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A Study of Facilities and Infrastructure Planning, Prioritization, and Assessment at Federal Security Laboratories (Revised)

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Executive Summary

The Office of Science and Technology Policy asked the IDA Science and Technology Policy Institute (STPI) to collect information on the state of planning, prioritization, and assessment of facilities and infrastructure (F&I) at a set of Federal laboratories that conduct national security research and development. These laboratories—referred to in this report as "Federal security laboratories"—advance the state of science and technology for military purposes, civil defense, emergency preparedness, intelligence services, and nuclear stockpile maintenance. Aging and deteriorating F&I of Federal security laboratories threaten their ability to successfully complete their national security missions.

Study Approach

The STPI study team used multiple methods to document the planning, prioritization, and assessment of F&I at Federal security laboratories. The team reviewed relevant government documents; had discussions with F&I staff from laboratories, Federal agencies, and architectural and engineering firms; and convened a workshop with national security and F&I experts.

Little formal literature was available on this topic, so the team reviewed government documents, primarily from the Government Accountability Office, the National Research Council, and the agencies and laboratories being studied.

The team talked to nearly 100 individuals from four groups:

- F&I staff at 10 Department of Defense (DOD), Department of Energy (DOE), and Department of Homeland Security (DHS) laboratories that conduct national security research
- F&I staff at the DOD (including Army, Navy, and Air Force headquarters), the DOE Office of Science and National Nuclear Security Administration, and the DHS
- Staff at 3 DOE laboratories that have experience with alternative financing mechanisms (Oak Ridge National Laboratory, Pacific Northwest National Laboratory, and Y-12 National Security Complex)
- Staff at 5 architectural and engineering firms that provide F&I planning and implementation guidance at several Federal laboratories

After most of the discussions with laboratories and agencies were completed, the study team convened a workshop to bring together 50 experts in national security and F&I. These experts included staff from the Federal laboratories and agencies in this study and from other U.S. Government offices and agencies; management and operations contractors; and consulting, legal, and architectural and engineering firms. The purpose of the workshop was to broaden the scope of input for the study; to confirm findings from the discussions with laboratories; and to document additional findings, challenges, and strategies not uncovered during the laboratory and agency discussions.

Findings

This study identified four areas critical to Federal security laboratories F&I planning, prioritization, and assessment: planning processes, prioritization criteria, stakeholder involvement and communication, and data and metrics. The subsections that follow describe these four areas and the challenges that laboratories and agencies identified in each area. The strategies that some laboratories and agencies have implemented to overcome these challenges in each area are summarized in the table on the next page. The four areas overlap, as one would expect, and are not mutually exclusive.

Planning Processes

A primary challenge that F&I staff face in the planning process is a lack of agency and laboratory leadership support in defending the need for maintaining, upgrading, and constructing F&I. This lack of support results in the absence of an integrated agency plan to address long-term F&I needs across the agency and the national security enterprise. Also, annual budget decisions and F&I reporting requirements are not linked with a strategic vision and investment strategy. The challenge of connecting short- and long-term plans is exacerbated by a lack of trained F&I support staff necessary for effective master planning and efficient use of innovative alternative financing mechanisms. DOD laboratory staff members face the additional constraint of their F&I needs being prioritized against other types of F&I and other military needs, such as schools, hospitals, and barracks. Depending on their governance structure and location, DOD Federally Funded Research and Development Centers (FFRDCs) and University Affiliated Research Centers (UARCs) must also meet requirements and seek financing from the military installations or university campuses on which they are located. Laboratories from all agencies in the study have encountered barriers to using alternative financing mechanisms for F&I projects.

Examples of strategies used to address these planning challenges include leveraging resources through partnerships, setting aside funding for large F&I projects specifically for laboratories in the agency's annual budget, developing F&I master plans, and using a combination of in-house capability and external architectural and engineering firm expertise. Some DOE and DOD laboratories have successfully facilitated cross-agency

and laboratory participation in F&I investment decisions to use alternative financing mechanisms, such as third-party operating leases. However, in recent years, agencies and the Office of Management and Budget have not approved this particular type of financing.

