Report of the Secretary of Energy Task Force on DOE National Laboratories

June 17, 2015

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Executive Summary

This interim report of the Secretary of Energy Advisory Board (SEAB) National Laboratory Task Force (TF) identifies the constraints on and evaluates the effectiveness of laboratory operations that impact the performance and efficiency of the DOE national laboratories. The TF stresses the overriding importance of two actions: clarifying the authorities and responsibilities of the entities involved in laboratory management and adopting a disciplined process for implementing change.

The TF report further proposes targeted "experiments" in three areas: (1) the management and operation (M&O) contracting system that the U.S. Department of Energy (DOE) uses to run the laboratory system; (2) technology transfer as a means for creating value for the private sector; and (3) Laboratory Directed Research and Development (LDRD). The discussion and recommendations in each of the three areas are mutually reinforcing. For example, reducing the time and streamlining the complex bureaucratic procedures required for DOE National Laboratories to get approvals from DOE will facilitate greater cooperation with industry.

Each of the targeted "experiments" the TF recommends can be conducted using existing DOE authorities and should be abandoned or expanded according to results. The TF expects that these experiments would run for 12 to 24 months.

Relieving management constraints on the DOE laboratories enables better technical outcomes and greater efficiency but it does not guarantee this desirable outcome. Success requires disciplined and continuing integration of planning for the R&D program and management to implement productive change. This TF report does not address important integration issues.

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Acronyms and Abbreviations

ACT	Agreement for Commercializing Technology
ANL	Argonne National Laboratory
BNL	Brookhaven National Laboratory
CFR	Code of Federal Regulations
CRADA	Cooperative Research and Development Agreement
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DSSG	Defense Science Study Group
EERE	Energy Efficiency and Renewable Energy
EH&S	environment, health, and safety
ESSG	Energy Science Study Group
Fermilab	Fermi National Accelerator Laboratory
FFRDC	Federally Funded R&D Centers
FNAL	Fermi National Accelerator Laboratory
GOCO	Government-Owned Contractor-Operated
GOGO	Government-Owned Government-Operated
INL	Idaho National Laboratory
JPL	Jet Propulsion Laboratory
KCP	Kansas City National Security Campus
LANL	Los Alamos National Laboratory
LBNL	Lawrence Berkeley National Laboratory
LDRD	Laboratory Directed Research and Development
LLC	limited liability corporation
LLNL	Lawrence Livermore National Laboratory
LOB	Laboratory Operations Board
LPC	Laboratory Policy Council
M&O	management and operation
NASA	National Aeronautics and Space Administration
NLDC	National Laboratory Directors' Council
NNSA	National Nuclear Security Administration
NREL	National Renewable National Laboratory
NNSS	Nevada National Security Site
ORNL	Oak Ridge National Laboratory
Pantex	Pantex Plant

PDRD	Plant Directed Research and Development
PEMP	Performance Evaluation and Measurement Plan
PNNL	Pacific Northwest National Laboratory
PPPL	Princeton Plasma Physics Laboratory
R&D	research and development
RFQ	Request for Quotations
SAR	synthetic aperture radar
SC	(U.S. DOE) Office of Science
SDRD	Site Directed Research and Development
SEAB	Secretary of Energy Advisory Board
SNL	Sandia National Laboratories
SPP	Strategic Partnership Projects
SRNL	Savannah River National Laboratory
TF	Task Force
TJNAF	Thomas Jefferson National Accelerator Facility
WFO	Work for Others
Y-12	Y-12 National Security Complex

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Framework

> ***"A proliferation of duplicative and burdensome requirements are choking the DOE National Laboratories."***

This interim report of the Secretary of Energy Advisory Board (SEAB) National Laboratory Task Force (TF) proposes a series of new mechanisms and procedures to enhance the performance of the DOE National Laboratory system through targeted "experiments" in three key areas: (1) the management and operation (M&O) contracting system that the U.S. Department of Energy (DOE) uses to run the laboratory system; (2) technology transfer as a means for creating value for the private sector; and (3) Laboratory Directed Research and Development (LDRD). Each of these targeted experiments can be conducted using existing DOE authorities and resources, and could be scaled and replicated if successful. The discussion and recommendations in each of the three areas are mutually reinforcing. For example, reducing the time and streamlining the complex bureaucratic procedures required for DOE National Laboratories to get approvals from DOE will facilitate greater cooperation with industry.

DOE and its predecessor agencies have been stewards of the national laboratory system, a vital national asset. DOE's duty is to maintain the quality of its personnel and the scientific and technical excellence of the national laboratories so this capability can be brought to bear on major national problems (e.g., national security, energy, and economic well-being). The DOE national laboratories remain unequaled and envied by other countries. Nevertheless over the years many questions have been raised about the management and performance of this system.

Congress and others have commissioned <u>many</u> studies analyzing the purpose, organization, performance, and cost of the DOE National Laboratory system. A number of recent and prospective studies are given in the reference section at the end of this report. The Secretary of Energy has asked the SEAB to form a DOE National Laboratory Task Force to (1) review past studies and to address specific issues where the Secretary of Energy has the authority to take action to improve the effectiveness and efficiency of the DOE National Laboratories and (2) remain informed about the findings and recommendations of in-progress studies and provide advice regarding the DOE's response. The Secretary of Energy's Terms of Reference are included in Appendix A, and the membership of the DOE National Laboratory Task Force is given in Appendix B.

TF findings and recommendations are based on an extensive review of applicable reports issued primarily over the past decade (see the Reference section at the end of this report) and on meetings with DOE officials, laboratory directors, management and operations (M&O) contractors, directors of other federal agency laboratories operated using the (M&O) contractor model, and members of industry (Appendix C). Many TF members also draw upon direct experience in the National Laboratories and/or the DOE.

The TF approach is to propose specific actions rather than new general policies and procedures. The TF suggests that actions that do not require modification of existing regulations or authorities be undertaken as 'experiments' that would be abandoned or expanded according to results. The TF expects that these experiments would run for 12 to 24 months.

STRENGTHENING THE FRAMEWORK

DOE operates 17 laboratories at an annual cost to the DOE and other government agency sponsors (which account for roughly 15%) of about $13.5 billion.[1] The 17 DOE National Laboratories, managed by the Under Secretary for Science & Energy, the Under Secretary for Management and Performance, and the National Nuclear Security Administration (NNSA) Administrator, are aligned with DOE's four missions – science, energy, nuclear security and environmental management (see Table 1). In addition, Table 1 indicates four production facilities that are closely related to the DOE's national security mission.

Table 1. Laboratory types and stewardship roles for DOE National Laboratories and NNSA production sites. The DOE Office stewarding each laboratory is given in parentheses.

Under Secretary for Science and Energy			NNSA Administrator		Under Secretary for Management & Performance
Small/ Single-Program Science Laboratories	Energy Laboratories	Large Multi-Program Science Laboratories	National Security Laboratories	National Security Production Facilities	Environmental Management Laboratory
Ames (SC)	INL (NE)	ANL (SC)	LLNL (NNSA)	Pantex (NNSA)	SRNL (EM)
Fermilab (SC)	NETL (FE)	BNL (SC)	SNL (NNSA)	Y-12 (NNSA)	
PPPL (SC)	NREL (EERE)	LBNL (SC)	LANL (NNSA)	KCP (NNSA)	
TJNAF (SC)		ORNL (SC)		NNSS (NNSA)	
SLAC (SC)		PNNL (SC)			

SC = Office of Science; NE = Office of Nuclear Energy; FE = Office of Fossil Energy; EERE = Energy Efficiency and Renewable Energy; NNSA = National Nuclear Security Administration; EM = Office of Environmental Management
Ames = Ames National Laboratory; Fermilab = Fermi National Accelerator Laboratory; PPPL = Princeton Plasma Physics Laboratory; TJNAF = Thomas Jefferson National Accelerator Facility; SLAC = SLAC National Accelerator Laboratory; INL = Idaho National Laboratory; NETL = National Energy Technology Laboratory; NREL = National Renewable Energy Laboratory; ANL = Argonne National Laboratory; BNL = Brookhaven National Laboratory; LBNL = Lawrence Berkeley National Laboratory; ORNL = Oak Ridge National Laboratory; PNNL = Pacific Northwest National Laboratory; LLNL = Lawrence Livermore National Laboratory; SNL = Sandia National Laboratories; Los Alamos National Laboratory; Pantex = Pantex Plant; Y-12 = Y-12 National Security Complex; Kansas City = Kansas City National Security Campus; NNSS = Nevada National Security Site; SRNL = Savannah River National Laboratory

Figure 1 shows the growth in DOE expenditures on laboratories compared to the growth in the DOE budget from Fiscal Year (FY) 2000 to FY 2014. Expenditures on laboratories have commanded a slightly larger portion of the DOE budget since FY 2008 (ranging from 39% to 45%). Between FY 2000 and FY 2013, DOE expenditures increased by approximately 50

[1] See Appendix D for current laboratory contract details

percent while laboratory budgets, which include sub-contracts, increased by approximately 67 percent. Laboratory staffing increased by about 5 percent during this period, with greater growth at NNSA laboratories than at science laboratories.[2] In short, the laboratories have experienced stable budgets since 2000.[3] The chart shows much greater variability after 2008, due in part to the effect of a sharp, one-time increase of American Recovery and Reinvestment Act of 2009 (ARRA) and the effects of sequestration.

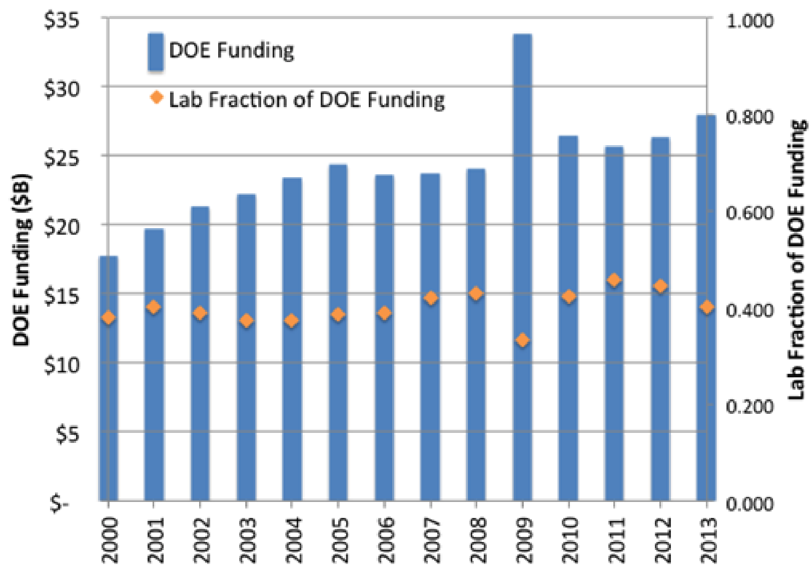

Figure 1. Total DOE appropriations (blue columns; left axis) from FY 2000 to FY 2013, along with fraction of appropriations budgeted to all 17 DOE National Laboratories (orange diamonds; right axis) over the same period.

Unfortunately, over the past decade or so, budget pressures, unattended infrastructure needs,[4] significant cost over-runs, and a massive increase of headquarters-applied regulations and oversight contributes to a situation—widely described as a breakdown in trust—between many laboratories and certain DOE programs. While tension exists throughout the laboratory complex, the greatest feeling of dissatisfaction exists in the large NNSA weapons laboratories (i.e., LLNL, LANL, and SNL). The National Laboratory Directors' Council has been active in suggesting steps to remove burdensome oversight and operational requirements from the laboratories. Nevertheless, little progress has been made on reducing burdensome requirements, as indicated in a recent National Association of Public Administration report, which presents a formidable partial list of the directives with which laboratories must comply.[5]

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[2] Based on data obtained from the DOE Office of the Chief Financial Officer.

[3] The science and energy laboratories have fared better in the 2000 to 2013 period than the NNSA laboratories.

[4] See, for example, the National Research Council Report, *Intelligent Sustainment & Renewal of DOE Facilities*, 2004.

[5] These examples are given in National Academy of Public Administration Report on the Department of Energy, *Positioning DOE's Labs for the Future: A Review of DOE's management and oversight of the national laboratories*, January 2013. These requirements are beyond the considerable reporting burden include the annual performance evaluation and the elaborate "contractor assurance system."

Congress, too, has directed several different studies to review the effectiveness of the DOE National Laboratories, notably establishing a commission in Section 319 of the 2014 Omnibus Appropriation Bill.[6]

RECOMMENDATIONS

The TF found that proliferation of duplicative and burdensome requirements are choking the DOE National Laboratories. The first TF recommendation is for DOE to remove or reduce the many overlapping control points imposed on the laboratories and to lessen the expensive administrative effort required to gain approval for laboratory work. For convenience, we have included all the TF recommendations in Table 2 at the end of this section.

Recommendation 1.1: Clarify the roles and responsibilities for mission execution at the laboratories. The Secretary of Energy should lead the Laboratory Policy Council in clarifying roles and responsibilities and direct the Under Secretary for Management and Performance to lead the Laboratory Operations Board in implementing these changes.

Six organizational units have roles in managing DOE National Laboratories:

- The laboratory director and the director's leadership team
- DOE Headquarters (HQ) sponsoring program offices
- DOE Site Offices (called Field Offices in NNSA)
- DOE Service Centers
- DOE operational oversight offices (e.g., the Office of Independent Enterprise Assessment)
- The M&O contractor.

