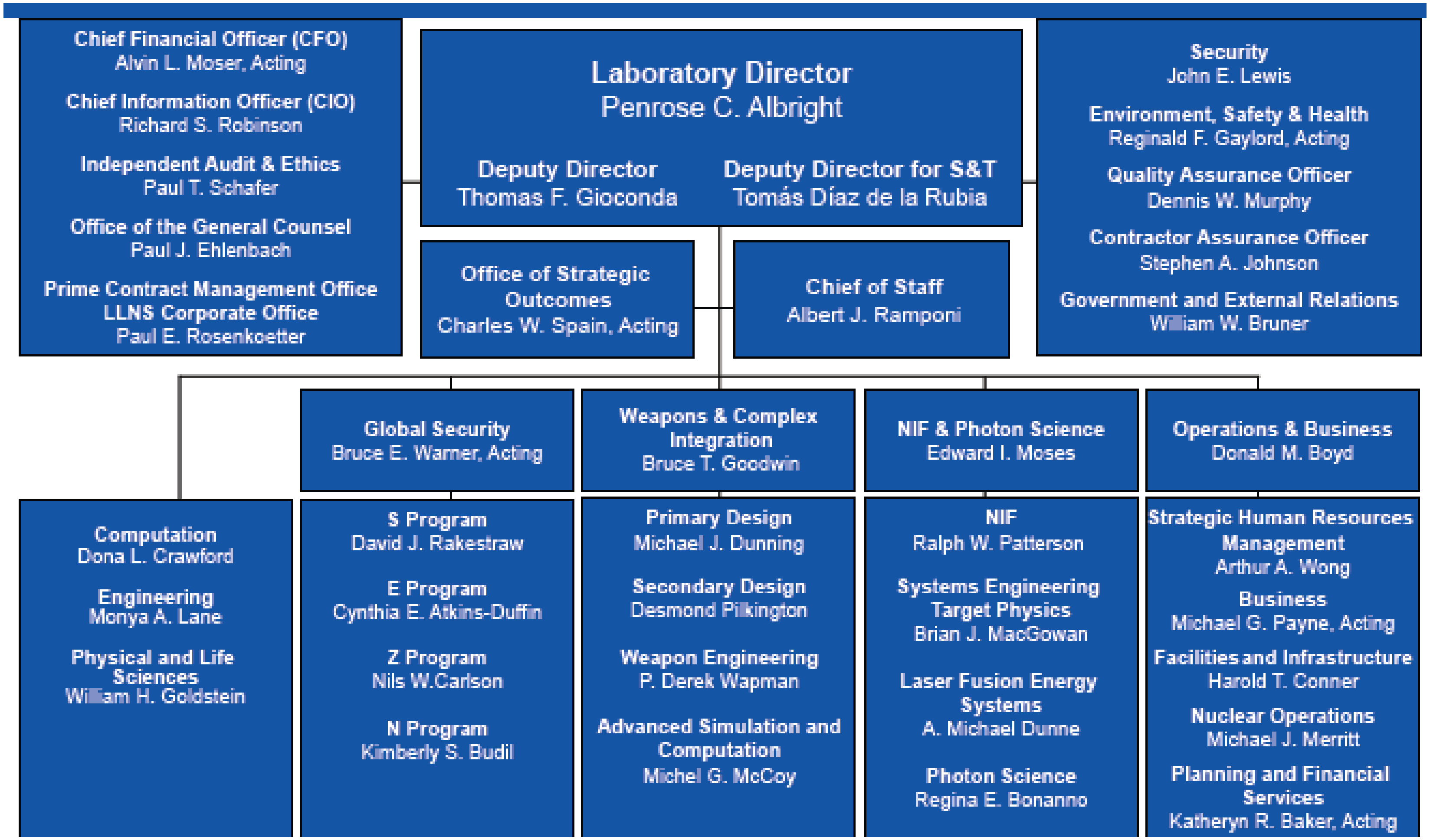


FIGURE D.5 Lawrence Livermore National Laboratory. SOURCE: See LLNL current org chart as of July 2011, available at https://www.llnl.gov/images/about/org_chart.pdf.

E

What the Laboratories' Management and Operations (M&O) Contracts Say About the Conduct and Evaluation of Science and Engineering

For each laboratory management corporation, the contract is the primary document governing its relationship with the government. Each contract includes a statement of work and an annual Performance Evaluation Plan (PEP), which is included in the contract as a contract modification. Other modifications are also included as agreed between the government and the contractor. Other important documents that affect the conduct of science and engineering are the Contract Management Plan, the Parent Organization Oversight Plan, and the annual Performance Evaluation Review (PER), which is based on the PEP.

Although they have important specific differences, the contracts governing SNL, LANL, and LLNL are generally similar in form and content. In general, each specifies: (1) what the laboratory is and does; (2) what the management corporation is committed to do; (3) what work is to be done at the laboratory (the "statement of work," or SOW); and (4) how that work is to be reviewed, evaluated, and rewarded. The contracts also specify certain rights and responsibilities of specific government offices to task and/or oversee the work.

The SOWs, while lengthy, are basically general. The contracts do not assign specific program tasks. The following—from the LLNL contract—is representative:[1]

> Inasmuch as the assigned missions of the Lawrence Livermore National Laboratory (Laboratory) are dynamic, this Statement of Work (SOW) is not intended to be all-inclusive or restrictive, but is intended to provide a broad framework and general scope of the work to be performed at the Laboratory. This SOW does not represent a commitment to, or imply funding for, specific projects or programs. The National Nuclear Security Administration (NNSA) and Department of Energy (DOE) work requirements are developed through strategic planning and program plans.

While this quoted paragraph refers primarily to programmatic work, the contracts make clear and specific that the laboratory management is committed to other duties, including operational and administrative tasks. Indeed, these management tasks constitute a large part of the work against which the management corporations are evaluated.

The performance evaluation process determines how successful the management has been for the period being evaluated (usually a year), and the contract specifies how success is rewarded. The rewards consist of an award fee (incentive fee) and an award term (i.e., an extension of the temporal term of the contract without need for competition). Independent of the review, the management corporation also receives an annual fixed fee (specified in the contract) and payment for allowable expenses associated with running the management corporation (much of which is associated with paying officials of the various boards and advisory groups).

The incentive fees and fixed fees vary across the laboratories and by year. Table E.1 displays approximate values for comparison.

[1] See Modification No. M003 Supplemental Agreement to Contract No. DE-AC52-07NA27344, titled "Part III, Section J, Appendix B-Statement of Work" from the LLNL contract for the Statement of Work in full, available at http://www.llnsllc.com/contract/docs/AppendB_mod53_012209.pdf.

TABLE E.1 Approximate Annual Fee Structures (in millions of dollars)

Laboratory	Fixed Fee	Maximum Incentive Fee
SNL	16	9-10
LANL	22	52
LLNL	12.5	29.5

Most (≥90 percent) of the incentive fee is awarded when a laboratory successfully executes tasks specified in its annual PEP so that the amount of incentive fee that is really "in play" in any evaluation process is in reality a few million dollars (out of a total annual laboratory budget in excess of $1 billion).

All three contracts state that science and engineering are major parts of what the laboratories do. The LLNL contract is perhaps most explicit in this regard, the SNL contract least so. The following excerpt from the LLNL contract also appears verbatim in the LANL contract (but with a different identifying number):

> **H-36 INTELLECTUAL AND SCIENTIFIC FREEDOM**[2]
>
> (a) The Parties recognize the importance of fostering an atmosphere at the Laboratory conducive to scientific inquiry and the development of new knowledge and creative and innovative ideas related to important national interests.
> (b) The Parties further recognize that the free exchange of ideas among scientists and engineers at the Laboratory and colleagues at universities, colleges, and other laboratories or scientific facilities is vital to the success of the scientific, engineering, and technical work performed by Laboratory personnel.
> (c) In order to further the goals of the Laboratory and the national interest, it is agreed by the Parties that the scientific and engineering personnel at the Laboratory shall be accorded the rights of publication or other dissemination of research, and participation in open debate and in scientific, educational, or professional meetings or conferences, subject to the limitations included in technology transfer agreements and such other limitations as may be required by the terms of this Contract. Nothing in this clause is intended to alter the obligations of the Parties to protect classified or unclassified controlled nuclear information as provided by law.
> (d) Nothing in the Section I clause entitled "DEAR 952.204-75 Public Affairs" is intended to limit the rights of the Contractor or its employees to publicize and to accurately state the results of its scientific research.

The LLNL SOW states (emphasis added):

> **2.0 Laboratory Mission and Scope of Work.**
> The Contractor shall manage, operate, protect, sustain and enhance the Laboratory's ability to function as a NNSA Multi-Program Laboratory, while assuring accomplishment of **the Laboratory's primary mission - strengthening the United States' security through development and application of world-class science and technology to enhance the nation's defense and to reduce the global threat from terrorism and weapons of mass destruction.**

To some degree, these, and similar statements are "boilerplate" in that they have no specific obligations attached to them. However, they are indicators of what the orientation of the laboratory is expected to be. Indeed, Section H-13 of the LLNL contract says more pragmatically:

[2] See Contract No. DE-AC52-07NA27344 Modification No. 241 for Sections B-H of the LLNL contract, available at http://www.llnsllc.com/contract/docs/Part_I_Section_B-H-LLNL_992011mod241.pdf.

> **<u>This Contract is a management and operating contract</u>**, which holds the Contractor accountable for performance. This Contract uses clearly defined standards of performance consisting of performance objectives and performance incentives

Identical language is found in H-12 of the LANL contract and H-10 of the SNL contract.

Section 2.0 of the LLNL SOW lists 17 major points that the scope of work is to include. Five of these 17 deal explicitly with science and technology, as indicated by **<u>bold underline below:</u>**

- Conducting major NNSA research and development programs including using an earned-value management system;
- **<u>Fostering an environment of scientific skepticism and peer review of research programs;</u>**
- Assuring the safety, security, reliability, and performance of the national nuclear weapons stockpile pursuant to national security policy and presidential and congressional directives;
- Demonstrating design and development capabilities to support a Reliable Replacement Warhead strategy, and stockpile and complex transformation;
- **<u>Providing scientific, engineering, and computational capabilities that support assessment, dismantlement, manufacturing, and refurbishment of the enduring stockpile at a number of sites;</u>**
- Operating major facilities including the National Ignition Facility and the Device Assembly Facility that support broad national interests and users.
- Ensuring the secure handling and safe disposition of plutonium, highly enriched uranium, and tritium;
- Helping to deter, detect, and respond to the proliferation of weapons of mass destruction;
- **<u>Conducting fundamental science research, nuclear energy development, and nuclear waste management technology in support of other DOE programs;</u>**
- Contributing to civilian and industrial needs and non-NNSA defense activities through a work for others program by using the scientific and technical expertise that derives from carrying out the Laboratory mission;
- Providing access to the capabilities of the laboratory to further Department of Homeland Security mission objectives;
- **<u>Advancing of science, mathematics, and engineering education;</u>**
- **<u>Advancing science through technological innovation, public and private sector collaboration, and technology transfer to enhance U.S. economic competitiveness and national security;</u>**
- Managing and operating the Laboratory facilities and infrastructure in an efficient, cost effective, and innovative manner;
- Remediating and restoring the Lawrence Livermore National Laboratory sites;
- Managing waste minimization, treatment, storage, and disposal of all wastes; and
- Assisting the nuclear weapons complex in waste stabilization, storage and disposition technologies.

The lists for the other two laboratories are similar, but with different specific elements. These lists appear to be something more than general principles and something less than specific contractual obligations.

Regarding expectations of performance, all three contracts say in Section H-2:

> **<u>H-2 PERFORMANCE DIRECTION</u>**
> **(a) The Contractor is responsible for the management and operation of the site in accordance with the Terms and Conditions of the Contract, duly issued Work Authorizations (WAs), and written direction and guidance provided by the Contracting Officer and the Contracting Officer's Representative (COR). NNSA is responsible for establishing the work to be accomplished, the applicable requirements to be met, and overseeing the performance of work of the Contractor. The Contractor will use its expertise and ingenuity in Contract performance and in making choices among acceptable alternatives to most effectively, efficiently and safely accomplish the work called for by this Contract**

NNSA is responsible for telling the contractor what to do, and the contractor is responsible for figuring out how to do it.

EVALUATION OF THE QUALITY OF SCIENCE AND ENGINEERING

The contracts make clear that the primary responsibility for monitoring contract performance rests with the site offices: Los Alamos Site Office (LASO); Livermore Site Office (LSO); and Sandia Site Office (SSO). From Section G of each of the contracts:

> The NNSA Manager, Livermore Site Office (LSO), is the Contractor's primary point of contact for all technical and administrative matters, except as identified in (b) below, regarding this Contract. The LSO Administrative Contracting Officers are the Contractor's primary point of contact for all contractual matters for this Contract.
>
> The NNSA Manager, Los Alamos Site Office is the Contractor's primary point of contact for all technical and administrative matters, except as identified in (b) below, regarding performance of this contact. The LASO Administrative Contracting Officer is the Contractor's primary point of contact for all contractual matters.
>
> The NNSA Manager, Sandia Site Office (SSO), is the Contracting Officer responsible for this Contract. The SSO is the Contractor's focal point of contact for all matters, except as identified in (b) below, regarding this Contract.

Clause (b) cited in each of these states that "The Patent Counsel, Office of Chief Counsel, NNSA Service Center, is the Contractor's focal point for items concerning patent, intellectual property, technology transfer, copyright, open source, licenses and technical data issues."

However, all three contracts make clear that there are major authorities that are reserved to the contracting officer, and not the site manager:

> (b) Clarifying the Contract Relationship
> NNSA will establish the work to be accomplished by the Contractor, set applicable requirements to be met by the Contractor and provide performance direction to the Contractor regarding what NNSA wants in each of its programs. NNSA will issue performance direction to the Contractor only through a warranted Contracting Officer or a designated Contracting Officer's Representative. All other Federal staff and oversight components are therefore precluded from tasking contractor personnel.
>
> **H-2 PERFORMANCE DIRECTION**
>
> (a) The Contractor is responsible for the management and operation of the site in accordance with the Terms and Conditions of the Contract, duly issued Work Authorizations (WAs), and written direction and guidance provided by the Contracting Officer and the Contracting Officer's Representative (COR). NNSA is responsible for establishing the work to be accomplished, the applicable requirements to be met, and overseeing the performance of work of the Contractor. The Contractor will use its expertise and ingenuity in Contract performance and in making choices among acceptable alternatives to most effectively, efficiently and safely accomplish the work called for by this Contract
> (b) Only the Contracting Officer may issue, modify, and priority rank WAs.
> (c) (1) The Contracting Officer and the NNSA Administrator will appoint, in writing, specific NNSA employees as CORs with the authority to issue Performance Direction to the Contractor. CORs are authorized to act within the limits of their delegation letter . . . COR functions include technical monitoring, inspection, and other functions of a technical nature not involving a change in the scope, cost, or terms and conditions of the Contract. The COR is authorized to review and approve technical reports, drawings, specifications, and technical information delivered by the Contractor.
> (2) The Contractor must comply with written Performance Directions that are signed by the COR

The following from the LLNL contract is representative (**emphasis added)**:

> (b) Performance Appraisal Process.
>
> (1) Performance Evaluation Plan.
>
> (i**) A Performance Evaluation Plan shall be developed and finalized by the *Contracting Officer*, with Contractor input . . . The *NNSA Livermore Site Office Manager* reserves the unilateral right to make the final decision on all performance objectives and performance incentives (including the associated measures and targets) used to evaluate Contractor performance. The *NNSA Administrator* reserves the unilateral right to make the final decision on all award term incentives (including the associated measures and targets) used to evaluate Contractor performance.**
>
> (ii) **Only the *Contracting Officer* may revise the Performance Evaluation Plan, consistent with the Contract's Statement of Work, during the appraisal period of performance . . .**
>
> (2) Contractor Self-Assessment. The Contractor shall prepare an annual self-assessment of its performance against each of the performance objectives and incentives contained in the Performance Evaluation Plan . . . The Contracting Officer will identify the structure and medium to be used by the Contractor in delivering its annual self-assessment.

Matters are complicated by the fact that the three site offices are organized differently.

Recent Contract Management Plans (CMP) for the three laboratories[3,4,5] make it clear that in the case of each location, the contract manager has most of the responsibility. The CMPs for LANL and LLNL are very similar. Note, however, that in section 5.3 (which describes the Site Manager), there is a significant difference.

The LANL contract states: "The Site Office Manager is a senior NNSA manager that provides an on-site, day-to-day presence at the laboratory. The LASO Site Manager is responsible for effective contract administration at LANL to ensure the successful implementation of NNSA programs. The Site Manager relies on the Site CO . . . to administer contracts based upon demonstrated individual qualifications and Site Office needs, as well as to handle most day to-day administrative contract duties. **The LASO manager currently does not possess CO authority**. As such, he **must rely on his COs and jointly issue direction** to LASO which is or may be considered outside the current scope of the Prime Contract."

The LLNL contract states: "The Site Office Manager is a senior NNSA manager that provides an on-site, day-to-day presence at the laboratory. The LSO Site Manager is responsible for effective contract administration at LLNL to ensure the successful implementation of NNSA programs. The Site Manager is also an Administrative Contracting Officer with authority to administer contracts based upon demonstrated individual qualifications and Site Office needs.
Although the **LSO Site Manager is a warranted CO**, she **relies largely on the Site CO . . . to handle most day-to-day administrative contract duties.**

The SNL contract states: (section 5.1.1)

> **The SSO Site Manager is appointed as a Contracting Officer. . . .** The SSO Manager is a senior NNSA manager that provides an on-site, day-to-day presence at SNL. The SSO Manager is responsible for effective contract management and oversight at SNL to ensure the successful implementation of NNSA programs. The SSO Manager is also a CO with authority to administer the Sandia Contract based upon demonstrated individual qualifications and SSO needs. Although the SSO Manager is a warranted CO, she relies largely on the SSO CO to handle most day-to-day

[3] Contract Management Plan for Los Alamos National Laboratory, Contract No. DE-AC52-06NA25396, Los Alamos CMP-9-3-08, 2008.

[4] Livermore Site Office, Contract Management Plan for Lawrence Livermore National Laboratory, Contract No. DE-AC52-07NA27344, LSO_CMP_6-10-088, 2008.

[5] Contract Management Plan for Sandia Corporation, 2007.

administrative contract duties. "5.5 Contracting Officer (CO): The CO has sole authority to enter into, administer, or terminate Federal contracts. The CO, through properly written modifications to the contract, is the only person authorized to make changes to cost, scope, and schedule. The CO must ensure that all requirements of law, executive orders, regulations, and all other applicable procedures, including clearances and approvals, have been met. The CO is also responsible for ensuring performance of all necessary actions for effective contracting, ensuring compliance with the terms of the contract, and safeguarding the interests of the United States in its contractual relationships. The FAR allows the CO wide latitude to exercise business judgment. This duty includes the balanced objective of safeguarding the interests of the United States in its contractual relationships and ensuring that contractors receive impartial, fair, and equitable treatment."

In a formal sense, the site manager is responsible for the evaluation process, but most of the authority rests with the CO. The evaluation begins with the preparation of the PEP, which is agreed (and signed) among the laboratory director, the site manager, and the CO. The laboratory then conducts a self evaluation, which the CO (with the help of others at the site office) uses in the preparation of a PER (performance evaluation report). Final sign-off on the results of the evaluation rests with the Principal Deputy (NNSA) Administrator. Typically, none of these individuals is a scientist or engineer.

These three contract management plans say little or nothing about scientific quality, and nothing about the process for evaluating scientific quality. On the other hand, there is a lot of emphasis on deliverables, both substantive (i.e., related to the research and program work) and procedural/managerial/legal.

PERFORMANCE EVALUATION PLAN

NRC staff reviewed PEPs for LLNL[6] and for LANL.[7] For each laboratory, the annual PEP is the official basis for the evaluation of performance under the contract, which in turn is the basis for the award (incentive) fee and the award term (i.e., award of continuation of the contract). The PEP is a modification to the contract; it becomes Part III, Section J, Appendix F [of the M&O contract]. Each PEP is the product of the specific site office, and they are significantly different in form.

LLNL PEP

This plan lists eleven Strategic Performance Objectives:

1. Complete essential activities for core weapons program requirements.
2. Strengthen the foundation of deterrence through stockpile science, technology, and engineering.
3. Propose and implement strategies for sustaining a strong deterrent at low numbers compatible with START, NPR and CTBT goals.
4. Execute Inertial Confinement Fusion Ignition and High Yield Campaign in support of stockpile stewardship.
5. Support nonproliferation and threat reduction.
6. Provide science, technology, and engineering excellence.
7. Support current and evolving mission performance by providing effective and efficient facilities and infrastructure.
8. Maintain safe and environmentally sound operations in an efficient and effective manner in support of mission objectives.

[6] LANL Performance Evaluation Plan for FY2011.

[7] LLNL Performance Evaluation Plan, dated April 28, 2010, is for the evaluation of performance for FY2010 (beginning October 1, 2009).

9. Maintain secure operations in an efficient and effective manner in support of mission objectives.
10. Manage business operations in an effective and efficient manner while safeguarding public assets and supporting mission objectives.
11. Governance assures performance and creates long-term sustainable value for the institution.

The PEP organizes the Strategic Performance Objectives as six program objectives (1-6), three operations objectives (7-9), and two institutional management objectives (10 and 11). Objective 6 deals explicitly with excellence in science and engineering and is the only objective to do so.

Attachment 1 breaks the 11 objectives into more detail. The part of that table dealing with Objective 6 is shown in Table E.2.

In calculating the performance objective award fee, all six of the program objectives are considered together. Roughly 35 percent of this part of the fee depends on the six program objectives; 45 percent depend on the three operations objectives, and 21 percent depend on the two institutional management objectives. Although it is not explicitly stated, it appears that Objective 6 (excellence in science and engineering) accounts for perhaps 6 percent of the incentive fee.