Between them, these organizations have the responsibility and authority for all laboratory activities, which include:

- technical (i.e., planning and executing the technical program)
- financial (i.e., budget, procurement, and financial reporting and controls)
- personnel (i.e., hiring, retention, benefits, and diversity)
- site operations (i.e., facilities, construction, and environmental remediation)
- environment health, and safety (EH&S) practices
- security
- other (e.g., legal, collaborative agreements, work-for-others, and operating user services).

The TF believes that the efficiency and operations of the laboratories would be greatly improved if there were greater clarity about how the authority, responsibility, and potential for liability for each of these activities were more clearly assigned across the six, or fewer, organizational units listed above. These clarified assignments should align incentives for achieving key technical objectives at specified cost and schedule and, most importantly, should remove duplicative decision authority and reporting requirements.

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[6] The mandated study is directed in Section 319 of the 2014 Consolidated Appropriation Act.

Secretary Moniz recognizes the need to address the laboratory problems and has taken steps to do so.[7] He has established the DOE National Laboratory Policy Council (LPC) and a Laboratory Operations Board (LOB). Secretary Moniz meets with laboratory directors on a regular schedule and has continued taking action on the 20 recommendations made in 2010 by the National Laboratory Directors' Council. For example, his action to merge the activities of the Office of Science and the Energy Program Offices under a single Under Secretary for science and energy will also enable a more streamlined approach to managing the DOE National Laboratory system.

The TF's vision is that the LPC, chaired by the Secretary with all the Under Secretaries as members, sets laboratory policies. In particular, the LPC should undertake the great simplification cleanup objective as stated in Recommendation 1.1 as one of the seven objectives listed in its charter (Appendix E).

The LOB, composed of the next level of department leadership (e.g., the Principal Deputy Under Secretaries), is charged with implementing the policies of the LPC. The LOB board coordinates implementing actions, which remain the responsibility of the Under Secretary or Administrator of NNSA to execute. In sum, the TF believes the LOB should focus on implementing changes that will improve the performance, the efficiency, and morale of the DOE National Laboratories.

Recommendation 1.2: The Under Secretary for Management and Performance should lead a process to establish a structure and process that replicates the Office of Science (SC) Office of Laboratory Policy for the NNSA and the Energy laboratories.

The DOE National Laboratory categories shown in Table 1 cover a wide variety of missions, scales, technical communities, and facilities. Therefore, the welfare of each laboratory should be the responsibility of a single DOE secretarial program office with clear separation between the secretarial office that is responsible for implementation at the laboratory and the DOE headquarters offices responsible formulating laboratory policy.

Up to the present, the LOB's activities have focused on assessing operational and performance matters that affect all DOE National Laboratories, especially the adequacy of the existing laboratory infrastructure to support the mission and maintain the core capabilities of each laboratory. The LOB has not moved to build a professional career staff for each area charged with implementing policy, rapidly resolving laboratory issues, and communicating best practices. Only SC and NNSA have formal annual laboratory policies and evaluation processes in place for each of their laboratories that include public evaluation reports. However, those reports are often not very enlightening because the very narrow performance grades are often insufficient to identify and advance laboratory best practices.

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[7] A brief, informative description of *Distinctive Characteristics of DOE's National Laboratories* is available on the DOE's Office of Science Laboratory Policy and Evaluation website: http://science.energy.gov/lpe/

SC is unique in having a dedicated office, the Office of Laboratory Policy to manage and coordinate all matters related to SC laboratory interactions.[8] The functions of the Office of Laboratory Policy include:

- facilitate the laboratory appraisal and planning processes
- support the SC Head of Contracting Activity on all procurement matters
- coordinate uniform policy with regard to contractor human resource management, LDRD, technology transfer, and Work for Others[9] and provide advice to the SC Deputy Director for Field Operations on these matters.
- manage the SC LDRD and WFO programs
- coordinate the reporting and approval of all SC conference expenses
- support SC headquarters program offices and site offices by lending technical expertise to advise and/or assist in resolving issues
- represent SC on DOE and inter-agency working groups and councils whose focus relates to the general health, utilization, and vitality of the DOE National Laboratory system.

The TF believes that the Office of Laboratory Policy, staffed by a small team of career professionals, has over the years accumulated experience and gained broad respect in the management of DOE science laboratories and laboratory–department relationships. There is no equivalent office for the NNSA or Energy laboratories, nor is there a tradition of a small cadre of career staff to facilitate laboratory-DOE headquarters interactions. This absence is particularly evident for the NNSA laboratories who uniformly express frustration at the length of time and difficulty required to resolve operating issues that arise daily. The TF has been unable to identify a philosophy or management process that NNSA uses to manage its laboratories similar to that employed by SC.

The TF recommends the DOE structure its decision-making and policy implementation as illustrated in Figure 2. The DOE energy and science offices were only recently organized under a single Under Secretary (as was the case in the beginning of DOE's history). Over time, modifying the proposed organizations to include only two laboratory policy offices—national security and energy/science—may be desirable. In addition, the TF suggests changing the name "Office of Laboratory Policy" to "Office of Laboratory Policy Implementation" to underscore that the purpose of these groups is implementation, not definition, of policies. Finally, rather than have an additional Office of Laboratory Stewardship for Environmental Management with stewardship of a single laboratory, an option is to have the Applied Energy Office of Laboratory Stewardship be responsible for Savannah River National Laboratory.

The overriding purpose of the proposed organization is to facilitate operations and associated operational efficiencies with each laboratory, and to expedite resolution of the numerous issues that regularly arise that impede program execution and unnecessarily increase costs. The focus

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[8] http://science.energy.gov/lp/

[9] Although WFO was recently changed to Strategic Partnership Programs, or SPP, we use WFO throughout to maintain continuity.

should be both on improving program outcomes and managing cost and risk. These changes will enable more effective laboratory performance. However, the Task Force emphasizes these management changes must be integrated with the planning of laboratory programs.

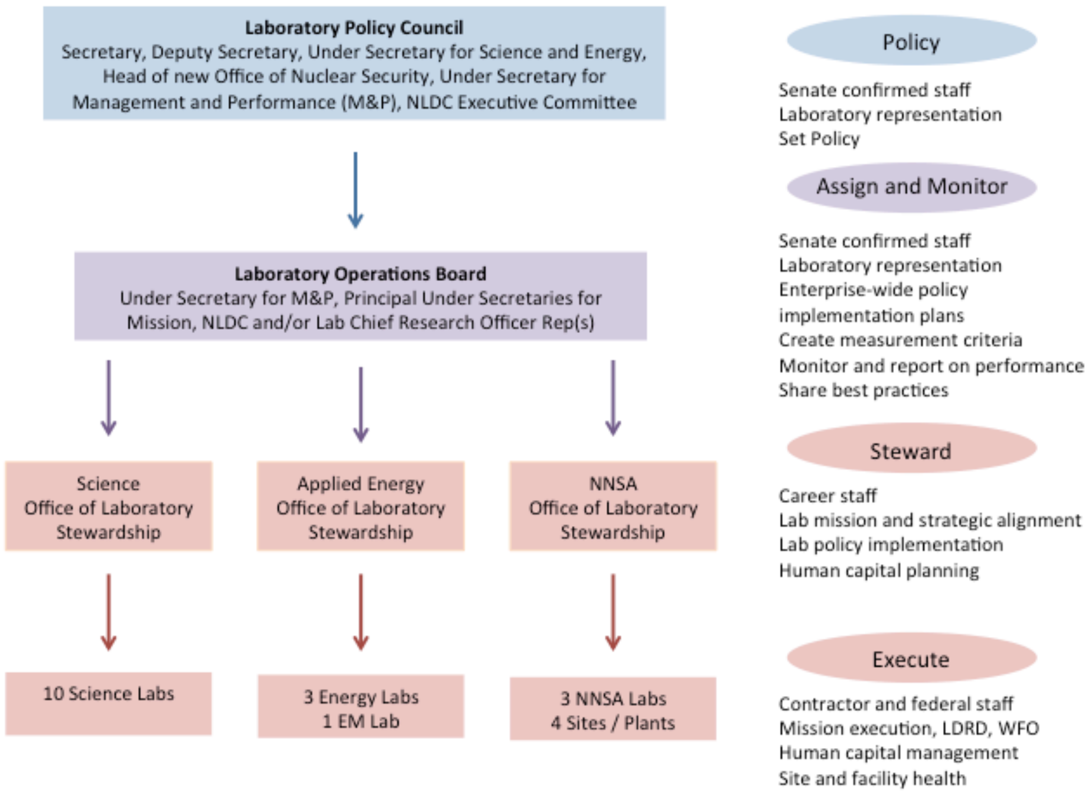

Figure 2. Decision and implementation workflow.

The TF recommendations are broadly consistent with the charter of the LOB, chaired by the Under Secretary for Management and Performance:

> The objectives of the National Laboratory Operations Board ("Board") are to strengthen and enhance the partnership between the Department and the National Laboratories, and to improve management and performance in order to more effectively and efficiently execute the missions of the Department and the National Laboratories. The Board will contribute to an enterprise-wide effort to identify, manage, and resolve issues affecting the management, operations, and administration of the National Laboratories.

This recommendation shifts the emphasis for how the LOB should organize its efforts to facilitate laboratory operations and performance and improve program execution. The LOB's approach should be coordination and encouraging "best practices" across the DOE system, not setting direction. The LOB should be an instrument of change rather than another headquarters rule maker.

Proposed Next Steps for the SEAB National Laboratory Task Force

This interim TF report addresses three topics of importance to the DOE National Laboratory system: (1) M&O contracts, (2) technology transfer, and (3) LDRD.

The two objectives that have guided the TF's work are (1) to propose actions within the Secretary of Energy's existing authority and (2) to implement many of the actions as 'experiments' that may justify broad adoption only after evaluation of results.

During its second phase, which extends until December 2015, the TF will address both aspects of Secretary Moniz's charge (see Appendix A) and three additional specific issues:

1. Work for others (WFO). The emphasis will be on WFO for federal agencies since non-federal WFO is addressed in the Technology Transfer section of this interim report.
2. Cooperative efforts among laboratories, especially cooperation between the SC and NNSA laboratories and between NNSA laboratories and NNSA production facilities.
3. The morale, mentoring, and professional development of the technical workforce at the DOE National Laboratories, recognizing the additional challenges posed by the security nature of research at the three major NNSA laboratories (i.e., LLNL, LANL, and SNL).

In addition, the TF will review the findings and recommendations of recent studies that bear on the DOE National Laboratories. At least three studies will be reviewed:

1. The Congressional Panel report, *A New Foundation for the Nuclear Enterprise*, (The Augustine-Mies report), November 2014.
2. The National Research Council report, *Aligning the Governance Structure of the NNSA Laboratories to Meet 21st Century National Security Challenges*, Jan-Feb 2015.
3. The Phase I report of *The Commission to Review the Effectiveness of the National Energy Laboratories,* released February 13, 2015.

For each study, the TF will meet the Secretary of Energy's request and take the following actions:

1. review the findings and recommendations of these studies
2. identify actions that DOE should take to implement such recommendations
3. provide an implementation plan for each recommended action.

Table 2. Summary of TF Recommendations

	Recommendation	Owner	Time TF Assessment
1.1	Clarify roles and responsibilities for mission execution at the laboratories.	Laboratory Policy Council, chaired by the Secretary of Energy	60 days
1.2	Extend responsibilities of *Laboratory Operations Board* for Science, Energy and NNSA Laboratory Policy & Program Execution Offices	Under Secretary for Management and Performance (M/P)	90 days
2.1	Complete study to evaluate options for changes to the contracting model.	Director, Office of Science	90 days
2.2	Authorize experiments, including establishing timelines, to reduce and simplify control authority for certain operational procedures for laboratory management.	Under Secretary for M/P	30 days
3.1	Issue policy statement that technology transfer activities are part of the DOE National Laboratories' mission.	Secretary of Energy	30 days
3.2	Organize technology transfer activities using a decentralized approach, including flexible experimental agreements to facilitate rapid Laboratory-industry engagements.	Under Secretary for Science and Energy (S/E) NNSA Administrator	90 days
3.3	DOE should create fast-track Cooperative Research and Development Agreement (CRADA) and non-federal WFO processes supported by dedicated laboratory/DOE team of legal and procurement experts with a leader to shepherd each agreement to completion, and pilot at three laboratories.	Under Secretary for S/E NNSA Administrator	120 days
3.4	Each DOE National Laboratory should adopt an entrepreneurial leave program for a limited number of staff with assurance of appropriate resources upon return to restart a research program.	Laboratory Directors	180 days
3.5	Each DOE National Laboratory should track its impact on the industry.	Laboratory Directors	180 days
4.1	The National Laboratory Directors' Council should prepare and share a best practices document for managing LDRD programs.	National Laboratory Directors' Council (NLDC)	90 days
4.2	Set LDRD cap at 6% of laboratory budget.	Secretary	30 days
4.3	Provide enhanced reporting by the DOE on the substance and value of LDRD.	Under Secretary for S/E NNSA Administrator Under Secretary for M/P	180 days
4.4	Pilot independent peer review of LDRD program impacts and process of four laboratories, evaluating up to ten years of projects.	NLDC	180 days
4.5	Pilot LDRD approach where laboratories define project scientific areas, but do not obtain approval of specific tasks.	Under Secretary for S/E NNSA Administrator	180 days
4.6	Design Energy Sciences Study Group for launch	NLDC	90 days

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Management and Operations (M&O) Contracting

Background

> ***"The increasing number and complexity of government entities within and outside the DOE that exercise decision and oversight roles is leading to a highly burdensome operating environment."***

The efficacy of the DOE National Laboratories is shaped by their Government-Owned Contractor-Operated (GOCO) management structure, in which DOE program offices contract with external partners to oversee M&O of laboratory work on a day-to-day basis for 16 of the 17 DOE National Laboratories.[10] However, the increasing number and complexity of government entities within and outside the DOE that exercise decision and oversight roles is leading to a highly burdensome operating environment that severely diminishes the effectiveness of this arrangement.