The award term is tied to five objectives, none of which is science and technology *per se*. These are: stockpile stewardship mission; site transformation activities; sustainable management; safety management system; and contractor assurance system. The first of these five contains explicit science-based milestones and objectives, but these objectives are not "excellence in science." These five "ATI"s (award term incentives) are generally combinations of near-term (i.e., current year) and near-to-midterm (i.e., 1-3) objectives.

TABLE E.2 LLNL PEP Strategic Performance Objective 6

Performance Category	Number	Performance Objective/Measure/Target	Type	DOE Strategic Plan Reference	NNSA Program Office Crosswalk
Programs	6	Provide science, technology, and engineering excellence	Objective	3. Scientific Discovery & Innovation	NA-121.4
Programs	6.1	Assure the quality of the core science, technology and engineering (ST&E) competencies	Measure	3.2 Foundations of Science	NA-121.4
Programs	6.1.1	Demonstrate R&D excellence in program execution through external peer reviews, evidence of awards and recognition, and benchmarked S&T metrics.	Target(s) - Essential only	3.2 Foundations of Science	NA-121.4
Programs	6.1.2	Recruit and retain a workforce, including students and postdocs, that provides the technical engineering, and scientific staff for mission-relevant national needs.	Target(s) - Essential only	3.2 Foundations of Science	NA-121.4
Programs	6.2	Develop, implement, and periodically update an integrated and balanced ST&E strategy.	Measure	3.2 Foundations of Science	NA-121.4
Programs	6.2.1	As a measure of successful implementation of the FY 2009 5-year ST&E Roadmap, demonstrate that internal investments (e.g., LDRD) are aligned with thrust areas identified in the strategic plan.	Target(s) - Essential only	3.2 Foundations of Science	NA-121.4
Programs	6.2.2	Monitor the long-term impact that LDRD investments have made on the scientific, programmatic, and intellectual property position of LLNL for 2011.	Target(s) - Stretch only	3.2 Foundations of Science	NA-121.4
Programs	6.3	Develop Strategic Collaborations and an Open Campus	Measure	3.2 Foundations of Science	NA-121.4
Programs	6.3.1	Implement a strategy for seeking new collaborative research with commercial, governmental, and academic entities. Execute design and construction activities that deliver a facility with open access with beneficial occupancy in FY11.	Target(s) - Essential only	3.2 Foundations of Science	NA-121.4

SOURCE: LANL Performance Evaluation Plan, dated April 28, 2010, for the evaluation of performance for FY2010 (beginning October 1, 2009), Attachment 1.

LANL PEP

The plan lists and explains 19 performance based incentives (PBIs). PBI 18 is concerned with the award term incentives while the others are related to award (incentive) fee. PBI 12 is focused on science and engineering quality:

> **PBI No. 12** Objective: **Excellence in Science, Technology, and Engineering**
> **Objective Statement:** Science, technology, and engineering underpin and enable Los Alamos to provide knowledge and technologies to execute its national security missions. State of the art equipment and facilities enable science to push the frontiers of knowledge; however capabilities rely on the appropriate mix of people and resources. Leadership, competence and insight drive science and position the institution for success.

This is a termed a "stretch" PBI with a maximum value of $5,500,000 (or 10.7 percent of the maximum available). It is evaluated subjectively according to the guidance shown in Table E.3.

PBI 18 lists five performance measures for the award term. One of these five, Measure 18.3 Demonstrate Leadership in Pu Science, is explicitly related to science. The detailed description of measure 18.3 is shown below in Figure B.

TABLE E.3 Performance Measures for LANL PBI No. 12

SECTION 4
PERFORMANCE MEASURES
List associated performance measures, expectations, targets, and fee schedules for FY 2010.

Measure 12 **Excellence in Science, Technology, and Engineering (Subjective/Stretch)**

Expectation Statement:
The NNSA will subjectively evaluate the contractor's performance in

Completion Target:

Criteria	Target
12.1 Leadership in Scientific, Technology and Engineering Challenges of National Importance	The list below represents subject areas to be considered for scoring. Less than expected performance in a given area does not necessarily equate to a failed score. Similarly, this list is not considered all inclusive and other topics, issues, or area of concern may be commented on under this criterion. • Pursue national security missions in the national interest that are mutually beneficial to NNSA and other customers. • Science, technology and engineering strategic plans. • Willingness to pursue novel approaches and/or demonstration of innovative solutions to problems that are important to the Nation and Laboratory's customers. • Effectiveness in driving the direction and setting the priorities of the community in a research field.

continues

TABLE E.3, *continued*

	12.2 Quality of Science, Technology & Engineering	The list below represents subject areas to be considered for scoring. Less than expected performance in a given area does not necessarily equate to a failed score. Similarly, this list is not considered all inclusive and other topics, issues, or area of concern may be commented on under this criterion. Impact and contribution to the scientific community as measured by: • Peer reviewed publications generated. • Significant awards (R&D 100, FLC, society fellows, etc.). • Voice of the customer obtained through the "Modified Office of Science" approach. • Assessments by 2010 LANL capability reviews. • Invited talks, citations, making high-quality data available to the scientific community. • Development of tools and techniques that become standards or widely-used in the scientific community. • Staff members visible in leadership positions in the scientific community.	
	12.3 Capability Based Science Program	The list below represents subject areas to be considered for scoring. Less than expected performance in a given area does not necessarily equate to a failed score. Similarly, this list is not considered all inclusive and other topics, issues, or area of concern may be commented on under this criterion. • Alignment of skills and capabilities with NNSA mission using workforce capabilities tool. • Institutional investment in science infrastructure. • Effectiveness in leveraging (synergy with) other areas of research. • Provide planning and acquire facilities and infrastructure required to support the continuation of the Laboratory's mission and programs.	

continues

TABLE E.3, *continued*

	12.4 Stewardship of LANL Scientific Resources	The list below represents subject areas to be considered for scoring. Less than expected performance in a given area does not necessarily equate to a failed score. Similarly, this list is not considered all inclusive and other topics, issues, or area of concern may be commented on under this criterion. • Increase the effectiveness of the entire scientific enterprise. • Scientific user facility utilization. • Balance with Laboratory missions by maintaining STE capabilities and facilities in a mutually beneficial manner for the multiple customers. • Accountability to institution and institutional practices. • Provide efficient and effective communications and responsiveness to customer needs by responding to customer requests with accurate and timely information.	
	12.5 Energy Frontiers & Challenges	The list below represents subject areas to be considered for scoring. Less than expected performance in a given area does not necessarily equate to a failed score. Similarly, this list is not considered all inclusive and other topics, issues, or area of concern may be commented on under this criterion. • Address recommendations from 2009 review of Laboratory's Energy Security Science Strategy. • Expand the Energy Security Science Strategy to include components for staffing and infrastructure resources. Plan elements for staffing and infrastructure will be delivered to LASO by September 1, 2010. • Implement the Laboratory's Energy Security Science Strategy. • Effectiveness of joint planning (e.g., workshops) with outside community. • Development of capabilities, ideas for new facilities and research programs. • Diversify funding base to maintain core science, technology and engineering base.	

continues

TABLE E.3, *continued*

	12.6	Work for Others Management and Technology Transfer Programs	The list below represents subject areas to be considered for scoring. Less than expected performance in a given area does not necessarily equate to a failed score. Similarly, this list is not considered all inclusive and other topics, issues, or area of concern may be commented on under this criterion. • Effectiveness and efficiency of the management of work for others (WFO) and technology transfer and in the benefits to the Laboratory's mission performance. • Leveraging CRADAs and WFO to maintain critical NNSA capabilities • Implementation of corrective actions from FY 2009 management assessments, audits, and capability reviews. • Leverage intellectual property for cooperative research projects.	
	12.7	Science ARRA Management Stimulus	The list below represents subject areas to be considered for scoring. Less than expected performance in a given area does not necessarily equate to a failed score. Similarly, this list is not considered all inclusive and other topics, issues, or area of concern may be commented on under this criterion. • Implementation of stimulus capability applicability process for all stimulus competitive grants that are issued. • Share lessons learned on stimulus capability applicability process with applicable S&T organizations. • Demonstration of effective communication and teaming with outside entities associated with stimulus-related work. (State of New Mexico, other laboratories, municipalities, etc.) • Oversight of execution of stimulus-funded S&T work to ensure baselines (scope, cost, and schedule) are achievable. • Oversight of execution of stimulus-funded S&T work to ensure appropriate reporting is submitted to sponsors. • Other related items, concerns, and missions.	

continues

TABLE E.3, *continued*

	12.8	Science, Technology, and Engineering Leadership and Management	The list below represents subject areas to be considered for scoring. Less than expected performance in a given area does not necessarily equate to a failed score. Similarly, this list is not considered all inclusive and other topics, issues, or area of concern may be commented on under this criterion. • Integration, alignment, and balancing of institutional STE resources to deliver on mission commitments. • Integration in and proactive resolution of performance and management concerns. • Integration and synergy across the institution. • Management of institutional resources to position Laboratory for FY 2011 and beyond • Risk to DOE/NNSA and Laboratory continuity by LANS action or inaction • LANS management and mitigation of site risks • Consideration of any increases or decreases in site risks • Effective leveraging of WFO to offset and/or leverage landlord costs.	
	12.9	Management of Emergent Science, Technology, and Engineering Issues	The list below represents subject areas to be considered for scoring. Less than expected performance in a given area does not necessarily equate to a failed score. Similarly, this list is not considered all inclusive and other topics, issues, or area of concern may be commented on under this criterion. • Timely identification and effective action to resolve emerging performance concerns and issues including non-conformances and non-compliances. • Response to and implementation of new NNSA, DOE, Presidential and/or Congressional initiatives and requirements • Other related items, concerns, and missions.	

SECTION 5
ASSUMPTIONS / TECHNICAL BOUNDARY CONDITIONS

List foreseeable impacts to performance.

- The NNSA and LANS, LLC will agree within 30 days of receipt of final appropriations, or by mutually agreed to date if under a long-term Continuing Resolution, that the funding is sufficient to accomplish these measures. If by this date, Continuing Resolution funding or final appropriation is less than the President's Budget Request, LANS shall identify any impacts to the FY 2010 PEP measures within 30 calendar days. If interim Continuing Resolution funding is less than the President's Budget Request, LANS shall identify any impacts to the FY 2010 PEP measures within 15 business days following the approval of the Continuing Resolution.
- If no specific due date is referenced with any of the PBI completion elements, the due date of that element is to be September 30, 2010.
- If LANS cannot meet/complete a PBI because of conditions or events that are outside of LANS' ability to control, the PBI will be renegotiated.
- Performance Objectives (POs) 11, 12, 13, and 14 may each address elements of concern and/or success

Measure 18.3 Demonstrate Leadership in Pu Science (Award Term)

Expectation Statement:
Develop a peer reviewed Pu Science and Research strategy to ensure integration with LLNL, leverage international Pu scientific efforts, and form the basis for scientific pursuits at LANL.