It is important that laboratories are aligned to DOE and national priorities, and that the DOE, laboratory management, and contractor management are all aligned with the goals and mission of the program offices (i.e., NE, SC, EERE, NNSA, EM, FE) in charge of each mission. While a number of well-functioning models exist within the framework of the current M&O contracting model, there is ample room for improvement.

Historical Context

At the inception of the DOE National Laboratories, during the 1940s and 1950s, laboratory management was regarded as a national service and was accomplished through an essentially no-fee/no-liability arrangement by major research universities (e.g., the University of California system) or major industrial concerns (e.g., Union Carbide, Western Electric, Monsanto, and DuPont).[11] In these arrangements, the M&O contractor organizations brought significant technical, industrialization, and/or program management expertise to the laboratories. In return, their service to the nation added to the reputation of the contractor, and often provided career-development experience for emerging contractor leaders. In the broadest terms, these arrangements were true strategic partnerships and represented pure GOCO endeavors: the government defined the mission, provided the funding, and assumed the liability, while the contractor directly managed the laboratory operations and personnel.

Since the creation of the DOE in 1977, there have been a variety of M&O contracting arrangements, and the laboratory missions have broadened in response to national needs and scientific advances.

[10] The National Energy Technology Laboratory is a government-owned, government-operated (GOGO) laboratory.
[11] DOE Acquisition Guide, Chapter 17.6, Discussion of the origin, characteristics, and significance of the DOE's M&O form of contract, DOE (2007).

Most of the contractors in the late 1970s (e.g., Western Electric, DuPont, Union Carbide, Monsanto, and the University of California) had maintained these positions since the World War II Manhattan Project that preceded the Atomic Energy Commission. However, beginning in late 1992, Congress and the administration shifted to a more commercial model with contracts and frequent re-competition of laboratory contracts in attempts to improve technical performance, realize cost efficiency, and improve accountability.

Today, M&O contractors often compete on a commercial, for-profit basis, frequently by forming limited liability corporations (LLCs). LLCs are a mechanism to allow separate entities (e.g., Battelle and the University of Tennessee) to join together to compete for a contract. While the LLC mechanism partially shields the parent entity from certain liabilities, DOE's requirement to sign "corporate guarantees" keeps most of the liability with the parent organizations.

The competition for an M&O contract includes little opportunity for negotiation. The DOE issues a Request for Proposal that contains all of the terms and conditions to be included in the final contract. To qualify, a competitor must accept the entire contract and respond with a technical and cost proposal.

It is important to note that the decision to respond to a Request for Proposal represents a significant commitment of cost and human resources on the part of the contractor. The contract terms require the M&O contractor to accept significant liability, which affects the risk-reward proposition for the potential bidders. As contract requirements have become more onerous and the contract process more complex, the number of qualified entities willing to respond has diminished.

The variation in laboratory award fees between Science, Energy, and National Security laboratories has raised questions and concerns among some DOE officials and Congressional committees. M&O contractors understandably expect consideration for the responsibility and the financial and reputational risk they are accepting in the arrangement. Although the size of the management award fee is large for some contracts compared to what it had been before 1990, it is modest when compared to profit on other revenues that most of the participating commercial firms expect.[12] Key contract variables that can also affect the contracts include the allowability of reimbursable costs for operating the laboratories, size of the management award fee, length of the contract, award term considerations, and liability coverage. Further contributing to variability, for-profit organizations are seen to have different motivators compared to universities and nonprofit organizations, which are more focused on strategic research partnering and the ability to attract and retain top quality faculty and researchers.

Findings

Many aspects within the framework of the current M&O contracting model for the DOE National Laboratories work well. The laboratories are an essential part of the national research science and technology portfolio and the envy of the rest of the world. However, when contrasted with

[12] See Appendix D for current laboratory contract details

similar Federally Funded R&D Centers (FFRDCs) within other federal agencies, there is clear opportunity for improvement.

Two notable examples of successful FFRDCs are the U.S. Department of Defense (DOD) Lincoln Laboratory, managed by the Massachusetts Institute of Technology (MIT), and the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL), managed by the California Institute of Technology (Caltech). Both Lincoln Laboratory and the JPL function as autonomous facilities operating independent of their parent organization.[13] According to JPL leadership, NASA provides mission direction and JPL/Caltech takes steps to achieve the mission goals. NASA designates the JPL laboratory director as a Special Government Employee so that the director can be a part of the budget process inside NASA. Such trust is sorely missing in the DOE enterprise, especially within the NNSA laboratories. The success of the FFRDC model implementation found in NASA/JPL and DOD/Lincoln Laboratory provides a pair of useful benchmarks for potential contract and contract management changes at DOE.

Stakeholders in the M&O process have different primary objectives for the management arrangements. DOE mission owners look for laboratories that are scientifically and technically excellent in the execution of their programmatic missions, consistent with cost and process constraints. Office of Management and Budget and procurement personnel in DOE give priority to cost transparency and accountability in the M&O contracting arrangement. Meanwhile, DOE operational oversight organizations (e.g., the DOE Office of Environment, Health, Safety and Security organization, the Office of Independent Enterprise Assessment, and Office of Enforcement) view reduced risk as the primary measure of success. The complications that arise from having so many participants involved in the management and oversight of a laboratory add significant burdens to both the DOE's and the contractor's task in managing the laboratory to deliver on its mission.

"The [Office of Science] laboratory alignment and planning process is a "best practice" that has developed over many years and is culturally institutionalized in headquarters, the field, the science laboratories, and its contractor community"

The SC laboratory alignment and planning process defines a "best practice" that has developed over many years and is culturally institutionalized in headquarters, the field, the science laboratories, and its contractor community. This process ensures that science output is the first and most important measure of success, that operational management and long-term stewardship are visible and shared, and that the M&O Performance Evaluation and Measurement Plan (PEMP) process is aligned to the laboratories annual mission and operating plan. This relationship provides a vehicle for

[13] "The Evolution of Federally Funded Research & Development Centers", J.M. Hruby, D. K. Manley, R, E. Stoltz, E. K. Webb, J. B. Woodard, Public Interest Report, Spring, 2011, pp 24-31

performance and human resource development. Progress has been made over the last few years in establishing a similar culture and process view in the applied energy laboratories.

However, the partnership and stewardship philosophies that exist in the SC system cannot be found in the NNSA system. The lack of clear ownership at the NNSA headquarters level for the laboratories and their alignment with mission, little evidence of an effective joint planning process, and the lack of clear long-term stewardship of the NNSA laboratories make it more challenging to achieve mission success and improved laboratory performance.

Recommendations

To achieve a more efficient DOE–laboratory partnership, the TF reiterates the point made in Recommendation 1.1 of the Framework that the roles and responsibilities of the participants in the process (i.e., Headquarters, laboratory management team, contractor, Service Center, and Site Office) should be continually clarified and communicated. Decisions, requirements, roles, responsibilities, authorities, and accountabilities across these layers must be clarified and implemented at all layers of management and redundancies must be eliminated to achieve the DOE mission objectives in the most cost-effective manner.

Furthermore, a major and growing element of many of the laboratories—WFO, now known as SPP—must be integrated into the M&O contracting and laboratory management landscape as this can comprise a major element of individual laboratories.

Recommendation 2.1: The SC Director should complete, expeditiously, the study currently underway to evaluate options for changes to the contracting model.

SC, at the suggestion of the TF, has established a working group to study potential modifications to M&O contracts for the single-purpose DOE National Laboratories that are overseen by SC. The Terms of Reference for this working group contains five items:

1. Review and summarize present models for the management of Federally Funded Research and Development Centers (FFRDCs).
2. Review and summarize major contract requirements, i.e., contract clauses or contractor requirement documents (CRDs), for DOE M&O contracts.
3. Summarize requirements that are the most problematic for the DOE M&O contractors and laboratories, and assess the need for and/or options to these contract requirements. Summarize the recent activity to identify burdensome practices and the outcomes of that activity.
4. Summarize the various external reviews and inspections at the DOE National Laboratories, and assess the need for and/or options to these reviews.
5. Recommend whether it is feasible and desirable to do an experiment at a single-program Office of Science laboratory with a simplified contractual arrangement, and provide the outline of a recommended experiment, if any.

The TF previously endorsed this work plan in a letter to Secretary Moniz and awaits the outcome and recommendations early in the third quarter of FY2015. The TF urges the SC working group to consider the examples of NASA/JPL and DOD/Lincoln Laboratory provided above in its analysis.

The TF understands that Secretary Moniz is in the process of launching a separate initiative to explore more substantial changes to present M&O contracting practices. The TF supports this initiative as well.

Recommendation 2.2: The Under Secretary for Management and Performance should authorize a number of experiments to move control authority for certain operational procedures to the laboratory management.

As the M&O contract process has evolved, additional and duplicative oversight has been layered onto laboratory operations in response to process lapses, and budget atomization has lowered the threshold level for Site Office, Service Center, and Headquarters financial control. One result is that laboratory authority for decision-making has been reduced.

Over the last several years, numerous study groups and task forces have provided input on operational processes that might be more effectively executed with minimal risk if decision authority were conferred back to laboratory management. The TF reviewed several previous efforts in this regard and also engaged the NLDC.[14]

While a number of viable opportunities exist to test new streamlined processes and to provide more local decision authority with low risk is extensive, the TF proposes seven such experiments that can yield results within a year. **The TF recommends that the Under Secretary for Management and Performance should, within 30 days of the release of this report, establish for each case below the specifics of the plan, the timing to which parties will commit for their respective actions, and the process by which results will be measured and reported over the course of the next year**.

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[14] "Positioning DOE's Labs for the Future: A Review of DOE's Management and Oversight of the National Laboratories", J.D. Breul, D.A. Ink, A. Burman, P.W. Marshall, et al. 2013. Found at: http://www.napawash.org/wp-content/uploads/2013/01/DOE-FINAL-REPORT-1-2-13.pdf.
"Turning the Page: Reimagining the National Labs in the 21st Century Innovation Economy", M. Stepp, S. Pool, N. Loris, J. Spencer. 2013. Found at: http://scienceprogress.org/wp-content/uploads/2013/06/2013-turning-the-page-national-labs.pdf.
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"America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States", W.J. Perry, J.R. Schlesinger, H. Cartland, J. Foster, et al. 2009. Found at: http://www.usip.org/sites/default/files/America%27s_Strategic_Posture_Auth_Ed.pdf.

2.2.1 Compensation Management: The current compensation approval process is eight times longer than industry norms,[15] and requires excessive data submission. After parameters are received from DOE in late July, laboratories must conduct market surveys and analyses and review affordability, which takes up to one month. This is followed by a white paper presentation and DOE review and approval, which can take a minimum of five weeks. Finally, M&O contractor review and approval takes one week. In total, the current review process can take ten weeks or more, and its variability impacts the laboratories' ability to effectively plan for compensation reviews.

The TF recommends an experiment in which intent and constraints are discussed and agreed upon with the DOE during the first week, and DOE review and approval time is reduced to one week. This will limit the compensation process timeline to six weeks, while still ensuring that total compensation meets DOE strategic intent and constraints.

2.2.2 Labor Negotiations: Currently, the process for labor negotiations is structured around approval parameters for bargaining on discrete elements (e.g., general wages and benefits). These parameters are determined through market surveys and analyses, as well as affordability reviews that are submitted to DOE for approval. Obtaining detailed point-by-point parameters from DOE can take months.

The TF recommends an experiment in which the process shifts to a "not-to-exceed total compensation" budget. The strategic intent and constraints would be discussed and agreed upon with DOE, so that DOE can provide authorization for a total cost ceiling. Such a change would ensure system-level controls are in place, while allowing the laboratories to decrease strike probability, improve the alignment of the contracts and broader strategic intent, and reduce bargaining costs. This process should be limited to a six-week timeframe (not including negotiating time).

2.2.3 Benefits: Currently, DOE utilizes individual reviews for lower-risk laboratory transactions, which is time consuming and can be a net drain on resources. The TF proposes that DOE authorize laboratories to manage benefits below a preset cost threshold. The proposed process will provide the laboratories with improved agility and increase focus on the overall total rewards design while maintaining market-reference and affordability. This process will reduce review and approval time by DOE from a one-month minimum to one week. After a period of 12 months, the program should be reviewed to determine its efficacy at containing benefits costs while still achieving competitive benefits levels and reduced transaction costs.

2.2.4 Annual Pension Funding: The current pension contribution process inhibits laboratories from making pension contributions utilizing a risk-based approach. The current process operates under existing constraints and peer-determined caps. Any pension contributions in excess of the actuarially determined Minimum Required Contribution must be submitted to DOE for approval. This process can take two to three months. In addition, the timing of DOE approval could result in mid-year changes to labor rates.

[15] Based on the experience of TF members in the private sector.

As an experiment, laboratories should discuss and agree on the strategic intent and constraints with DOE *in advance* of defining an annual pension management plan. The proposed process could help enable long-term strategic pension management and ensure pension plans meet agreed DOE minimum long-term strategic standards.

2.2.5 Conference Management Approvals: The current process for conference participation approval creates lengthy delays and barriers. Conference expenses expected to exceed $100K across all laboratories are routed through DOE for approval, which can take weeks or months. Once approval is secured, laboratories inform conference attendees of whether they are authorized to attend the conference, long after their names are submitted to the conference approval system.

This process hurts morale and hinders the ability of laboratory staff to network with their peers and build their knowledge base. It can also increase costs as later approvals result in higher conference attendance fees (missed early registration pricing) and higher travel costs.

Instead, the TF proposes piloting a new arrangement for two years in which laboratories and DOE agree to an annual ceiling for conference attendance and spending, and then allow the laboratory to make its own decisions on attendance on a conference-by-conference basis.

2.2.6 Outside Legal Counsel: The current process for engaging outside legal counsel requires substantial resources to negotiate low-risk items without commensurate value. Approval process variability can result in increased supplier payments and limit the number of suppliers willing to provide counsel to the laboratories.

The TF recommends directing field offices to streamline billing and for laboratories to provide annual billing submission to DOE, based on agreed upon strategic intent constraints with DOE. By eliminating the current process of field office reviews and Q&A interactions with the laboratories to secure approval, the process can be shortened by up to two months. The future process would support Title 10 of the Code of Federal Regulations (CFR) Part 719 requirements while implementing a streamlined, risk-based approach.

2.2.7 Large Request for Quotations (RFQ) and Contract Awards: The current review process for large RFQ and contract awards, defined here as >$1M, requires three rounds of duplicative reviews (i.e., field office contracting officer, Acquisition Project Management, and Head of Contracting Authority). Further, the reviews often include contradictory guidance/direction from the various reviewers. Consequently, high-dollar procurements are delayed, on average, by six to eight months.

Instead, the TF proposes utilizing a one-week discussion period with DOE to agree upon the strategic intent and constraints, followed by a single federal review once high-dollar RFQs are developed. The proposed process would reduce reviews to one contracting officer and could reduce review time to as little as two weeks.

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LABORATORY VALUE TO THE PRIVATE SECTOR, INCLUDING TECHNOLOGY TRANSFER

The DOE National Laboratories constitute an unparalleled collection of scientific expertise and facilities, built to address the DOE missions. Although the R&D culture across the DOE National Laboratories is not—and should not be—one of commercialization, the laboratories nevertheless play a vital role in helping the United States maintain the science and technology superiority needed to sustain its economic competitiveness in a highly innovative global economy. Laboratories have a long history of creating value for the private sector through user facilities and direct industry engagement on research collaborations, as well as through the commercialization of laboratory-developed technologies. However, the TF finds that there are further opportunities to significantly improve in this area.

BACKGROUND

> ***"The DOE National Laboratories have enormous value to industry through a variety of different modalities."***

The primary objective of DOE National Laboratories is to maintain scientific and technological leadership in their designated mission areas (i.e., national nuclear security, science, and energy/environment). The scientific and technical missions of the laboratories are not justified solely by cost of operations or short-term return on investment analyses (as might be appropriate for private sector firms), but rather on the basis of developing the facilities and workforces necessary to execute the DOE's core missions.

The DOE National Laboratories have enormous value to industry through a variety of different modalities. For example, the major laboratory user facilities (e.g., light sources, microscopes, and computing resources) combined with the depth and breadth of knowledge of the laboratory staff, offer a world-class capability that is highly valued by the private sector. In addition, numerous laboratory-developed innovations have had significant commercial impact in the private sector—a fact well understood by private sector companies that regularly capitalize on the highly specialized knowledge bases that reside at the laboratories. The Sandia Combustion Laboratory in Livermore, California is an excellent example in how a specialized DOE facility with unique expertise in both combustion experiments and modeling has, over many years, advanced technology in a wide range of industries through long term collaboration. However, there are clear opportunities to improve the rate and impact of industry engagement, including, but not limited to, transfer of laboratory-developed technologies.

Below, the TF provides its findings and proposes a set of recommendations—all of which can be undertaken with existing authorities and budgets—aimed at identifying and disseminating best practices that can improve the overall technology transfer process and dramatically enhance the program's impact.

HISTORICAL CONTEXT

Technology transfer has been an important consideration at DOE since its founding. During this time, most of the attention has been devoted to how far DOE's energy programs should extend beyond research and development (R&D) to demonstration and deployment, and what mechanisms are appropriate and efficient for the department to employ for this purpose.

Less attention has been given to the important alternative pathway of direct transfer of technology developed at a laboratory to potential industry users. However, almost every DOE National Laboratory has had some effort in place for many years to stimulate technology transfer, at times with particular emphasis on helping local or regional industry.[16]

There is a general impression that the laboratories do not have a strong record stimulating technology transfer, particularly in comparison with universities (which are the strongest engine, after private sector firms, in developing and launching new technology ventures). As an example, although laboratories are barred by law from independently submitting ARPA-E proposals, the laboratories' participation as partners (about 5 percent by dollar value) nevertheless appears very small, and venture capital firms have not championed many laboratory start-ups. The TF estimates that universities create 5 to 8 times more start-up companies on a research adjusted basis than the DOE national laboratories.[17] In response, Congress has consistently encouraged greater technology transfer efforts by the laboratories and enacted a number of measures to achieve this purpose.[18]

The TF was surprised to learn that the department does not have a policy stating that technology transfer is a legitimate laboratory objective. Many laboratory and industry commentators told the TF that such a policy statement would be useful, for instance as an addition to the department's vision statement.

PROCESS AND OBSERVATIONS

The TF approached the issue of technology transfer with a focus on the *value* the DOE National Laboratories can offer to industry. On this basis, guided by a set of questions found in Appendix F, the TF conducted a series of interviews with laboratory directors, industry, and DOE staff. Industry representatives were chosen to cover a broad spectrum of small and large

[16] The 1980 Stevenson-Wydler bill allows each DOE National Laboratory to spend up to 0.5 percent of their R&D budget on technology transfer activities.

[17] Analysis of data obtained from the DOE Office of the CFO, a Brookings Institute report (http://www.brookings.edu/~/media/research/files/papers/2013/11/start-ups-tech-transfer-valdivia/valdivia_tech-transfer_v29_no-embargo.pdf) and the Center for Measuring University Performance at Arizona State University (http://mup.asu.edu/MUP-TARU-Part-II-MUP-Research-Universities.html), not accounting for differences in mission or structure.

[18] The 2005 EPAct requires DOE to spend 0.9% of its applied energy Research, Development, Demonstration and Deployment funds with private partners to encourage commercialization of promising technologies. See a full description and history of relevant legislation as of 2011 at http://globals.federallabs.org/pdf/FLC_Legislation_and_Policy.pdf

businesses that have (or have had) DOE National Laboratory interactions and included researchers, management, technology transfer staff, and others.

The DOE National Laboratories employ four contractual mechanisms to interact with the industry: (1) CRADA; (2) WFO; (3) Agreement for Commercializing Technology (ACT); and (4) licensing of intellectual property.[19] These activities are typically a small fraction (less than 5 percent, excluding federal WFO) of the laboratories' total budget.

With the help of DOE personnel, the TF gathered a large set of data to learn about trends in the laboratory-industry interactions. The most pertinent data sets that the TF collected and analyzed are given in Appendix G.

These data reveal the following:

- <u>In general, DOE National Laboratories seem to prefer WFOs to CRADAs</u>, which may be due to the higher administrative burden associated with CRADAs.
- <u>Most laboratories primarily use either WFOs or CRADAs</u>, not both, which suggests that once a laboratory figures out the process for one mechanism, it uses that mechanism at the expense of others.
- <u>For several laboratories, there are periods of considerable expansion or reduction of CRADAs with industry</u>. Understanding the causes of these periods of decline or expansion should be of interest to the laboratories.
- <u>As expected, a correlation exists between greater number of patents and more income-bearing licenses at a laboratory</u>. While patents and income-bearing licenses are metrics of successful technology transfer, they are not the only metrics. In many cases, stakeholders can benefit indirectly from the technology transfer project (e.g., local communities and state governments), which can add to the value of the laboratories' technology transfer efforts. For instance, an important indicator of success is whether the laboratory-industry cooperation led to value creation in the private sector; however, this value is difficult to measure.
- <u>There is a large variation among the laboratories in royalty income per budget dollar</u>. In general, most royalty income comes from just a few patents, a pattern also found in universities. Laboratories that enjoy a high level of royalty income tend to allocate a larger fraction of this income to industry-engagement activities.
- <u>The highest royalty bearing "blockbuster" patents result from non-exclusive licenses that benefit an entire industry</u>. This is the ideal outcome for collaborative activities that use public funds.

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[19] Brief descriptions of these mechanisms are given in Appendix G. More details can be found at http://technologytransfer.energy.gov/doework

FINDINGS

TF discussions with industry representatives revealed that the DOE National Laboratories are highly valued for the technical core competencies they provide via: (1) their scientific infrastructure (e.g., user facilities, computing facilities); (2) the depth and breadth of knowledge and know-how of their staff scientists and engineers; and (3) the technologies that they create. The industry also values the scientific credibility and convening power the laboratories provide.

TF discussions with laboratory directors revealed some important common elements. Laboratory directors are seeking ways to interact with industry and explore new mechanisms. There is an interest in moving collaborations beyond proof-of-concept to proof-of-system (e.g., Cyclotron Road at LBNL) to help spin off start-ups based on laboratory-created technologies. Examples of other experiments include LBNL's CalCharge master CRADA effort,[20] Fermilab's FermiTech experiment,[21] and use of EERE's small-business voucher program[22] to cover some laboratory costs. These experiments should be encouraged and are consistent with the decentralization principle suggested by the TF. The success of these efforts should be monitored, using an appropriately defined return on investment (both for the laboratory and for the industry partners) with attention paid to improved morale and/or enhanced retention of participating laboratory scientists. Those efforts that are deemed particularly successful could then be used as models for other laboratories.

Existing Industry-Laboratory contract practice places all risk on the industry partner and this is reflected in contract terms. There is a balance: if DOE wants to encourage industry to be a facility user and undertake joint projects with the lab, contract terms should support this objective. The present practice with industry does not reflect shared risk. However, the present practice of shared risk in DOE users facilities with non-industry shows that shared risks works effectively. The Task Force believes this practice should be extended to industry partners. The Agreements to Commercialize Technology (ACT) provides a mechanism for accomplishing this objective.

The TF also found that the best approach for laboratories to create value for the private sector is through long-term strategic partnerships between laboratories and industry, when the technical core competence ("technology push") of the laboratories intersects with the needs ("demand pull") of the industry. These partnerships are most productive when the objectives of such

[20] LBNL has initiated a public-private partnership that implements a master CRADA approach to partnering with universities, non-profit, and for-profit institutions to advance electrochemical energy storage research in California, with SLAC joining the CalCHARGE partnership as well. More information can be found at http://calcharge.org/.

[21] Fermilab is exploring the creation of a non-profit, FermiTech, to serve as a conduit, possibly using a master CRADA approach, to the Illinois Accelerator Research Center (IARC), a new facility scheduled to open in April 2015 jointly funded by the state of Illinois and the DOE. More information can be found at http://iarc.fnal.gov/.

[22] DOE's EERE program is piloting a small business voucher program, which aims to (1) leverage DOE National Laboratory capabilities for economic development by establishing a laboratory voucher program for small business and (2) provide access to expertise, competencies, and equipment at all DOE National Laboratories.

partnerships are clear to the laboratories and firms involved, and are aligned with the goals of both parties. The technical milestones, schedule, and costs should be well understood and transparent.

The top three barriers to such successful strategic partnerships identified by industry and laboratory representatives occurred in the following areas:

Barrier 1 – Centralization: The centralized approach that DOE has pursued with regard to technology transfer efforts at the headquarters level, by defining uniform cooperation mechanisms with industry, approval, and reporting requirements across all the DOE National Laboratories, creates multiple barriers.[23] In part this is a natural bureaucratic tendency to prefer centralized control over distribution of authority. In general, these efforts have not been very successful and have led to three barriers that result from this approach: (a) the slow rate of establishing laboratory-industry partnerships and projects, (b) process complexity that inhibits industry engagement, and (c) lack of flexibility in cost-sharing and intellectual property ownership.

Barrier 2 – Mission: The lack of consistent and sustained expectations by the DOE for engagement with industry by the laboratories has driven inconsistent focus on industry engagement by laboratory management. Many laboratory directors noted the cyclical nature of DOE expectations regarding industry engagement and the uncertainty regarding industry engagement as part of the DOE mission.

"In practice, the time required to negotiate and gain approval for a project is seen both by industry and the laboratories to restrict greatly the number of opportunities that are available."

Barrier 3 – Personnel: The absence of personnel policies that encourage laboratory experts to take time-limited leave to participate in an entrepreneurial or company venture with the opportunity to rejoin the laboratory without loss of career opportunity has reduced staff willingness to start new ventures in private industry.

The CRADA, WFO, ACT, and other contract mechanisms and DOE personnel policies are, in principle, flexible. But, in practice, the time required to negotiate and gain approval for a project is seen both by industry and the laboratories to greatly restrict the number of opportunities that are available.

[23] The 2005 Energy Policy Act requirement suggests a "top down" approach to technology transfer rather than the "bottom up" approach the TF advocates.

Recommendations

Recommendation 3.1: The Secretary of Energy should provide a statement to the DOE enterprise, including DOE staff and the laboratories, that laboratory technology transfer activities intended to create value for industry are part of the mission for DOE National Laboratories. Such a statement should be accompanied by any necessary implementation instructions.

The TF believes that the statement by the Secretary of Energy would create alignment within the DOE about the broader value that laboratories create for industry as defined by their utilization of user facilities, direct engagement in research collaborations and commercialization of laboratory-developed technologies. This recommendation addresses Barrier 2 above.