Develop a living Pu Science and Research Strategy that:

- Ensures a path forward for plutonium science to support the nuclear weapons program and the key issues of pit reuse, refurbishment and remanufacturing
- Builds upon and links to LLNL and Seaborg Institute pursuits while leveraging worldwide efforts
- Assures chemistry, physics and metallurgical aspects are addressed
- Explicitly establishes Pu Science as a sustainable and desirable field of study at LANL
- Encourages visible excellence through publications and conference participation
- Rewards publication in peer-reviewed journals to demonstrate the capacity of the staff to do world-class research
- Assures historical data is mined and knowledge captured for experiential calibration and correlation
- Addresses Pu isotopes, alloys, interactions, and experiences relative to the stockpile
- Integrates LDRD, programmatic and other funding sources to define a timetable
- Clearly defines the linkages to current and planned efforts in the Pu community
- Attracts and retains world-class scientists and engineers to plutonium research and applications.
- Broadens the applications portfolio to include nuclear nonproliferation, nuclear forensics, and nuclear energy to provide a more attractive research environment for recent graduates.
- Rejuvenates plutonium metallurgical research and surface science
- Develops new predictive theoretical tools for the highly correlated actinide systems
- Seeks improvement in the operational environment for plutonium experimental science
- Defines activities to be conducted at NTS and aligns to the FYNSP
- Reflects the planned de-inventory of LLNL and resulting LLNL, LANL, and NTS capabilities
- Integrates with and supports certification and stockpile stewardship goals
- Integrates with and supports the Predictive Capability Framework, the Boost Initiative, campaign implementation plans, and DSW requirements
- Informed by planning for Advanced Certification and Dynamic Plutonium Experiments Campaigns

Completion Target:
This measure has been achieved when the Contractor has:

1. Submitted a detailed outline for a Pu Science and Research Strategy meeting the above Expectation Statement by December 15, 2009
2. Submitted a Draft Pu Science and Research Strategy NLT March 31, 2010
3. Submitted a Final Pu Science and Research Strategy by June 30, 2010 with the Director's endorsement, (consistent with the FY 2010 budget, LDRD planning, FYNSP Programming guidance & Nuclear Posture Review)
4. Implemented the FY 2010 LANL elements of the Pu Science and Research Strategy
5. Hosted peer reviews by science leaders no later than September 30, 2010, to provide multi-tiered review for a credible outcome.
6. Socialized the PSRS draft with NNSA and DOE elements by September 1, 2010, i.e., meetings, briefings.

Deliverables

- Detailed outline of the Pu Science and Research Strategy by December 15, 2009 for LLNL and NNSA review
- Draft of the Pu Science and Research Strategy by March 31, 2010 for NNSA review
- Final Pu Science Strategy by June 30, 2010 for LLNL and NNSA review
- Implement the FY 2010 LANL elements of the Pu Science Strategy by September 30, 2010
- Proposal for revised Advanced Certification and DPE national plans and milestones to support out-year budget programming and planning

FIGURE E.1 Evaluation measures for LANL 2010 PBI No. 18.

F

The Investment/Value Returned Framework for Management of S&E

An effective management system for science and engineering (S&E) has four main responsibilities: deciding what to do and allocating the investment; supporting, monitoring, and facilitating the execution of the chosen portfolio; evaluation, and communication, of the results; and maintaining and growing capabilities, both human and technical facilities. Any comprehensive assessment of a particular management system must include both a structural portion—analyzing and assessing the systems, processes, and relationships that are in place—and an implementation portion, assessing the way in which the management system actually operates and is used.

A general approach to such an assessment is the Investment/Value Returned (I/V) framework, which has been used with good effect in industrial research settings. The core principle of the I/V framework is that S&E management should be driving toward an optimum value return on the R&D investment that is being supported. Creation of such an I/V framework provides a consistent set of intellectual underpinnings across a wide and diverse set of activities, and can serve as a key element of the core culture of an institution. The framework provides coherent and relatively explicit linkage between the enterprise's mission to the specific results aimed for at the working level, and upward from the individual scientist and engineer back to that overarching mission.

An I/V approach to the effectiveness with which management is operating involves at least the following four management challenges:

- Management must have a clear view of the nature of the returns—the value received—from investing in S&E. How do these values support the missions? Into what categories does the value fit? Inevitably there will be multiple "buckets" of value. What metrics and indicators are available and used to assess value returned, both retrospective and prospective? It is important to recognize that management must play the key role in working with the key investors to develop a shared understanding of the returns, their value, as well as appropriate metrics and indicators to assess value. Left to their own to decide, the investors will often fail to recognize how much value can be, or is being, delivered, and will thus sub-optimize their investment, for example by putting too little value on areas with high value in the longer term.
- On a prospective basis, how does management allocate investment, both to basic S&E versus the other elements, and within the S&E portfolio, aimed at maximizing the value created? For S&E it is clear that an optimum allocation methodology will involve both top-down and bottom-up approaches, vigorous debate, and ultimately a set of decisions. This discussion is expanded below in the section on "Best Practice Processes."
- How does management ensure that infrastructure and operational processes are in place relative to the S&E workforce, aimed at maximizing their ability and their motivation to create and deliver value? What metrics and indicators are used in this area? Is the set of tools and processes in place to track on an ongoing basis how much and how well value is being created and delivered by the S&E investment over the long term (for basic research) and in the nearer term (for applied research), and what inhibitors exist ?
- Are closed-loop quality processes in place to continuously improve the output, to ensure that technical capabilities are sustained and grown, driving change in each step from portfolio selection to

operational processes to infrastructure investment? A key element of this aspect of management is the set of processes which ensure that the highest level of talent is recruited to the institution, nurtured, developed, and retained.

Evaluating the effectiveness of S&E management against these four management challenges provides a far more systematic picture than does the all-too-common collection of anecdotes and qualitative impressions.

For laboratories such as the NNSA National Security labs, the success of which is strongly dependent on S&E and which do not have a profit motive, the set of values returned from the S&E investment includes at least the following:

- Essential support for achieving the labs' core missions, through core work that exploits deep aspects of physics, materials science, engineering and computational science. Without a strong internal base in these areas of S&E the core programs of the laboratories would not be viable.
- Highly talented and motivated staff, both in S&E itself and across the organization, to provide a basis for long-term success in addressing a changing portfolio of work.
- Deep contact with, and the ability to draw on and contribute to (and to some degree shape), the agendas of the broad world of science, which can, in turn, be mined for the laboratories' own uses.
- Targeted basic research to fill gaps not pursued in the open community.

The process of investment allocation—both strategic and cyclical, and both human and fiscal—is clearly one of management's major challenges, and has a huge impact on what value will be returned. This process is almost always seriously constrained by resource limitations, and demands that choices be made among a set of investment proposals each promising high value return. The investment allocation process, particularly for S&E, must effectively balance broad top-down objective setting with proposals driven by the instincts and intuitions of the S&E staff, both individuals and small groups. These processes must aim for value creation in a balanced way, and ultimately rely to a large degree on the judgment of talented and experienced management. There is no effective algorithmic approach.

A key role of management is to ensure that supportive infrastructure and processes enable optimum use of the S&E assets in executing the committed projects and programs. At a fundamental level this certainly must include minimizing the time S&E staff must spend on less productive, less value-producing, or even interruptive activity. Metrics and indicators are key to achieving this goal, as are consequent ongoing attention to reduce non-productive expenditure of time. Clearly some portion of the S&E researcher time must be diverted from research to administrative activity, proposal preparation, reporting, training in security and safety, travel, and the like.

A BEST-PRACTICE MANAGEMENT CYCLE

In the experience of the committee, the most effective systems for managing laboratories are built around a closed-loop cycle involving planning and allocation, execution, and retrospective assessment, all driven by the I/V returned model. The cyclic processes are clearly linked to a strategic backdrop tied to the institutional mission. We describe one such cyclic set of processes in this section. This cycle and its processes do not deal with the core project management, which may drive the majority of institutional resource, but deal instead with the underlying and supporting S&E which is essential to success in many deeply technical enterprises. The period of this cyclic process would typically be annual.

A key backdrop and underpinning for this process is an annually updated Outlook, or world view. This Outlook accumulates knowledge and projections from numerous sources to provide a detailed view of the environment in which the institution must achieve its mission, and is sufficiently detailed that it can be used as an environment in which potential scenarios can be modeled. It includes information on, and potential impacts of, the relevant drivers of change—technical, economic, potentially political and social—competitive factors, customer and marketplace drivers, etc. It captures the essence of "Here is the world we see in front of us in which we must succeed in our mission." And it forms, in various versions, the base for much of the communication among the parties involved: the investors and beneficiaries of the S&E work, the S&E management and technical staff, partners, customers, and others involved in the enterprise. By its exposure to the relevant parties, and open discussion and debate about the assumptions built into the Outlook, inputs for change are continuously provided. A reasonable point to define as the beginning of the (annual) cycle is a fairy formal update of the Outlook, aimed at incorporating what has been learned in the past year, as well as identifying and dealing with newly emerging trends and developments in all the key driver areas.

With an updated Outlook having achieved some level of consensus acceptance, the Strategy and Planning work begins. This will update a durable long-term set of goals and approaches to their achievement, and lay out of a set of investment options for the S&E investment. This investment allocation process is clearly the most difficult part of the cycle, since the options inevitably cannot all be committed within the available resources. As is clearly the case for the NNSA labs, and also experienced in the industry sector, the resources for S&E must be allocated among three fairly distinct types of activities. First, the bulk of the S&E must support the mission and core project goals, and thus the prioritization of this portion is driven primarily top-down from the mission, but with significant input from and debate with the S&E management and staff, both on the "what" and the "how." A second, and essential, portion of the resource—in NNSA's case, mostly represented by the LDRD resources—is primarily allocated by S&E management, laboratory directors and their colleagues, with major bottom-up input. It is this portion of the resource which ensures the health of the labs; it aims to drive major breakthroughs and develop and exploit new areas of knowledge which are not on the direct and obvious path of the mission projects. The third source and use of resource, common in industry as well and in the NNSA labs, is external funding, in the best case driven by the outside party recognizing the potential of the S&T team to create major value for the outside investor. This is not simply "works for hire" but, with proper management, represents exploitation of unique resources and programs which are synergistic with the core S&E mission and creates value for both the external investor and the S&E organization. While one might aim for this portion of the portfolio to have stability of the same sort as the "base" programs, it will almost inevitably have more dynamics through the cycle than the others.

A key piece of this planning portion of the cycle is the allocation of resources for both equipment and facilities, driven by the strategic plan. The human resource aspects of the plan are also obviously key.

The output of this portion of the cycle is an updated strategy and operating plan for the period. Best-practice organizations have, as do the NNSA labs, multiple mechanisms of both internal and external review and advice on execution. These are best structured into a coordinated rhythm and calendar, with periodicities appropriate to the particular type of review. An obvious risk is excessive and intrusive reviewing and auditing, which distracts energy from the work at hand. Appropriate dashboards, metrics and indicators are useful during this process, although they do not substitute for deep dives into issues which are surfaced by the dashboards.

Closure in the cycle is typically represented by a series of higher level reviews focused on what has been accomplished relative to committed plans, other achievements, goals missed and causes, and some quantitative metrics constituting a balanced scorecard used for overall assessment of effectiveness. In addition to overall S&E assessment, a valuable output of this end-of-cycle summary is a set of lessons-learned, and inputs for the subsequent cycle.

There is evidence from industry that driving management and culture from this I/V framework and sustained use of such a process cycle can have major positive effects in many areas. These include sustaining support for the S&E enterprise, and building a coherent internal culture which effectively balances, for the scientist or engineer, the value system of his or her technical area with the value system uniquely appropriate to the institution in which his or her S&E in embedded.

G

Selected Supporting Information

LABORATORY BUDGETS

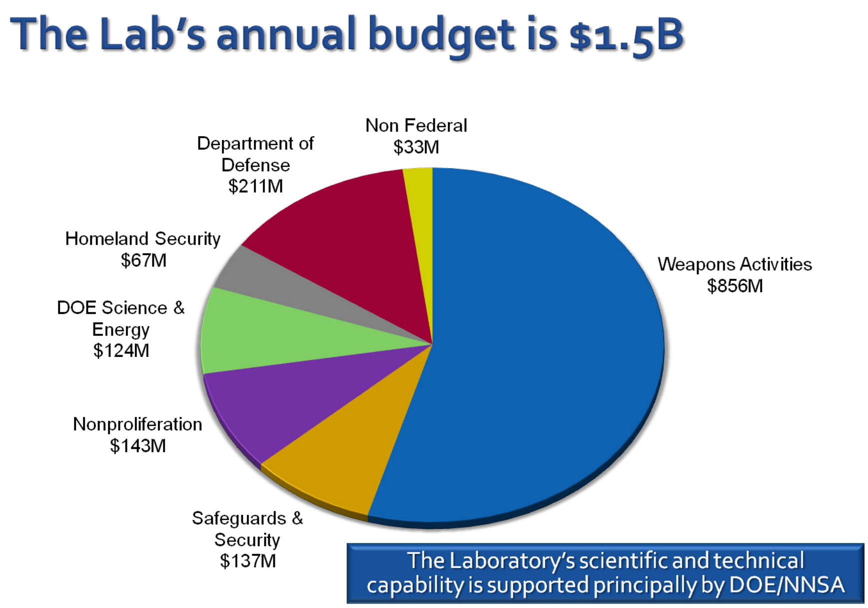


FIGURE G.1 Lawrence Livermore National Laboratory (LLNL) FY2010 Annual Budget. SOURCE: George Miller, LLNL Director, presented to the committee by on April 26, 2011, at Lawrence Livermore National Laboratory, Livermore, California.

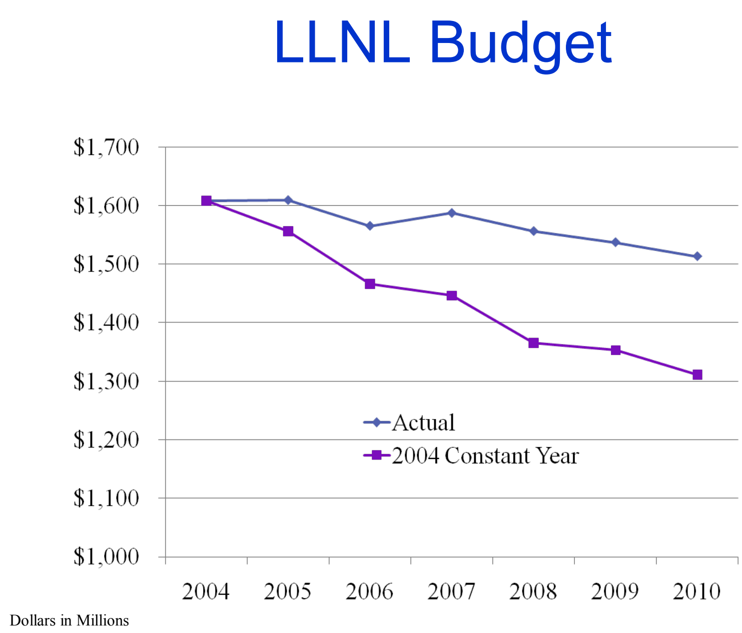


FIGURE G.2 LLNL Budget for FY2004-FY2010. SOURCE: Alice Williams, Livermore Site Office Manager, presented to the committee on April 27, 2011, at Lawrence Livermore National Laboratory, Livermore, California.

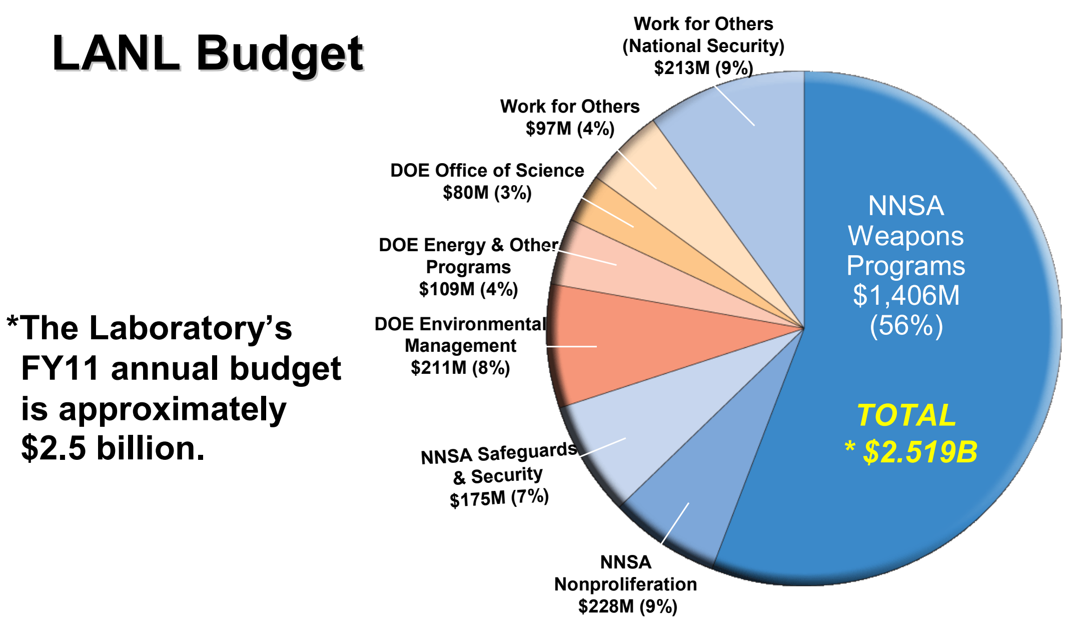


FIGURE G.3 Los Alamos National Laboratory (LANL) FY2011 Annual Budget. SOURCE: Michael Anastasio, LANL Director, presented to the committee by on April 11, 2011, at Los Alamos National Laboratory, Los Alamos, New Mexico.

Budget		
	FY10 Actual	**FY11 Estimate**
Operations & maintenance	$ 2,323.0 million	$ 2,470.9 million
Capital equipment	$ 29.0 million	$ 21.6 million
Construction	$ 14.0 million	$ 14.9 million
TOTAL	**$ 2,366.0 million**	**$ 2,507.4 million**

Note: Sandia's fiscal year runs from October 1 through September 30.

Revenue by source		
	FY10 Actual	**FY11 Estimate**
Energy & Water Development Appropriations		
Weapons activities	$ 977.8 million	$ 1,103.6 million
Defense nuclear nonproliferation	$ 173.2 million	$ 174.5 million
Other NNSA	$ 1.2 million	$ 1.5 million
Total NNSA	**$ 1,152.3 million**	**$ 1,279.6 million**
Energy efficiency & renewable energy	$ 90.4 million	$ 76.2 million
Nuclear Energy Science & Technology	$ 16.2 million	$ 25.8 million
Science programs	$ 61.3 million	$ 58.2 million
Environmental management	$ 15.0 million	$ 19.8 million
Other defense activities	$ 12.6 million	$ 11.3 million
Radioactive waste management	$ 23.1 million	-
Fossil energy conservation	$ 2.3 million	$ 5.8 million
Other DOE	$ 14.1 million	$ 43.9 million
Total DOE Funding	**$ 1,387.2 million**	**$ 1,520.6 million**
Non-DOE (Work For Others) Funding	**$ 978.8 million**	**$ 986.8 million**
Total Sandia Revenue	**$ 2,366.0 million**	**$ 2,507.4 million**

FIGURE G.4 Sandia National Laboratory (SNL) Annual Budget. NOTE: Data shown is for SNL's FY2010 actual expenditures and FY2011 estimated expenditures. SOURCE: Data from Sandia National Laboratories website, available at http://www.sandia.gov/about/faq/