Recommendation 3.2: The DOE should organize its technology transfer activities using a decentralized approach where industry and laboratory participants interact directly to structure programs. As an experiment, the DOE could consider flexibility in such agreements to facilitate rapid laboratory-industry engagements.

As described previously, the TF believes that the best strategic partnerships between laboratories and industry occur when the technical core competence ("technology push") intersects with the needs ("demand pull") of the industry over a period of time. Every laboratory has a unique history, and laboratory staff members understand the opportunities and challenges in the context of their own unique ecosystem. Hence, the identification of where this intersection creates value is best achieved at the local laboratory level, and not at the DOE. As a concrete step towards decentralization and to speed up the process of engagement, the DOE could try an experiment where the laboratory-industry partnership can occur with decision-making authority at the laboratories, perhaps with time and funding limits on such engagements. Such rapid engagements would allow laboratories and industry to identify whether a longer-term engagement is needed, for which CRADAs, WFOs, and ACTs could then be used. This recommendation addresses Barrier 1 above, especially (c).

DOE headquarters has an important role to play in making a decentralized approach effective. First, broad policies must be established to define the boundaries of approved laboratory practice. Department guidance on initiatives, selection criteria, intellectual property rules, and cost-sharing should be adopted on a broad, as opposed to case-by-case, basis. It is important that DOE HQ track activities underway at the different laboratories and compile accurate data on a department wide basis.[24] In this regard, the TF endorses the work of Dr. Ellen Williams, who acted as the Senior Advisor to the Secretary on Technology Transfer and has now been confirmed as the Director of ARPA-E. The TF believes that someone should be tasked to continue her oversight of the department's technology transfer activities in the Office of Technology Transitions.

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[24] All federal agencies are required to file information specific metrics of their technology transfer activities to NIST annually. Additional requirements were added in 2012 Presidential Memorandum -- *Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses.*

Recommendation 3.3: The DOE should create fast-track CRADA and non-federal WFO contracting and approval processes supported at the laboratory level by a dedicated laboratory/DOE team of legal and procurement experts with a leader authorized to shepherd each agreement to completion, and pilot this process at three laboratories. This recommendation should be implemented by the Under Secretary for Science and Energy and the Administrator of the NNSA.

This is one specific approach to addressing Barrier 1 above, especially (a) and (b). An initiative to simplify greatly existing CRADA and non-federal WFOs contracting procedures and the subsequent DOE approval process would significantly facilitate technology transfer efforts. The TF supports such an initiative but recognizes that it would involve complicated issues and participation of many parties, possibly require Congressional authorization, and take a long period of time. Accordingly, the TF recommends a limited, more targeted experiment to determine the benefits of a simplified process, using the SC Nanoscience Research Center fast-track CRADA as a model.

The TF also suggests examining the ARPA-E solicitation and contracting process, in which a dedicated team of legal/procurement experts take ownership to shepherd each agreement and contract to completion. This arrangement was largely responsible for the success of the agency's solicitation, selection, and contracting effort. The experiment should be implemented for 24 months and evaluated on the basis of reduced agreement execution time, streamlining of the number of stakeholders who participate in an agreement approval, and the degree that the experiment limits laboratory risk exposure to fast-track agreements.

Recommendation 3.4: Each DOE National Laboratory should adopt a personnel pathway that permits a limited number of staff to take entrepreneurial leave for a designated period with the assurance of appropriate resources upon return to restart a research program.

This recommendation addresses Barrier 3 above. Technology transfer is a "contact sport" and the chance of successful technology transfer is greatly increased if experts directly involved in new discovery and invention are also involved in a firm's early development and commercialization efforts. National laboratories need to craft personnel policies[25] that allow a limited number of staff to take leave from the laboratory for this purpose with the option to return to resume at least comparable research positions after a designated period of time. This approach would enhance the laboratory innovation ecosystem and staff retention. Both the DOE program office and the laboratories should explore existing and new mechanisms that could be used to underwrite the cost of providing researchers who take entrepreneurial leave with "safe harbor" should they choose to return to the laboratory. The total number of individuals involved should not be so high as to strain laboratory resources, including LDRD.

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[25] Within the GOCO model, entrepreneurial leave policies are determined by the M&O contractor for a particular DOE National Laboratory. For example, ANL provides unpaid leave to qualified employees to pursue entrepreneurial activities using ANL intellectual property (http://www.anl.gov/diversity-inclusion/policies-practices).

Recommendation 3.5: Each DOE National Laboratory should track its impact on the industry.

In addition to addressing the key barriers described earlier, each laboratory should identify quantitative and qualitative metrics to better measure the efficacy of its engagement with industry (e.g., how many technologies have made it to commercial deployment [regardless of revenues, private sector funding, or in-kind support] immediately following licensing or joint development; or the number of patent filings by the commercial entity including inventors from the DOE National Laboratory) and build a historical record of value created by the laboratory for industry. Furthermore, each laboratory should consider benchmarking against other successful partnerships at peer institutions (domestic and international). The DOE should play a role in bringing uniformity to these metrics and creating benchmarks for success.

LABORATORY DIRECTED RESEARCH AND DEVELOPMENT (LDRD)

BACKGROUND

> ***"LDRD is used to leverage the national investment to maintain world-class science and engineering talent and facilities, and to investigate new ideas in the DOE mission areas."***

It is near universal practice in industry, universities, academic medical centers, and government to make discretionary resources available to the organization's technical leadership to advance the effectiveness of its innovative activities. For DOE National Laboratories, discretionary resources are allocated through the LDRD program. This program is the only discretionary research funding available to laboratory directors to strengthen core capabilities.

Across the laboratory complex, LDRD is used to leverage the national investment to maintain world-class science and engineering talent and facilities, and to investigate new ideas in the DOE mission areas. Since the inception of the LDRD program, it has been heavily reviewed and improved. The TF suggests the following additional opportunities for increasing its effectiveness in achieving its core aims:

- maintaining the scientific and technical vitality of the laboratories, including through enhanced opportunities for early career research and the development of the future workforce
- positioning the laboratories to better address future DOE/NNSA missions
- fostering world-class creativity and stimulating exploration of forefront science and technology
- serving as a proving ground for new concepts in R&D.

After consultations with a range of stakeholders (e.g., NLDC, management at DOE, management of laboratories outside of DOE in government, and the private sector) and a survey of previous reports, Congressional studies, and DOE reviews concerning laboratory management and the LDRD program, the TF proposes a series of experiments designed to enhance the LDRD program. These initiatives can be conducted using existing authorities and budgets. The TF also recommends an overall level of LDRD funds that will give the laboratories the resources to adequately address current and future DOE mission needs.

HISTORICAL CONTEXT

While the origins of LDRD are found in the *Atomic Energy Act of 1954*, the modern DOE LDRD program is a legacy of the Exploratory Research and Development Program established in 1985, which first allowed the DOE National Laboratories to initiate self-directed R&D projects.[26]

[26] An update to the original order was issued in 1991 that responded to recommendations from various audits of the program, and changed the name of some of the current LDRD programs. Plant-Directed R&D (PDRD) and Site-Directed R&D (SDRD) were authorized for the NNSA production facilities in 2001 and 2002, respectively, by Section 310 of the FY 2001 Energy and Water Development Appropriations Act (P.L. 106-377), Section 3156 of the FY 2001 Floyd D. Spence National Defense Authorization Act (P.L. 106-398), and Section 310 of the FY2002 Energy and Water Development Appropriations Act, 2002 (P.L. 107-66). Over the years there have been additional audits and reviews of the LDRD program, including formal reports from the 1994 Process Improvement Team and 2004 LDRD Core Team.

The LDRD program is governed by DOE Order 413.2B, which sets program requirements such as caps on spending, overhead spending, certifications of the use of LDRD funding, and mandates an annual report to Congress. Further guidance issued by each of the Program Secretarial Offices: Science, Energy, and Nuclear Security details management practices, including DOE oversight and laboratory reporting requirements. An informal working group with representatives from each of the programs with LDRD projects works together as needed to ensure consistency and address policy issues, external review actions, and Congressional requests. The NNSA national security site and plants have analogous programs (i.e., Site Directed Research and Development [SDRD] and Plant Directed Research and Development [PDRD] funds) that serve a similar function tailored to the needs of the site and plants.

Features of LDRD Spending

Current LDRD funding levels are set by the 2014 Energy and Water Appropriations Act (P.L. 113-76), which reduced the maximum allowable funding level of an LDRD program to 6 percent (down from 8 percent) of a DOE National Laboratory's operating/capital equipment budget. The NNSA plants/site have a ceiling of 4 percent on PDRD and SDRD funds.

Currently, all 16 eligible laboratories choose to have active LDRD programs: AMES, ANL, BNL, Fermilab, INL, LANL, LBNL, LLNL, NREL, ORNL, PNNL, PPPL, SLAC, SNL, SRNL, and TJNAF (NETL is not eligible, as a Government-Owned Government-Operated, or GOGO, laboratory).[27] FY 2013 LDRD spending is shown in Figure 3. The funding totals for each of these categories are as follows:

- $150.8M at Science laboratories
- $390.5M at NNSA laboratories
- $32.3M at the NNSA Plants/Site
- $32M at Energy laboratories
- $5.6M at SRNL (EM)

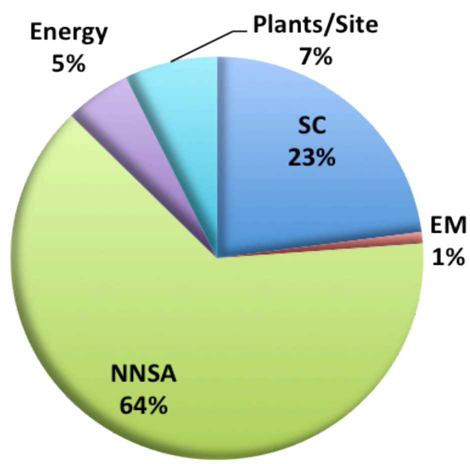

Figure 3. FY 2013 LDRD spending by laboratory steward, with NNSA plants and site included separately.

[27] FNAL and TJNAF initiated LDRD programs in FY 2014.

For FY 2013, the average LDRD spending level of the NNSA laboratories was around 6 percent, while Science laboratories reported spending between 1.5 (SLAC) and 4.9 percent (PNNL). The implementation of LDRD programs varies among laboratories, as they must all balance internal investment for infrastructure and mission support with R&D that supports the future. How LDRD programs are managed is largely discretionary within set guidelines and there is no accepted set of best practices that guides laboratories in managing activities or evaluating outcomes.

The level of investment at individual laboratories does not radically change year-to-year, as most laboratories tend to settle into a budgeting rhythm that creates a balance among the various spending demands. As detailed in Figure 4 and Figure 5, the actual costs and spending percentages for the DOE/NNSA laboratories have not varied significantly since FY 2008. The Science laboratories are generally well below the congressionally mandated cap, with the NNSA laboratories closer to the prior limit of 8 percent.[28]

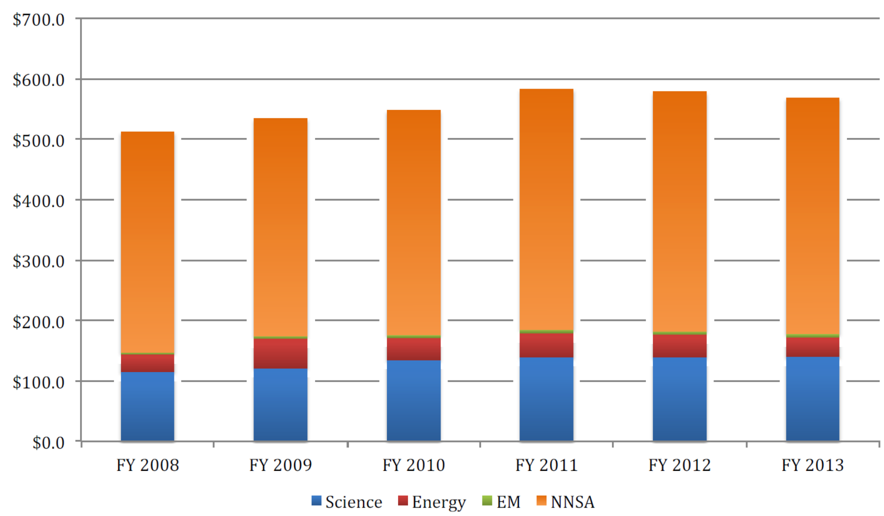

Figure 4. LDRD costs ($M), FY 2008-2013

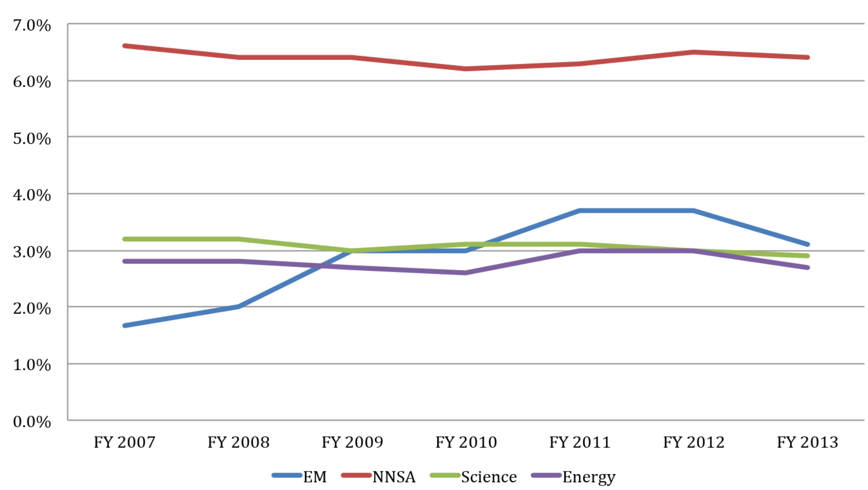

Figure 5. History of LDRD spending percentages from FY 2007-2013.

[28] Note that the limit is 6 percent as of FY 2014.

Other requirements mandated by DOE Order 413.2B include a limit of 36 months per project unless an exception is granted by the appropriate program secretarial officer and a restriction that projects must support areas of science and technology within the DOE mission. Currently, all projects are reviewed and approved by the relevant DOE Site Office.

Findings

Due to differences in scale, mission, and overall investment portfolio, laboratories have developed customized strategies for investing LDRD dollars. However, laboratory directors are accountable to the DOE and their respective contractors for the success of their portfolio of LDRD projects. LDRD makes critical contributions to DOE missions through investments in **personnel**, **research**, and **partnerships**. Figure 6 illustrates the range of program sizes as a function of total laboratory budget among laboratories within the different DOE mission areas; more detail on cost and numbers of projects for FY 2014 is provided in Appendix H.[29]

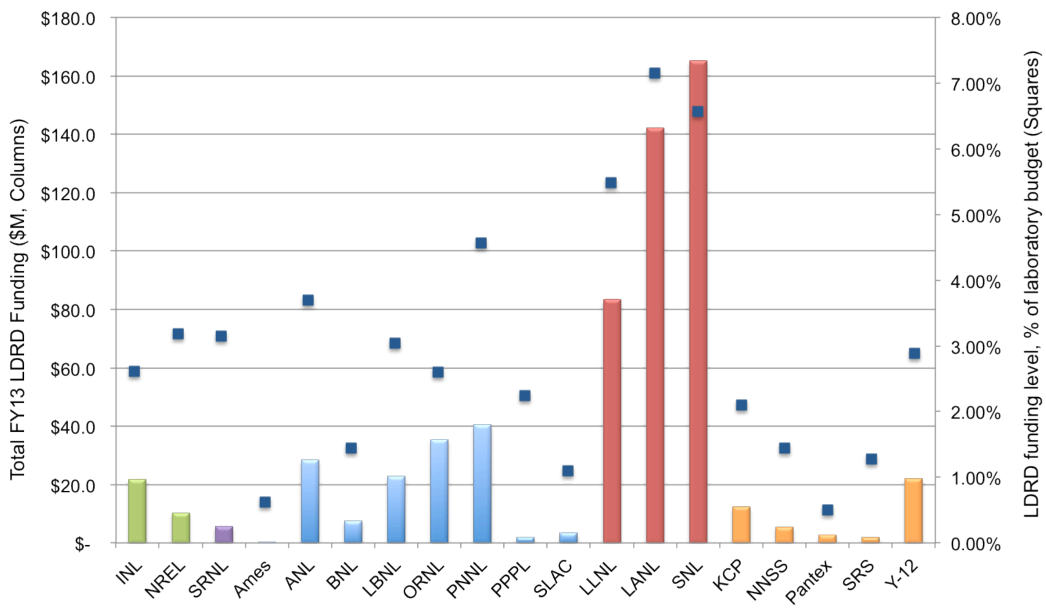

Figure 6. Total FY 2013 LDRD budget (columns; left axis) and LDRD funding as a percentage of laboratory budget for each laboratory, NNSA site and NNSA plant (squares; right axis).

Program Funding Level

The LDRD program funding level is consistent with discretionary funding levels found in other R&D organizations, including industry and government-funded laboratories across the federal government. These levels ranged from 3 to 10 percent, with many organizations devoting 4 to 5 percent of their resources for this purpose.[30]

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[29] Note that the maximum allowable percentage decreased to 6 percent in FY 2014. The laboratories provided the LDRD budget data and the office of the chief financial officer provided the total laboratory budgets.

[30] Comparator laboratories included DOD-funded FFRDCs, a NASA-funded FFRDC, and industry laboratories.

Recruiting and Retention of Personnel

There is perhaps no more important endeavor for laboratory leadership than the recruitment and retention of top talent for both early career and leadership positions, and LDRD can play a vital role in enabling strategic hires. Recruiting top talent raises the level of innovative R&D across the board. For the NNSA laboratories in particular, LDRD provides a way to maintain a pool of talented individuals whose work is aligned with the core mission of the laboratories. This is particularly important for recruiting early career staff, although more senior staff recruiting is impacted as well. This finding is supported by evidence of the participation of early career staff and recently recruited staff in LDRD programs.

The majority of LDRD projects include early career researchers. Figure 7, for instance, shows that at LANL early career researchers lead many LDRD projects, and that the distribution of LDRD principal investigators peaks at an age 10 to 15 years younger than that of the laboratory's overall research staff. These younger principal investigators have the opportunity to lead larger projects than they would have otherwise, which is an important development experience for future R&D leaders. In addition, many early career researchers are contributors to LDRD projects. Figure 8 shows the percentage of LDRD projects at six laboratories where early career staff contributions represent at least 10 percent of staff effort for FY 2008 to FY 2013 (except for LANL, where the total for FY 2015 is presented).

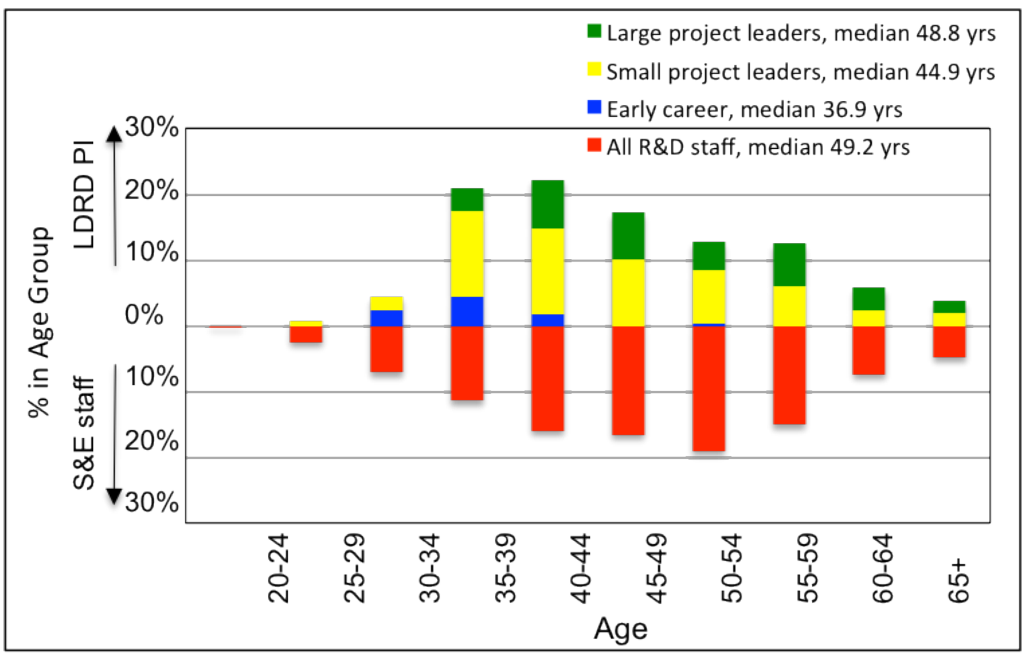

Figure 7. Demographics of LDRD principal investigators (top) and R&D population (bottom) at LANL in FY 2013.

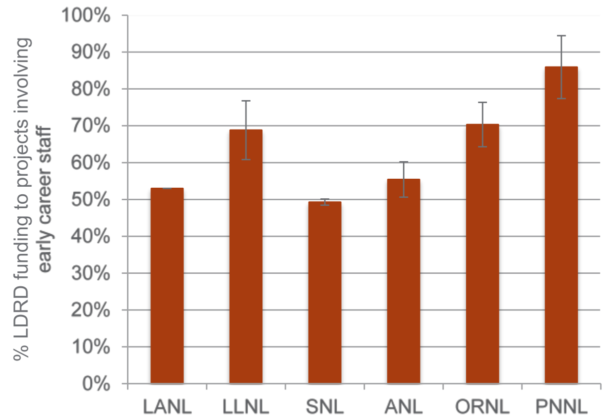

Figure 8. Percent of LDRD program funding to LDRD projects with early career contributors (>10% FTE). All budgets FY 2008–FY 2013 except for LANL (FY 2015).

RESEARCH INNOVATION AND CAPABILITY DEVELOPMENT

"LDRD support has been responsible for some of the most important ideas coming from the laboratories."

LDRD support has been responsible for some of the most important ideas coming from the laboratories. For instance, LDRD programs at SNL on synthetic aperture radar (SAR) permitted dramatic improvements in resolution, size and weight, image quality, and processing speed important for applications ranging from defense to environmental monitoring to urban development.[31] LDRD at ORNL supported the research on the creation of nanoposts in silica that demonstrated superhydrophobic coatings and surfaces that can be used to dramatically extend the lifetimes of marine coatings used by the U.S. Navy and by commercial shipping, as well as by systems used in municipal water supplies.[32] In addition, LDRD resources funded the initial proof of concept of unique superconducting bend magnets or "superbends," subsequently developed and installed in the Advanced Light Source at the LBNL. Ultimately, this capability was important in enabling Roger Kornberg to determine the structure of RNA Polymerase II, for which he received the 2006 Nobel Prize in Chemistry.[33]

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[31] As early as 1983, SNL was investing LDRD to design and test a SAR-based directional altimeter, with improvements in terrain mapping, strip image mapping, and real-time processing following shortly thereafter. These investments, over many years, led to higher-resolution static images from a miniaturized package (miniSAR) deployed on unmanned aerial vehicles, advanced imaging of moving targets, and real-time video radar. Obtained from: http://www.sandia.gov/research/laboratory_directed_research/ and http://www.sandia.gov/research/laboratory_directed_research/_assets/documents/LDRD_Impacts_Sandia_Nation.pdf

[32] The superhydrophobic coating using tailored nanoposts was discovered under an LDRD project at ORNL in 2004 via a biomimetic approach, and was quickly expanded through a subsequent LDRD project (2005-2006) to the creation of powders that could be used for coatings. These new materials are optically transparent, durable and synthesized using controllable processes. Obtained from: http://science.energy.gov/~/media/lp/pdf/laboratory-directed-research-and-development/impact/brochures/DOE_LDRD_Brochure_June-28_FINAL.pdf.

[33] These initial LDRD proof-of-principal studies justified construction and installation of several beamlines using actual "superbend" magnets. These new capabilities were an important component, along with other work at the Stanford Synchrotron Light Source, of Roger Kornberg's determination of the structure of RNA

Strategic Opportunities for Partnerships

LDRD has been instrumental in sponsoring cooperative studies and conferences within and among laboratories. Furthermore, by investing LDRD resources in foundational, leading-edge R&D and user facilities, laboratories can better support exploration of new ideas in partnerships with other agencies. Finally, LDRD allows laboratories to explore cooperative activities with industry, strengthening laboratory-industry and laboratory-university partnerships.

Communication Challenges

The value and impact of the LDRD program has not been effectively conveyed to Congress, industry, or the public. The current combination of local DOE oversight, internal and external reviews, and annual program reports to Congress do not come together as a compelling narrative about the nature of the overall program and its achievements. The result is insufficient appreciation of the strategic contributions that the LDRD program makes to the nation and to DOE's missions.

Recommendations

To improve the efficiency, performance, and understanding about the value of LDRD, The TF proposes the following:

Enhance Efficiency

Recommendation 4.1: The NLDC should prepare and share a best practices document for managing LDRD programs.

The NLDC should capture their distributed expertise and experience to improve the overall quality and impact of the LDRD program. These best practices would be particularly beneficial to the SC laboratories that have recently added LDRD programs, but would be useful across the complex. The NLDC should complete and distribute these best practices by the end of FY 2015.

Recommendation 4.2: The Secretary of Energy should set a common base for LDRD expenditures (the numerator) and laboratory expenditures (the denominator). It makes little difference if one uses Direct + Indirect cost or direct cost as the basis since the indirect cost portion will be roughly the same for all lab activities and LDRD activity. We prefer to use Total Direct Costs for the basis and we recommend 6%. Others may recommend more or less. We believe transparency in the method of calculation is important.

Polymerase II, and for which Kornberg received the 2006 Nobel Prize in Chemistry. Found at: http://science.energy.gov/lp/laboratory-directed-research-and-development/impact/2011/11-16-11-6/

The level of LDRD funding should be maintained with strong support from the DOE and capped at 6 percent.[34,35] This is comparable to many R&D institutions in the private and public sectors (e.g., DOD R&D laboratories such as Lincoln Laboratory). This level would ensure that the laboratories retain adequate capacity to develop the next generation(s) of capabilities—including recruiting, retention, and development of scientists and engineers—that address national science, energy, and security needs.

IMPROVE COMMUNICATION

Recommendation 4.3: Provide enhanced reporting by the offices of the Under Secretary for Science and Energy, the Under Secretary of Management and Performance, and the Under Secretary for Nuclear Security on the substance and value of LDRD.