LABORATORY WORKFORCE DEMOGRAPHICS

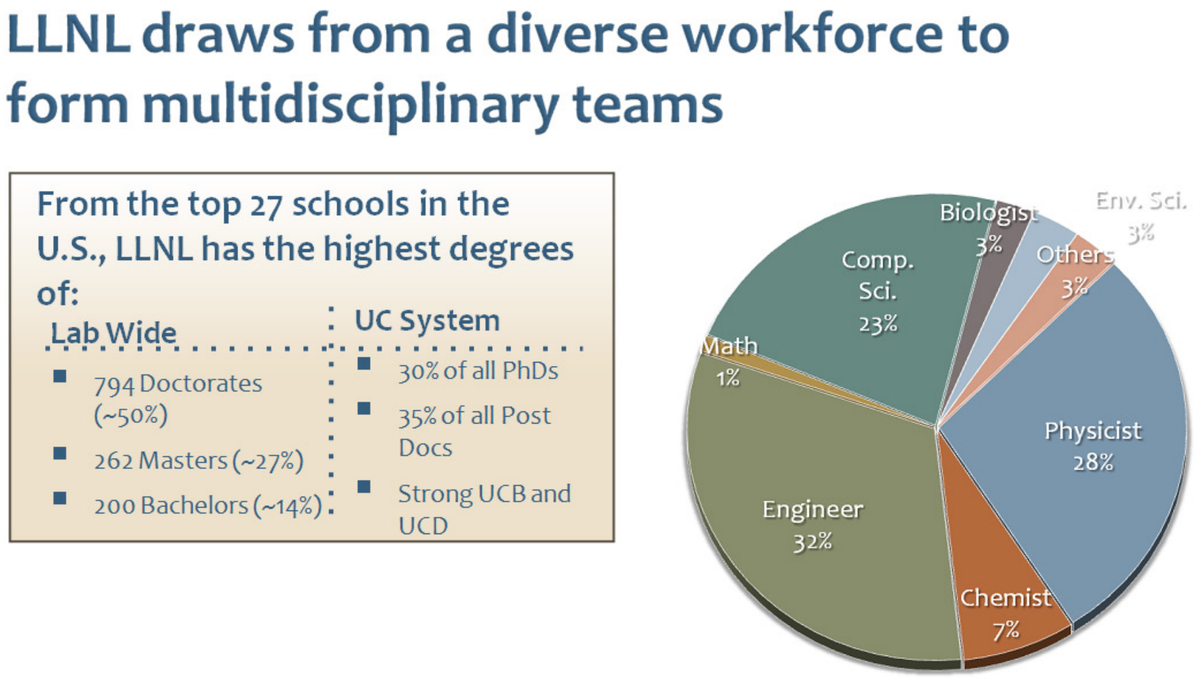
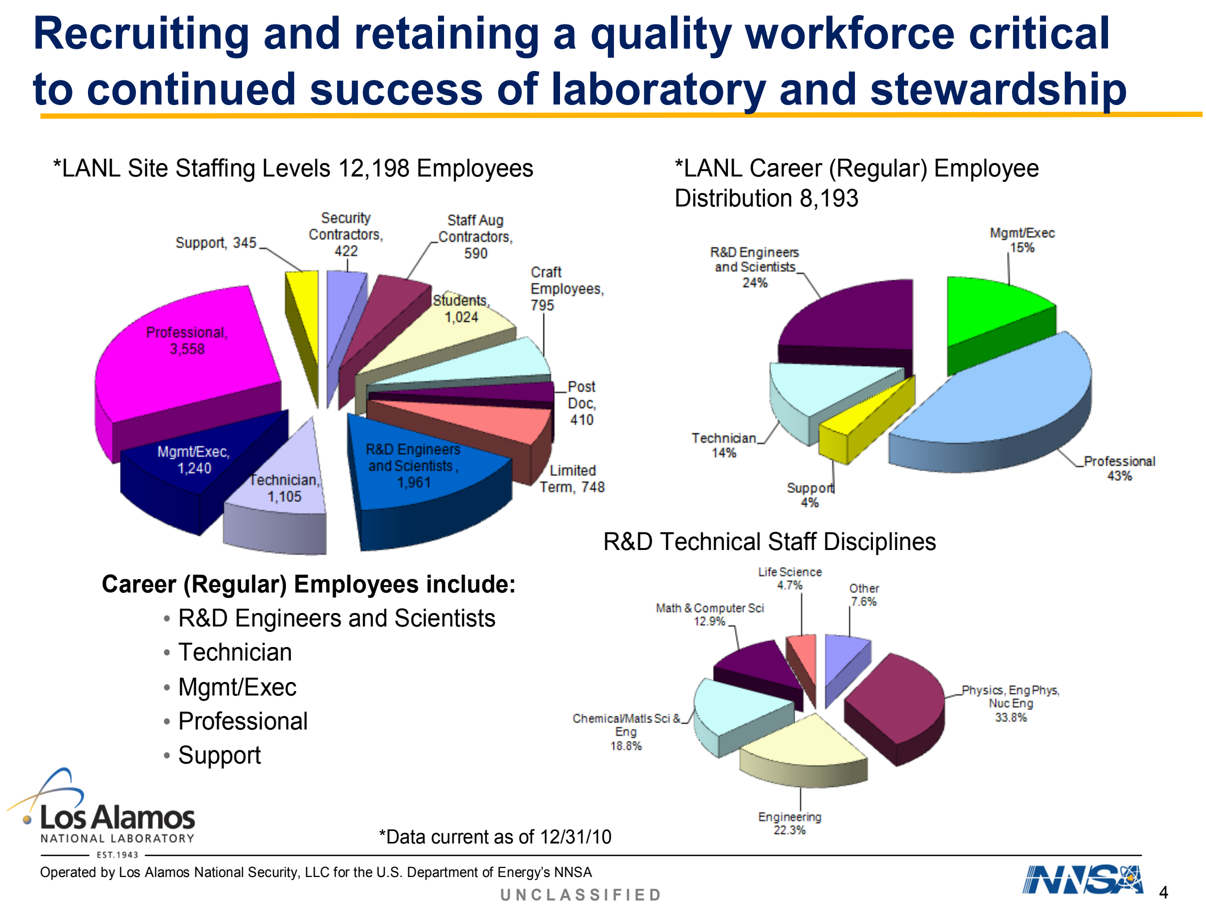


FIGURE G.5 Lawrence Livermore National Laboratory's workforce. SOURCE: Tomas Diaz de la Rubia, LLNL Deputy Director of Science and Technology, presentation to the committee on April 26, 2011, at Lawrence Livermore National Laboratory, Livermore, California.



For Fiscal Year 2011, LANL reported:

- 2,079 peer-reviewed publications which was the highest since 2006

- LANL won three R&D 100 Awards

- The number of post-doctorial candidates was an all-time high

FIGURE G.6 Los Alamos National Laboratory's workforce. SOURCE: Michael Anastasio, LANL Director, presented to the committee on April 11, 2011, at Los Alamos National Laboratory, Los Alamos, New Mexico.

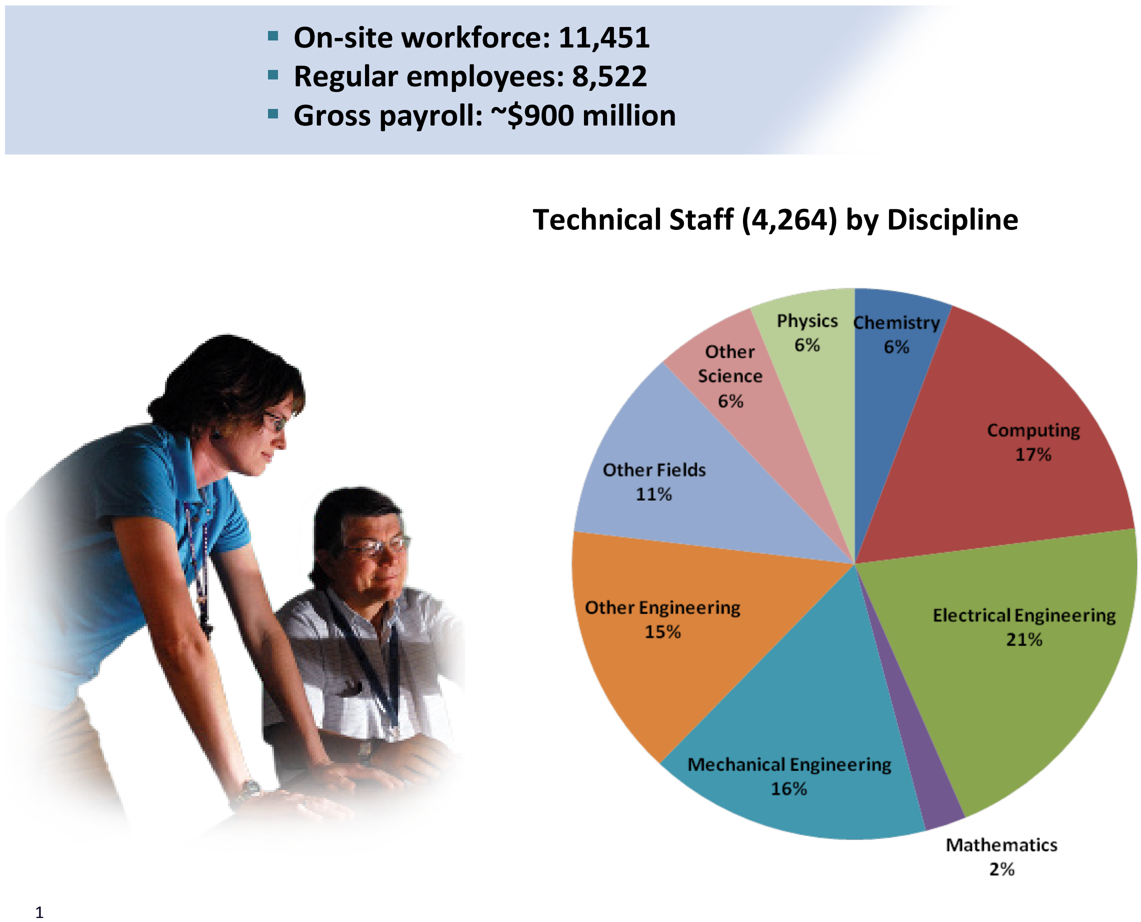


FIGURE G.7 Sandia National Laboratory's workforce. SOURCE: Paul Hommert, SNL Director, presentation to the committee on March 22, 2011, at Sandia National Laboratory, Albuquerque, New Mexico.

LABORATORY SITE OFFICE STAFF NUMBERS

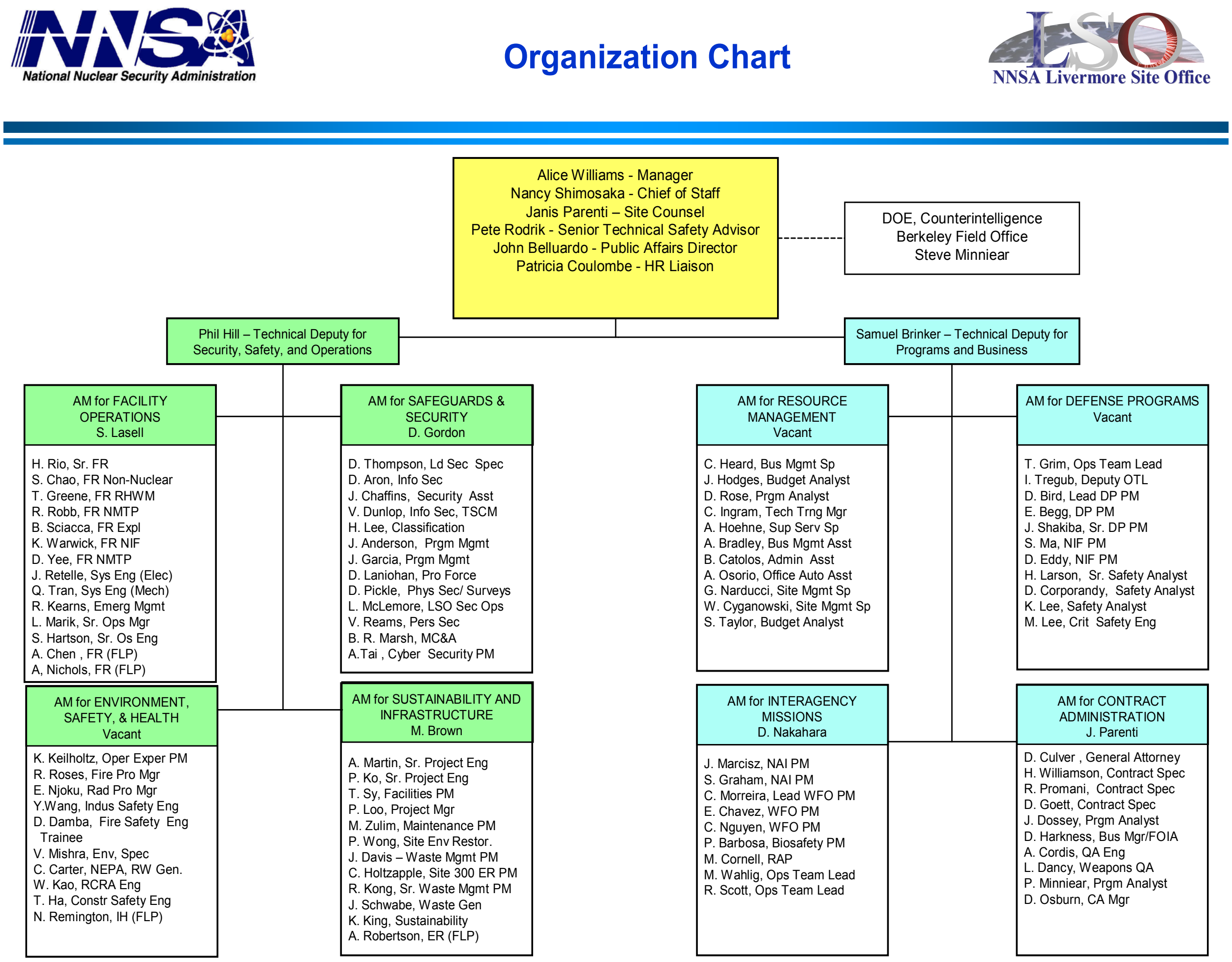


FIGURE G.8 Livermore Site Office (LSO). NOTE: This figure gives the organizational structure of the Livermore Site Office. Listed under each Assistant Manager (AM) position are the names of the individuals that the respected AM manages. According to the data in this figure, the size of the Livermore Site Office totals 106 employees, which includes all Assistant Managers (vacant and non-vacant positions), the staff they supervise, the Technical Deputies, and the positions located in the Manager's Office: Site Office Manager, Chief of Staff, Site Counsel, Senior Technical Safety Advisor, Public Affairs Director, and HR Liaison. SOURCE: Alice Williams, Livermore Site Office Manager, presentation to committee on April 27, 2011, at Lawrence Livermore National Laboratory, Livermore, California.