The current mandated LDRD report to Congress is prepared by the Office of the Chief Financial Officer. This report focuses on the cost and legislative authorization of the LDRD program and includes the entire list of the names of all LDRD projects, but does not convey the substance or impact of the LDRD program.[36] The DOE should charge the NLDC to develop an informative summary of the benefits and structure of the LDRD program, with ultimate responsibility for reporting to Congress held by the offices of the Under Secretaries. Furthermore, the improved report should include a narrative of selected program impacts seeded via LDRD investment that extend back into previous years, including cumulative benefits where appropriate. (This is in contrast to the current report, which is limited to results obtained in the current FY.) If a new Office of Laboratory Policy Implementation is established to provide oversight of all of the DOE National Laboratories per Recommendation 1.2, the report should be prepared by the new office on the basis of information provided by the offices of the Under Secretaries.

Recommendation 4.4: The NLDC should pilot an independent peer review of the LDRD program impacts and process of four laboratories, evaluating up to ten years of funded projects.

Best practices in the scientific community include peer review, and the TF believes the LDRD program at any given laboratory could benefit from a comprehensive and rigorous peer review of process and impact. Such a peer review could serve as a model for future assessment and continuous improvement.[37]

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[34] "Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories", C. Shank, C.K.N. Patel, J.F Ahearne, W.W. Burke, et al. 2013. http://www.nap.edu/catalog.php?record_id=13367.

[35] "Laboratory Directed Research and Development (LDRD) At Lawrence Livermore National Laboratory", J.F. Holzrichter. 2011. Found at http://www.johnholzrichter.com/lib/literature/IR-D_Livermore_092011.pdf.

[36] The annual LDRD report to Congress is coordinated by the Office of the Chief Financial Officer and is focused on financial reporting, with token reporting of publication totals, patent and invention disclosure totals, and number of postdoctoral researchers supported. The FY 2014 report can be found here: http://energy.gov/cfo/downloads/fy-2014-ldrd-report. A second document provides project titles and funding levels for all projects; the FY 2014 list can be found here: http://energy.gov/sites/prod/files/2014/12/f19/DOELDRDProjectListFY2014_0.pdf.

[37] "Laboratory Directed Research and Development (LDRD) At Lawrence Livermore National Laboratory", J.F. Holzrichter. 2011. Found at http://www.johnholzrichter.com/lib/literature/IR-D_Livermore_092011.pdf.

ENCOURAGE CREATIVITY

Recommendation 4.5: The Under Secretary for Science and Energy and the NNSA Administrator should pilot an approach with up to four laboratories, in which the laboratories define project scientific areas, but are not required to obtain approval of specific tasks.

This approach would encourage the laboratories to attack grand challenge problems and would foster more high-risk, high-payoff projects while decreasing the complexity of project approval. The laboratories should be encouraged to "think big" and develop LDRD programs that tackle complex, important science and technology challenges. This innovative approach would be effective for recruiting new talent to the laboratories.

ENHANCE COLLABORATION

The following recommendation underscores the TF's support for programs such as LDRD that encourage creativity and cooperation. The DOE National Laboratories should explore, develop, and adopt new approaches that serve this broader purpose. One such new idea is presented below; however, additional work is needed to define it better.

Recommendation 4.6: The NLDC should establish an Energy Science Study Group (ESSG) modeled on the Defense Science Study Group (DSSG) to develop laboratory leadership talent with broader capability to address and solve key DOE mission challenges.

In 1986 the DOD established the DSSG as a program of education and study to introduce outstanding science and engineering professors to U.S. security challenges and encourage them to apply their talents to these issues.[38] The TF recommends the NLDC consider adopting two DSSG model programs:

The first model program would be focused on the development of early career DOE National Laboratory scientists and engineers. Analogously to the DSSG, an ESSG would invite promising scientists and engineers from the laboratories to form teams collaborating to address and solve key challenges within the DOE mission space. When appropriate, the ESSG teams could expand to include individuals from the private sector, non-profits, and universities to broaden their examination of key technical and socio-economic issues. The ESSG experience would promote innovation and nurture technical leadership for early career investigators from across the laboratory complex. The ESSG would also help to improve cross-laboratory communication and collaboration, thereby increasing productivity and reducing duplication.

The second model program would establish multi-institutional teams composed of individuals from academia, non-profits, the private sector, and the laboratories to address significant problems in DOE mission areas. This model would expand the range of experts familiar with DOE problems and opportunities, increase recruiting operations, and broaden the range of engagement of laboratory scientist and engineers, thus enhancing their leadership potential.

In both cases, laboratory directors should be free to support ESSG related activities should they wish to do so.

[38] Paul Alivisatos, Director of LBNL, drew the TF's attention to the possibilities of the DSSG.

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Appendix A

The Secretary of Energy Advisory Board (SEAB) Task Force on DOE National Laboratories

(found at http://energy.gov/seab/secretary-energy-advisory-board-seab-task-force-doe-national-laboratories)

The Secretary of Energy
Washington, D.C. 20585

June 16, 2014

MEMORANDUM FOR THE CO-CHAIRS
SECRETARY OF ENERGY ADVISORY BOARD

FROM: ERNEST J. MONIZ

SUBJECT: Establishing a Task Force on DOE National Laboratories

I request that you form a Secretary of Energy Advisory Board (SEAB) Task Force on DOE National Laboratories (Labs) to provide advice, guidance, and recommendations on important issues related to improving the health and management of the labs. One of my priorities is to strengthen the relationship between the Department and the National labs and enhance the role of the labs in providing innovative solutions to our mission challenges in basic research, energy, nuclear security, and environmental remediation. I have undertaken a number of actions to reinforce an enterprise-wide view of the National lab system, including:

- Integrating basic research and applied energy programs under a single Under Secretary for Science and Energy who will better coordinate lab R&D activities;
- Initiating a dialog between Departmental and Lab senior leadership through the National Laboratory Policy Council;
- Establishing a Laboratory Operations Board to improve the effectiveness and efficiency of the labs and of the relationships among labs, DOE, and contractors; and
- Incorporating the lab leadership into DOE strategic planning, including launching research initiatives that cut across DOE programs and that may benefit from coordinated lab activity.

The SEAB National Laboratory Task Force has two broad purposes:

First: The Task Force should review past studies, Congressional reports and direction, and Departmental deliberations to identify key areas that have been raised concerning laboratory management and operations.

The Task Force should select a few specific issues for study, where the Secretary of Energy has the authority to make changes, which will improve laboratory performance and efficiency.

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Examples of issues for initial Task Force attention are:

1. Clarifying and/or modifying the character of the M&O contracting system to encourage greater efficiency, mission performance, and morale at the labs utilizing a range of contract vehicles with an emphasis on public service to commercial terms.
2. Clarifying the authority and responsibilities for various laboratory functions among the lab management, Headquarters' program offices, DOE site and field offices, and contractors;
3. Managing Work for Others (Strategic Partnership Programs) in a way that efficiently provides other government agencies needed access to DOE laboratories;
4. Recommending appropriate policies and practices to effectively transfer DOE laboratory technology to the private sector while maintaining a mission focus; and
5. Increasing the effectiveness and setting the level of Laboratory Directed R&D (LDRD) programs for all DOE laboratories.

Second: The Task Force should remain informed about the deliberations of several studies underway at the DOE laboratories, including the Congressionally-mandated, *Commission on the Effectiveness of the DOE National Energy Laboratories*. I am interested in learning SEAB's views about:

1. The findings and recommendations of these studies;
2. Actions that the Department should take to implement such recommendations. (If SEAB believes no action should be taken on a finding or recommendation, it should give an explanation for its view); and
3. A recommended implementation plan for each recommended action.

The Office of the Under Secretary for Science and Energy will support the Task Force's work as needed.

Designated Federal Official: Karen Gibson, Director, Office of Secretarial Boards and Councils

Schedule: The Task Force will submit quarterly reports to SEAB of its progress and submit a final report by December 2015.

Appendix B

The Secretary of Energy Advisory Board (SEAB) Task Force on DOE National Laboratories Membership

- John Deutch, Massachusetts Institute of Technology, Chair*
- Steven Koonin, New York University*
- J. Michael McQuade, United Technologies Corporation*
- Arun Majumdar, Stanford University*
- Carmichael Roberts, Northbridge Venture Partners*
- Martha Schlicher, Monsanto*
- Ram Shenoy, Conoco Phillips*
- Michael Anastasio, Los Alamos and Lawrence Livermore National Laboratories (retired)
- Jennifer Chayes, Microsoft
- James Decker, Decker, Garman, Sullivan LLC
- John Gordon, General USAF (retired)
- Eric Isaacs, University of Chicago
- William Madia, Stanford University
- Robert McGrath, Georgia Institute of Technology
- Peter Ogden, Center for American Progress
- Joan Woodard, Sandia National Laboratories (retired)

*denotes SEAB Member

Resource:

- Daniel Gaspar, Pacific Northwest National Laboratory

Designated Federal Official:

- Karen Gibson, Director, Office of Secretarial Boards and Councils

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Appendix C

List of Contacts Providing Input to the Task Force

Name	Role and Organization
Alexander, Kathleen	Assistant Deputy Administrator, NNSA
Alivisatos, Paul	Director, Lawrence Berkeley National Laboratory
Anderson, Loren	Senior Manager, Technical Affairs and Special Projects, Marcellus Shale Coalition
Arvizu, Dan	Director, National Renewable Energy Laboratory
Baier, Gretchen	Associate R&D Director of External Technology, Dow
Benton, Jeremy	Commercialization Manager, Y-12
Berg, Thomas	Director, Y-12 National Security Complex
Bloom, Paul	Vice President, Process and Chemical Research, Archer Daniel Midland Company
Bosco, Paul	Director, Acquisition and Project Management, DOE
Budil, Kimberly	Vice President for Laboratory Management, University of California
Cantwell, Elizabeth	Director, Mission Development, Lawrence Livermore National Laboratory
Carlson, Curtis	Vice Chairman for Innovation and former CEO, SRI International
Cejka, Cheryl	Director, Technology Development and Outreach, Pacific Northwest National Laboratory
Chalk, Steven	Principal Deputy Assistant Secretary, Energy Efficiency and Renewable Energy, DOE
Conger, Martin	Chief Financial Officer and Associate Director for Business Systems, Pacific Northwest National Laboratory
Cook, Donald	Deputy Administrator for Defense Programs, NNSA
Cotton, Chip	Program Manager, Energy Research and Development, General Electric Global Research
Covey, Debra	Associate Laboratory Director, Ames National Laboratory
D'Agostino, Thomas	Former Administrator, NNSA
Danielson, David	Assistant Secretary, Energy Efficiency and Renewable Energy, DOE
Dehmer, Patricia	Director (Acting), Office of Science, DOE
Elachi, Charles	Director, Jet Propulsion Laboratory
Evans, Eric	Director, Lincoln Laboratories
Farris, William	Associate Laboratory Director, Innovation, Partnering and Outreach, National Renewable Energy Laboratory
Ferraro, Patrick	Deputy Director, Acquisition and Project Management, DOE
Fetcenko, Michael	Vice President and Managing Director, BASF Battery Materials-Ovonic
Fjeldsted, John	Director, Mass Spectrometry Research and Development, Agilent Technologies
Fleener, R. Thomas	Executive Vice President, Chief Financial Officer and Treasurer, MRIGlobal
Francis, David	Senior Vice President, Metal Improvement Company, Inc
Gentry, Lucille	Program Manager, Advanced Simulation and Computing and Institutional Research and Development, NNSA
Gibbs, Doon	Director, Brookhaven National Laboratory
Gioconda, Thomas	Former Acting Deputy Administrator for Defense Programs, NNSA, and Deputy Director, Lawrence Livermore National Laboratory
Goldstein, William	Director, Lawrence Livermore National Laboratory
Gonzales, Manny	Manager, Chevron Energy Technology Company
Graham, Tammy	Manager, Technology Transfer Operations, Y-12

Name	Role and Organization
Grossenbacher, John	Director, Idaho National Laboratory
Hartney, Mark	Director, Office of Strategic Planning, SLAC National Accelerator Laboratory
Hazel, Brian	Staff Materials Engineer, Pratt and Whitney
Hennessy, Mark	Vice President, Business Development, Data Centric Systems, IBM T.J. Watson Research Center
Hoffman, Ron	CaRon Energy Strategies
Hommert, Paul	Director, Sandia National Laboratories
Howanitz, John	General Manager, Nuclear Security & Operations, Bechtel Nuclear, Security & Environmental
Hurd, Merna	Associate Deputy Director for Strategic Operations, Lawrence Livermore National Laboratory
Johnson, Duane	Chief Research Officer, Ames National Laboratory
Kao, Chi-Chang	Director, SLAC National Accelerator Laboratory
Kennedy, Stewart	President, Dry Surface Technologies
Kithil, Philip	Founder, Chairman and Chief Executive Officer, Atmocean
Klara, Scott	Director (Acting), National Energy Technology Laboratory
Kluse, Michael	Director, Pacific Northwest National Laboratory
Knotek, Michael	Deputy Under Secretary for Science and Energy, DOE
Kuhn, Garry	Senior Program Advisor, NNSA
Kumar, Sujeet	Co-Founder and Chief Technology Officer, Envia Systems
Labarge, John	Senior Program Analyst, Laboratory Policy and Evaluation, Office of Science, DOE
Levy, Donald	Vice President for Research and National Laboratories, University of Chicago
Littlewood, Peter	Director, Argonne National Laboratory
Lockyer, Nigel	Director, Fermi National Accelerator Laboratory
MacDougal, James	Senior Manager, Contract Development and Technology Transfer, Air Products
Markovitz, Alison	Director, National Laboratory Operations Board, DOE
Mason, Thom	Director, Oak Ridge National Laboratory
McBranch, Duncan	Chief Technology Officer, Los Alamos National Laboratory
McCarthy, William	Senior Patent Agent, RainDance Technologies, Inc
McMasters, Steven	Director, Technology Deployment, Idaho National Laboratory
McMillan, Charles	Director, Los Alamos National Laboratory
Meisner, Robert	Director, Advanced Simulation and Computing and Institutional Research and Development, NNSA
Meixler, Lewis	Head, Office of Technology Transfer, Patents and Publications, Princeton Plasma Physics Laboratory
Mertz, Landon	Chief Executive Officer, Cerion Advanced Materials
Michalske, Terry	Director, Savannah RNL
Mieher, Walter	Engineer, KLA-Tencor
Montgomery, Hugh	Director, Thomas Jefferson National Accelerator Facility
Morris, Thomas	Vice President, Quality, Hadron Technologies, Inc.
Morrow, Karen	President and Chief Financial Officer, Hadron Technologies, Inc.
Morrow, Stan	Chief Technology Officer, Hadron Technologies, Inc.
Murokh, Alex	Chief Technology Officer, Radiabeam
O'Riley, Mark	Office of the General Counsel, Government and Regulatory Affairs, IBM T.J. Watson Research Center
Peirce, William	Government Collaboration, General Motors
Pesiri, David	Division Leader, Richard P. Feynman Center for Innovation, Los Alamos National Laboratory
Prager, Steward	Director, Princeton Plasma Physics Laboratory
Raines, Robert	Associate Administrator, Acquisition and Supply Management, NNSA
Rankin, Richard	Director, Industrial Partnerships, Lawrence Livermore National Laboratory