The LASO Team

Authorized 107 NNSA and 28 EM employees:

10% Facility Representatives	10% Mission
10% Project Management	20% Nuclear Safety
20% Environmental	10% Management
10% Security	10% Support

About 85 percent possess BA, MA, or PhD and several qualify as subject matter experts in their fields

FIGURE G.9 Los Alamos Site Office Team. SOURCE: Kevin Smith, LASO Manager, data from presentation to committee on April 12, 2011, at Los Alamos National Laboratory, Los Alamos, New Mexico.

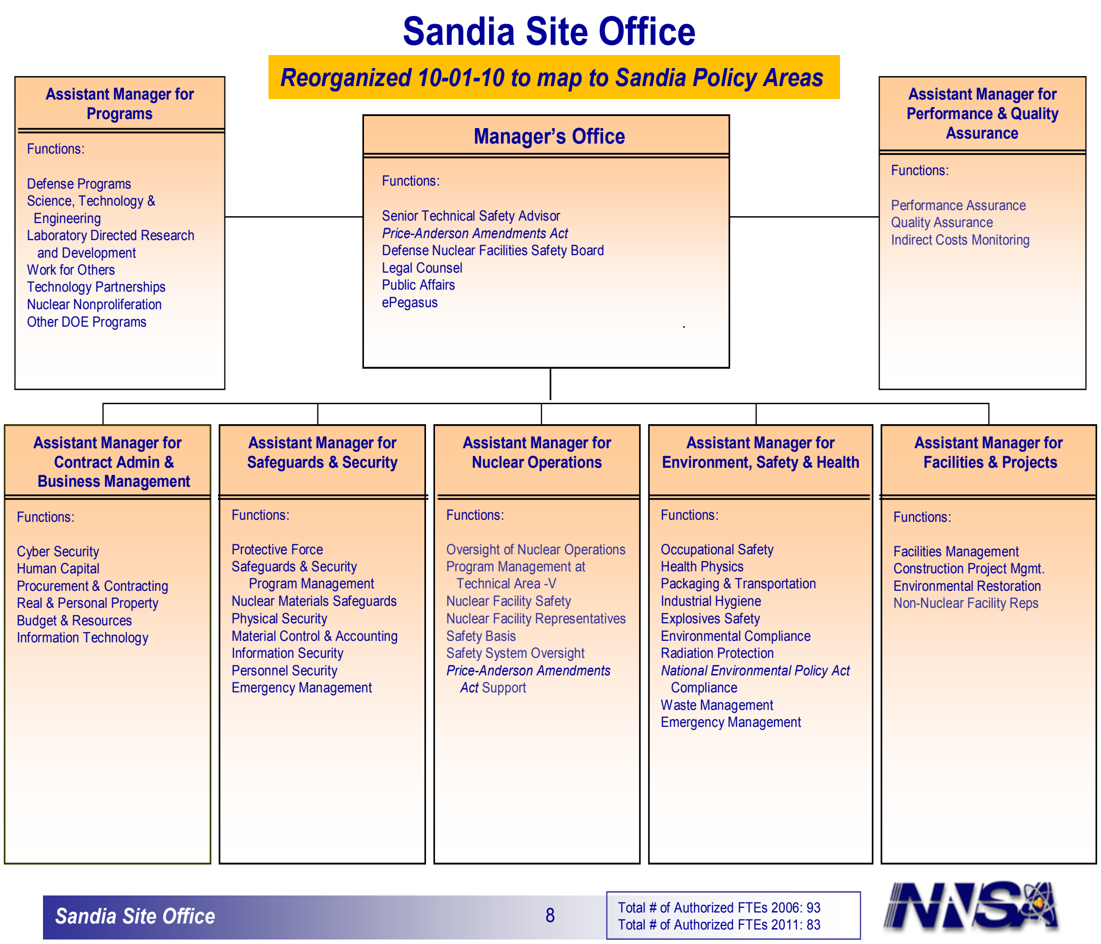


FIGURE G.10 Sandia Site Office's (SSO) Organizational Structure. NOTE: According to this data, as of 2011, the total number of authorized full time employees at the Sandia Site Office totaled 83. SOURCE: Sandia Site Office presentation to committee on March 23, 2011, at Sandia National Laboratories, Albuquerque, New Mexico.

LABORATORY CONTRACT TERM FEES

(2) The Maximum Available Fee related to the DOE/NNSA work effort, excluding Reimbursable work, for the Basic Term of the Contract is:

Contract Period	Maximum Available Fee			Earned Fee		
	Fixed Fee	At Risk Fee	Total Fee	Fixed Fee	At Risk Fee	Total Fee Earned *
01Jun06 – 30Sep06			$17,788,272			$17,788,272
01Oct06 – 30Sep07	$21,984,000	$51,296,000	$73,280,000	$21,984,004	$36,224,982	$58,208,986
01Oct07 – 30Sep08	$21,984,000	$51,296,000	$73,280,000	$21,984,000	$41,537,640	$63,521,640
01Oct08 – 30Sep09	$21,984,000	$51,296,000	$73,280,000	$21,984,000	$43,263,531	$65,247,531
01Oct09 – 30Sep10	$23,329,285	$54,435,000	*$77,764,285	$23,329,285	$44,262,497	$67,591,782
01Oct10 – 30Sep11	$22,109,570	$51,589,000	**$73,698,570			
01Oct11 – 30Sep12			$64,120,000			
01Oct12 – 30Sep13			$59,540,000			

*Note: This amount is the sum of the original FY 10 fee ($68,700,000), plus $9,064,285 due to increase in Total Estimated Cost and Fee during FY 09.

**Note: This amount is the sum of the original FY 11 fee ($68,700,000), plus $6,998,570 due to increase in Total Estimated Cost and Fee during FY 09. Also note that the MAF was bilaterally reduced by $2,000,000, for a future project.

FIGURE G.11 Los Alamos National Security (LANS) Contract Fee Structure. SOURCE: Excerpted from the *Management & Operating Contract for the Los Alamos National Laboratory National Nuclear Security Administration*, Unofficial Conformed Copy as of 9/16/11. Part I, Section B-2 “Contract Type and Value,” p. 6, available at http://www.lanl.gov/orgs/pcm/pdfs/conformed_prime_contract.pdf.

(2) The Maximum Available Fee related to the DOE/NNSA work effort, excluding Reimbursable work, for the Basic Term of the Contract is:

Contract Period	Maximum Available Fee
01Oct07 – 30Sep08	$45,542,169
01Oct08 – 30Sep09	$45,542,169
01Oct09 – 30Sep10	$42,506,024
01Oct10 – 30Sep11	$42,506,024
01Oct11 – 30Sep12	$42,506,024
01Oct12 – 30Sep13	$39,469,880
01Oct13 – 30Sep14	$39,469,880

(4) For FY 2008 through FY 2014, 30% of the Maximum Available Fee will be applied to Fixed Fee and 70% of the Maximum Available Fee will be applied to Performance Incentive Fee.

FIGURE G.12 Lawrence Livermore National Security (LLNS) Contract Fee Structure. SOURCE: Excerpted from the LLNS Management and Operating Contract, Part I, Section B-2 “Contract Type and Value,” p. 5.

(c) The Fixed Fee for the specified Contract period is set forth below:

Contract Period	Fixed Fee
October 1, 1993 through September 30, 2003	$155,733,103
October 1, 2003 through September 30, 2004	$ 15,400,000
October 1, 2004 through September 30, 2005	$ 16,256,548
October 1, 2005 through September 30, 2006	$ 16,596,769
October 1, 2006 through September 30, 2007	$ 15,603,798
October 1, 2007 through September 30, 2008	$ 16,372,062
October 1, 2008 through September 30, 2009	$ 16,345,315
October 1, 2009 through September 30, 2010	$ 18,040,617
October 1, 2010 through September 30, 2011	$ 18,537,589
October 1, 2011 through September 30, 2012	$ To be negotiated annually
TOTAL through FY11	$ 288,885,801

(d) The maximum available Performance Incentive Fee pool is set forth below:

Maximum Available Performance

Incentive Fee Pool	
October 1, 1993 through September 30, 2003	$Not applicable
October 1, 2003 through September 30, 2004	$ 8,200,000
October 1, 2004 through September 30, 2005	$ 8,708,865
October 1, 2005 through September 30, 2006	$ 8,891,126
October 1, 2006 through September 30, 2007	$ 8,359,178
October 1, 2007 through September 30, 2008	$ 8,770,748
October 1, 2008 through September 30, 2009	$ 8,756,419
October 1, 2009 through September 30, 2010	$ 9,664,616
October 1, 2010 through September 30, 2011	$ 9,930,851
October 1, 2010 through September 30, 2012	$ To be negotiated annually
TOTAL through FY11	$ 71,281,803

FIGURE G.13 Sandia Corporation Contract Fee Structure. SOURCE: Excerpted from the Sandia Corporations Management and Operating Contract, Part I, Section B-2.

TABLE G.1 Approximate Annual Fee Structures (in millions of dollars)

Laboratory	Fixed Fee	Maximum Award Fee
SNL	16	9-10
LANL	22	52
LLNL	12.5	29.5

COSTS ASSOCIATED WITH LANL AND LLNL CONTRACT CHANGES

When the contracts changed at LANL and LLNL, cost changes were incurred. Some of these were savings, and others were additional costs. Some were one-time charges or savings (or transfers), while others affect each year's budget. Many of the changes were changes in the cost to the government of running the laboratories that do not affect the budgets of the laboratories directly because they are paid directly by the government to some other entity without going through the laboratory.

Of particular concern to the laboratories are those additional costs and expenses that must be borne out of the laboratory budget. These affected operations at the laboratories because they caused net reductions in the overall money available to pay for laboratory activities.

Specifically, three categories are of major concern: (1) increases in the management fees; (2) changes in personnel costs due to changes in health and pension benefit plans as laboratory personnel transitioned from being U Cal employees to being employees of their respective LLCs (LANS, LLNS); and (3) changes in state and local tax obligations associated with the transition from a public institution (U Cal) to a private corporation. This last was much more significant at LANL and at LLNL.

At each of these two laboratories, the annual cost of doing business increased by **very roughly** $100 million per year.

- LANL
  - — The annual fee increased from less than $10 million to about $60 million, as shown in the contract excerpt in the preceding section. The actual amount varies by year and by performance. This increase is typically $40 million to $50 million
  - — State and local tax obligations increased by $65 million
  - — Pension plan changes necessitated a $30 million contribution to the new defined contribution plan.

The total increase is therefore on the order of $140 million per year.

- LLNL
  - — The annual fee increased from less than $10 million to about $45 million, as shown in the contract excerpt in the preceding section. The actual amount varies by year and by performance. This increase in typically $30 million.
  - — Pension plan changes necessitated a $30 contribution
  - — Healthcare costs increased about $10 million.
  - — There were no substantial tax changes at LLNL; taxes decreased by about $2 million.

The total increase is therefore on the order of $70 million per year.

At both labs, there were also large decreases in costs to the government. Since these amounts were not part of the laboratory budgets, they are not included in this accounting, and the laboratories did not benefit directly from them.

TENURES OF LABORATORY DIRECTORS

TABLE G.2 Tenures of Laboratory Directors

LLNL				LANL				SNL			
Director	Start Year	End Year	Tenure (years)	Director	Start Year	End Year	Tenure (years)	Director	Start Year	End Year	Tenure (years)
York	1952	1958	6	Oppenheimer	1943	1945	2	Landry	1949	1952	3
Teller	1958	1960	2	Bradbury	1945	1970	25	Quarles	1952	1953	1
Brown	1960	1961	1	Agnew	1970	1979	9	McRae	1953	1958	5
Foster	1961	1965	4	Kerr	1979	1986	7	Molnar	1958	1960	2
May	1965	1971	6	Hecker	1986	1997	11	Schwartz	1960	1966	6
Batzel	1971	1988	17	Browne	1997	2003	6	Hornbeck	1966	1972	6
Nuckolls	1988	1994	6	Nanos	2003	2005	2	Sparks	1972	1981	9
Tarter	1994	2002	8	Kuckuck	2005	2006	1	Dacey	1981	1986	5
Anastasio	2002	2006	4	Anastasio	2006	2011	5	Welber	1986	1989	3
Miller	2006	2011	5					Narath	1989	1995	6
								Robinson	1995	2005	10
								Hunter	2005	2010	5

LABORATORY PRODUCTIVITY

Laboratory productivity can be measured in a number of ways, including number of peer-reviewed journal articles published each year, and through the various awards earned by laboratory scientists. Several of the laboratories' key achievements from recent years are highlighted below.

Los Alamos National Laboratory

In FY2011:

- LANL had 2,079 peer-reviewed publications, the highest since 2006.
- The laboratory's number of post-doctoral candidates was at an all-time high.
- LANL won three R&D 100 Awards.[1]
- The E.O. Lawrence Award, which recognizes exceptional contributions in R&D that support the DOE and its missions, was awarded to two LANL scientists.[2]

TABLE G.3 LANL Peer-Reviewed Publications

	CY2007	CY2008	CY2009
LANL publications	1,928	1,780	1,743
LDRD-supported publications	401	452	376
Percent due to LDRD	21%	25%	22%

SOURCE: FY2010 LANL LDRD Annual Report, available at http://www.lanl.gov/science/ldrd/docs/LANL-LDRD-FY10-AR.pdf.

Lawrence Livermore National Laboratory

In FY2011:

- LLNL won two R&D 100 Awards.[3]
- LLNL researchers received Secretary of Energy Achievement Awards.[4]

TABLE G.3 Journal Papers Resulting from LDRD-Funded Research as a Percentage of Total Articles for the Past 5 Years

Journal Articles	2006	2007	2008	2009	2010
All LLNL articles	1,237	1,162	1,097	1,001	910
LDRD articles	223	237	212	161	186
LDRD articles as percentage of total	18%	20%	19%	16%	20%

SOURCE: FY2010 Laboratory Directed Research and Development Annual Report, Lawrence Livermore National Laboratory https://ldrd.llnl.gov/pdfs/LLNL_10LDRD.pdf

[1] Provided by the LASO Site Manager from the FY2011 LANL Self-Assessment.
[2] See News Release, available at http://www.lanl.gov/news/releases/lanl_scientists_win_two_prestigious_eolawrence_awards_from_the_doe.html.
[3] See News Release at https://www.llnl.gov/news/newsreleases/2011/Jun/NR-11-06-05.html.
[4] See News Release at https://www.llnl.gov/news/aroundthelab/2011/Nov/ATL-112211_awards.html.

TABLE G.4 Journal Papers Resulting from LDRD-Funded Research as a Percentage of All LLNL Papers from 2004 to 2008

Journal Articles	2004	2005	2006	2007	2008
All LLNL articles	1,158	1,296	1,237	1,162	1,097
LDRD articles	210	250	247	237	211
LDRD articles as percentage of total	18%	19%	20%	20%	19%

SOURCE: FY2008 LLNL Laboratory Directed Research and Development Annual Report, available at https://ldrd.llnl.gov/pdfs/LLNL_08LDRD.pdf.

H

Questions Posed to Panels at Site Visits

Questions Sent to the Site Office for Discussion at a Meeting with the Committee

1. What is the site office organization?
2. What are the basic roles of the major officers within the site office?
3. Who at the laboratory reports to whom at the site office? What information (inputs) does the site office get from laboratory management? To whom (within NNSA) does the site office report?
4. What determinations are made within the site office, and which are passed to NNSA HQ? What are the reporting chains?
5. What, specifically, does the site office do to carry out the maintenance of the stockpile? What decisions does the site manager get involved in? What work does the laboratory management have to put in to handle requirements from the site manager? How often does the site manager meet with laboratory personnel and on what topics? What are the annual information requirements of the site manager?
6. What is the site office role in management decisions? Does it make fee recommendations to the NNSA Principal Deputy Administrator? Do the laboratory and contractor officers report to the site office? How does the contractor Board of Directors interact with the Site office? What control does NNSA HQ have over the site office?
7. What role does the site office plays in determining the budget submission for the laboratory. Does the site office play an active role in setting strategy and determining financial resource needs? Or does it play a role as a reviewer?
8. How much of the site office role in the review process is devoted to mission performance, and how much to operational issues (e.g., safety and security)? How does the site office develop the performance evaluation plan? To what extent does the site office evaluate S&E quality? What kind of a role do they play in setting and implementing management policy to ensure high quality S&E; e.g., recruitment and retention of highly qualified scientists and engineers? Is it advisory, directive, consultative, just what? Does the site office exercise any direct leverage on providing incentives to improve quality?
9. What does the contract manager gets involved with, including which management decisions (if any)? What inputs does the contract manager need from the laboratory management? How much work or data gathering is involved, what times of the year, etc.? Does the contract manager work generally with laboratory director and staff, the CFO, or who?
10. The site office is an NNSA office. To what extent is the site office involved in management and evaluations of the labs' Work for Others (WFO)?

Questions Sent to Laboratory Senior Management for Discussion at a Meeting with the Committee

1. We interpret quality science and engineering as being that S&E that is necessary to support the mission of the laboratory both now and in the future. What is XXX laboratory's current mission and possible future missions? As part of your discussion please present to us the high-level description of you mission that you present to Congress. Could you walk us through your budget at a high level, in terms of both money and people?

2. How do you and your laboratory review and assess the quality of S&E activities? Do you use the same processes and standards for in-house work, for LDRD work, for WFO? Does the NNSA review the quality of the S&E work?
3. How does the NNSA evaluate and oversee your laboratory? What motivation is provided by the performance fee? In your self-evaluation, what level of attention is paid to operations vis-à-vis the quality of S&E performance?
4. In the last decade the laboratories have been buffeted by many dramatic events. Could you describe how events such as (i) End of the Cold War, (ii) Formation of NNSA, (iii) stockpile stewardship, (iv) Contract recompetition, (v) START treaty have affected your laboratory and the morale of your staff?
5. It has been asserted by some that the laboratories have lost flexibility in how they execute programs. If this is so, what flexibility do you retain? Is this an important issue for you in managing your laboratory?
6. How do you manage and support S&E foundations that support the strategic directions of the laboratory? Could you describe the "return on investment" in the short and long term from work performed in these foundational areas? What is the role of S&E in driving the future of your laboratory? How does the NNSA support and evaluate S&E foundations?
7. How do you draw upon experts and best practices at other laboratories as a part of continuous improvement?
8. How do you select work for others? Do you have a strategic plan for this activity? What do you see as the value of WFO?
9. One of the most important challenges for a laboratory is hiring the next generation of scientists and engineers. What are you doing to assure that your laboratory remains an attractive place to work? What are the impediments?
10. Please comment on the issue of trust with the NNSA with respect to performance evaluations. Does XXX laboratory's apparent preference for simple numerical measures of performance reflect something about the level of trust? How would you like the NNSA to evaluate the quality of S&E at your laboratory?
11. Can you envision any changes within the control of Congress and NNSA that would allow you to be more effective in assuring the highest quality S&E at your laboratory?

Questions Sent to Laboratory-Other Management for Discussion at a Meeting with the Committee

1. How do you review and assess the quality of S&E activities? Do you use the same processes and standards for in-house work, for LDRD work, for WFO?
2. It has been asserted by some that the laboratories have lost flexibility in how they execute programs. What flexibility do you retain? Is this an important issue for you in your management duties?
3. How do you manage and support S&E foundations that support the strategic directions of the laboratory? What is the role of S&E in driving the future in your own unit?
4. How do you select work for others? Do you have a strategic plan for this activity? What do you see as the value of WFO?
5. How do you draw upon experts and best practices at other laboratories as a part of continuous improvement?
6. One of the most important challenges for a laboratory is hiring the next generation of scientists and engineers. What are you doing to assure that your unit remains an attractive place to work? What are the impediments?
7. Please comment on the issue of trust across levels of management.
8. How do you think the scientists and engineers in your group would respond to a discussion about topics such as working conditions, opportunities for professional development, performance evaluation, rewards, and job security?

Questions Sent to Laboratory Senior Scientists and Engineers for Discussion at a Meeting with the Committee

1. It has been asserted by some that the laboratories have lost flexibility in how they execute programs. What flexibility do you retain?
2. What is the role of S&E foundations in driving the future in your own unit?
3. How well is the laboratory doing in attracting and retaining high-quality scientists and engineers. What are the impediments?
4. How do you think colleagues in your unit would respond to the following questions?

- How free am I to steer my own career? What constraints are placed on my choices?
- What resources (equipment, support staff, information, etc.) are available to me to enable my performing at a high level of quality?
- How much control do I have over my own time, both day-to-day and over longer terms?
- How much time is provided for me to report my findings? For travel to relevant events? For other professional development, in-house and outside?
- How is my competence and currency to be maintained?
- How much overhead must I attend to (security and safety processes, internal paperwork, etc.)?
- How is my performance measured in-house and by what metrics? How do those metrics map onto my understanding of S&E quality?
- How are my achievements rewarded in-house? Do I have opportunities to gain external awards?
- How secure is my position? My research area? Will management protect me?
- Can I communicate freely and effectively with my technical and administrative management when I have ideas, problems, and when they have news that affects me? Are the chains of control clear? Do my managers have the flexibility to help me do good work?