Name	Role and Organization
Rasar, Kimberly	Assistant Deputy Under Secretary for Science and Energy, DOE
Reis, Victor	Senior Advisor, DOE
Rosenfield, Michael	Vice President, Data Centric Systems, IBM T.J. Watson Research Center
Ruth, Ronald	Founder and Chairman, Lyncean Technologies, Inc.
Scarcello, Joseph	Chief Financial Officer and Manager, Business Operations, Thomas Jefferson National Accelerator Facility
Schwartz, Adam	Director, Ames National Laboratory
Sexton, James	Program Manager, IBM T.J. Watson Research Center
Shank, Charles	Former Director, Lawrence Berkeley National Laboratory
Shinoff, Josh	Director, Life Sciences Business Development, Bio-Rad Laboratories, Inc.
Snyder, Roger	Manager, Pacific Northwest Site Office, Office of Science, DOE
Stearrett, Barbara	Deputy Director, Acquisition and Supply Management, NNSA
Steen, Eric	Chief Science Officer and Founder, Lygos
Straubel, JB	Founder and Chief Technical Officer, Tesla Motors
Strevel, Nicholas	Manager, First Solar
Sullivan, Kelly	Director, Institutional Science and Technology Investments, Pacific Northwest National Laboratory
Summers, Eric	Vice President and Chief Scientist, ETREMA Products, Inc.
Suski, Gregory	Acting Deputy Director for Science and Technology, Lawrence Livermore National Laboratory
Townsend, Ron	Executive Vice President for Laboratory Operations, Battelle
Valentino, Daniel	Vice President, Global Technology and Innovation, LANDAUER, Inc.
Wade, Douglas	Deputy Director, Advanced Simulation and Computing and Institutional Research and Development, NNSA
Wall, John	Vice President - Chief Technical Officer, Cummins Inc.
Williams, Ellen	Senior Advisor, DOE
Winslow, Matt	Executive Vice President, Business Development, Cerion Advanced Materials
Wong, Jetta	Director, National Laboratory Impact Initiative, Energy Efficiency and Renewable Energy, DOE
Yetter, Christopher	Chief of Staff, Lawrence Berkeley National Laboratory
Zaidi, Ali	Associate Director for Natural Resources, Energy and Science, Office of Management and Budget
Zyuzin, Alex	Director of Research and Business Development, Advanced Cyclotron Systems, Inc.

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Appendix D

Contract, Contractor and Budget Summary for all 17 DOE National Laboratories

National Laboratory	Contractor	Incumbency,[a] Award, and End Dates			Award Term[b]	Partners	FY 2013 Budget, Other Cost,[c] and Fee, all $M			Fee Type[d]
Ames	Iowa State U.	1947	2006	2016	8/7	none	$45	$0	$0.84	$0.5M/$0.3M
Argonne	UChicago Argonne LLC	2006	2006	2016	8/7	Northwestern U. Parsons	$765	[e]	$5.3	Fixed
Brookhaven	Brookhaven Science Associates, LLC	2004	2015	2020	0/15	Battelle, SUNY-Stony Brook	$563	[e]	$7.4	Fixed
Fermilab	Fermi Research Alliance LLC	2007	2007	2016	8/7	U. Chicago, URA, Inc.	$376	$0	$3.9	Var.
Lawrence Berkeley	Regents of the U. Of California	1931	2005	2015	10/5	U. California	$743	$0	$4.5	Var.
Oak Ridge National	UT-Battelle LLC	1999	1999	2020	None	U. Tennessee, Battelle	$1,251	$0	$11.2	Var.
Pacific Northwest	Battelle Memorial Institute	1965	2002	2017	None	none	$967	$3.5	$11.9	Var.
Princeton Plasma Physics	Trustees of Princeton U.	1961	2009	2018	No addl. term	none	$78	$1.6	$1.9	Var.
SLAC National Accelerator Laboratory	Stanford	1962	2012	2017	None	none	$362	$0	$4.9	Var.
Thomas Jefferson Nat. Accel. Fac.	Jefferson Science Associates LLC	2006	2006	2016	7/7	SURA, Inc., Applied Techno-logies LLC	$142	[e]	$3.1	Var.
Idaho	Battelle Energy Alliance LLC	2005	2004	2019	None	EPRI, B&W	$1,129	[e]	$16.0	Var.
Nat. Energy Technology	N/A	N/A	N/A	N/A	N/A	N/A	$655	N/A	N/A	N/A
National Renewable Energy	Alliance for Sustainable Energy	2008	2008	2015	One 40 mo. period	Battelle, Mid-west Research Inst.	$347	[e]	$5.4	Var.
Savannah River	Savannah River Nuclear Solutions LLC	2008	2008	2016	Option to 7/31/ 2018	Newport News Nuclear, Fluor, Honeywell	$209	[e]	$5.9	Var.
Lawrence Livermore	Lawrence Livermore National Security, LLC	2007	2007	2018	4/9	Bechtel, U. California, B&W, URS Corp. Battelle	$1,449	[e]	$39.5	30%/70%
Los Alamos	Los Alamos National Security LLC	2006	2005	2018	5/8	Bechtel, U. California, B&W, URS Corp.	$2,066	[e]	$57.2	30%/70%
Sandia	Sandia Corp.	1993	2003	2016	None	Lockheed Martin	$2,503	$2.8	$28.1	$18M/$9.8M

(a) Incumbency refers to the date when current contractor began managing the laboratory.
(b) Award term refers to additional contract years awarded for excellent contract performance. The two numbers are the number of years earned, and the number of additional years that are available.
(c) Primary source of Other Cost is Home Office cost, i.e., allowable cost paid to LLC or other M&O contractor for services such as, e.g., benefits administration, negotiated as part of the contract. PNNL has the largest amount of Home Office cost; most laboratories have none. Except for PNNL, the budget shown is the maximum allowed by the contract; actual costs may be lower.
(d) Where two numbers (either fee amounts or percentages) are shown, the first number is the fixed portion of the fee, and the second number is the variable component of the fee. For example, $0.5M/$0.3M indicates $0.5M fee is fixed, and the variable fee is $0.3M.
(e) data not obtained by TF.

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Appendix E

Laboratory Policy Council Charter

Department of Energy
Washington, DC 20585

U.S. Department of Energy
National Laboratory Policy Council Charter

Objectives and Scope of Activities

The Department of Energy (DOE) National Laboratories are engaged in a broad program of scientific research and technological innovation supporting the Department's mission responsibilities in energy, nuclear security, science and environmental management.

The National Laboratory Policy Council will provide a forum for the National Laboratories to provide strategic advice and assistance to the Secretary in the Department's policy and program planning processes and for the Department to provide strategic guidance on National Laboratory activities in support of Departmental missions.

The scope of the Council shall include, but not be limited to, discussion of policies and strategies for:

- Advancing new research directions;
- Building human capacity;
- Supplying frontier research facilities for the U.S. research community;
- Supporting technology transfer;
- Improving communication with the public and other stakeholders;
- Enhancing the role of the national laboratories in addressing national priorities, such as nuclear security; and
- Providing strategic direction to the National Laboratory Operations Board.

The Council membership may raise additional issues for discussion, subject to approval by the Chair.

Membership

The National Laboratory Policy Council will include the following members:

- Secretary of Energy (Chair)
- Deputy Secretary
- Under Secretary for Management and Performance
- Under Secretary for Nuclear Security
- Under Secretary for Science and Energy
- Associate Deputy Secretary
- Director of the Office of Science
- Assistant Secretary for Energy Efficiency and Renewable Energy

- Assistant Secretary for Environmental Management
- Assistant Secretary for Nuclear Energy
- Assistant Secretary for Fossil Energy
- Deputy Administrator for Defense Programs
- Four National Laboratory Directors, as described below

The following Departmental offices will participate in activities of the Council as appropriate:

- Senior Advisors in the Office of the Secretary
- Assistant Secretary for Electricity Delivery and Energy Reliability
- Director of the Office of Energy Policy and Systems Analysis
- Director of the Advanced Research Projects Agency – Energy
- Chief Financial Officer
- General Counsel
- Assistant Secretary for Congressional and Intergovernmental Affairs
- Deputy Administrator for Defense Nuclear Nonproliferation
- Director of Intelligence and Counter Intelligence

The group of four Directors of the National Laboratories shall be nominated by the National Laboratory Directors Council and shall be able to represent activities across all DOE missions. The Chair may request broader participation, depending upon the topic or activity.

Frequency of Meetings

The Council will meet three times a year or as required by the Chair.

Operations

The Office of Secretarial Boards and Councils will provide a designee to serve as Executive Director to the Council. With guidance from the Office of the Secretary, the Office of Secretarial Boards and Councils will be responsible for ensuring that issues brought before the Council are properly analyzed and recommendations are formed for Federal employee decision and communication as appropriate.

The Council may seek advice from senior representatives from other elements of the U.S. Government and from experts outside the U.S. Government, in a manner consistent with applicable law. Any members of the Council will be employed by either the Federal government or a DOE management and operating contractor.

Effective Date: OCT 24 2013

Appendix F

Questions Posed to Industry Representatives Interviewed by the TF

1. In the context of broad engagement with the NLs, what value do you think the Lab can provide you?
2. What are the most effective ways to create this value (joint technology development; facility use; IP development and licensing; personnel transfer)?
3. Are the current mechanisms (CRADA, WFOs, ACT; IP Licensing) adequate?
4. What are the key barriers in effective engagement with the national laboratories?
5. How do (or should) you measure the value (follow-on funding; number of company personnel engaged and supported; technical know-how generated; IP generated and licensed/used)?
6. How could incentives be better aligned (internally in the Lab, in DOE and in the company) to make engagement with the national laboratories significantly more productive and valuable?

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Appendix G

Datasets Analyzed by the Task Force

G.1 Total budgets for all 17 NLs from FY 2008 to FY 2013, including DOE appropriations, federal WFOs and non-federal WFOs.

G.2 CRADA Funds-In, i.e., funding provided by industry to the laboratory as part of a CRADA agreement and Non-federal WFO funds for each Laboratory for FY 2008-FY 2013.

G.3 Patents and income-bearing licenses for each year from FY 2009-FY 2013 for each DOE National Laboratory.

G.4 Total royalties and royalties scaled by laboratory budget over the years FY 2008-FY 2013, and percentage of royalty revenue used to engage with industry.

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Appendix H

LDRD Projects and Funding for Each DOE National Laboratory for FY 2014

Excerpted from the annual LDRD report found at http://energy.gov/cfo/downloads/fy-2014-ldrd-report.

Table H.1. FY 2014 Overall Laboratory Costs and LDRD Costs at DOE National Laboratories

DOE National Laboratory	Number of LDRD Projects	LDRD Certified Costs ($M)	Total Laboratory Certified Cost Base ($M)	LDRD as a Percentage of Certified Cost Base
Ames Laboratory	9	1.0	**53.0**	1.89
Argonne National Laboratory	107	29.2	**753.6**	3.87
Brookhaven National Laboratory	40	9.6	**566.1**	1.70
Fermi National Accelerator Laboratory	7	0.2	**324.1**	0.06
Idaho National Laboratory	69	17.0	**827.7**	2.05
Lawrence Berkeley National Laboratory	83	23.6	**751.7**	3.14
Lawrence Livermore National Laboratory	147	78.2	**1,411.7**	5.54
Los Alamos National Laboratory	290	118.5	**2,068.0**	5.73
National Renewable National Laboratory	57	10.3	**356.3**	2.89
Oak Ridge National Laboratory	174	36.3	**1,231.8**	2.95
Pacific Northwest National Laboratory	182	38.9	**982.2**	3.96
Princeton Plasma Physics Laboratory	15	2.0	**102.0**	1.96
Sandia National Laboratories	419	151.3	**2,686.3**	5.63
Savannah River National Laboratory	40	6.2	**188.4**	3.29
SLAC National Accelerator Laboratory	20	4.4	**283.7**	1.55
Thomas Jefferson National Accelerator Facility	3	0.2	**107.9**	0.19
Total	**1,662**	**526.9**	**12,694.5**	**4.15**