Summary of Strategies for Improving Planning, Prioritization, and Assessment of Facilities and Infrastructure at Federal Security Laboratories

Area	Strategies
Planning Processes	Agency and laboratory leadership champions F&I needs and facilitates cross-agency and laboratory participation
	Agencies simplify F&I planning and operations by collocating their F&I
	Agencies set aside funding for F&I projects in the annual budget
	Laboratories develop an F&I master planning and investment framework
	Laboratories develop and use internal and external expertise in F&I master planning
	Laboratories use alternative financing mechanisms
Prioritization Criteria	Laboratories use data-driven and qualitative methods to evaluate criteria
	Agencies involve laboratory representatives in developing new criteria
	Agencies assign weights to prioritization criteria
	Laboratories use prioritization frameworks to help align criteria to mission goals
Stakeholder Involvement and Communication	Agencies coordinate with laboratories and guide the development of a clear, strategic vision
	Laboratories and agencies develop communities of practice through formal and informal meetings
	Laboratory F&I managers interact with researchers to ensure optimal planning and implementation of F&I and equipment
	Laboratories establish timely mechanisms to communicate with F&I-related stakeholders
	Laboratory management and operations contractors regularly and cooperatively engage with the site office
Data and Metrics	Laboratories and agencies provide high-level guidance on the importance of regularly collecting and updating data and metrics
	Agencies use long-term modeling tools for scheduling maintenance and assessment
	Laboratories and agencies engage in benchmarking or other data-sharing efforts
	Laboratories and agencies use integrated metrics

Prioritization Criteria

Federal security laboratories prioritize their F&I plans using a set of criteria based on impact on mission, health and safety, security, environmental compliance and zoning, energy usage and sustainability, costs and building conditions, and resource leveraging within and across laboratories. These criteria are assessed using metrics to track progress. However, laboratory F&I staff are often not included in developing agency-level prioritization criteria and metrics. As a result, the criteria and metrics used at the agency level may not fully capture the F&I impact relative to the agency's mission.

To address the challenges this incompatibility imposes, some agencies include laboratory representatives in developing the prioritization criteria and assess F&I projects in a participatory manner. They also create prioritization frameworks that meet specific needs and focus the dialogue on F&I investments, such as using a decision-gated process or assigning weights to different priorities, with generally the highest weight given to mission deliverables.

Stakeholder Involvement and Communication

Multiple stakeholders are involved in laboratory F&I planning and prioritization. In addition to the F&I planning staff, they include Federal research staff, private research customers, architectural and engineering firms, State and local governments, Congress and congressional committees, the Office of Management and Budget, agency working groups involved in environmental and safety monitoring and regulations, and local communities. The major challenges seem to be a lack of communication among all stakeholders and a need to understand the F&I portfolio within the agency enterprise. These challenges may be due in part to the laboratories' competing interests and their hesitation to share information. They could also be caused by the lack of a formal community of practice to bring stakeholders together to discuss challenges, share strategies, and leverage resources.

To address these communication challenges, agencies and laboratories have established inclusive F&I decision-making processes, interagency councils, coordinating committees, and communities of practice, such as the Energy Facility Contractors Group created by the DOE's management and operations contractors, which includes F&I agency and industry representatives.

Data and Metrics

Laboratories and agencies collect and use F&I data to assess the condition of assets, model future needs, and benchmark F&I at individual sites as well as across an agency's laboratory enterprise. F&I metrics provide a measure of the condition and use of F&I, the value and costs of maintenance and replacement needs, the relationship between an asset and its mission, and the environmental sustainability of the laboratory site.

Among the challenges to collecting F&I data and producing consistent metrics over time are that assessments are expensive, time-consuming, irregularly conducted. Further, at least for DOD laboratories, assessments may be performed by supporting organizations external to the laboratory. Data are entered annually for agency-level reporting requirements but otherwise are not updated, which make the data unreliable for use in daily laboratory management. In addition, some agencies and laboratories validate F&I data every few years or use estimates for data between years in which inspections are performed. Another challenge is that laboratory staff may hesitate to share their data with

each other for the purpose of benchmarking because they believe it could put them at a disadvantage when competing for F&I funds or customers. Additionally, creating an inclusive metric that describes whether an asset is sufficient to meet the laboratory or agency mission or to assess the impact of an asset's condition on the mission is difficult; it requires rigorous analysis of the research program and its outcomes in addition to data and metrics collection.

Strategies used to address these challenges include providing high-level guidance to define, collect, and maintain metrics; standardizing metrics and data elements across laboratories; and engaging in benchmarking and other data-sharing efforts. For example, the DOE's Office of Science has a Mission Readiness Peer Review Process where laboratory staff members review each other's F&I strategic and decision-making processes. At the DOD, some laboratories use or are beginning to use an F&I database management system called BUILDER to model long-term work requirements for maintenance, repair, and replacement and to compute metrics to justify annual budget requests.

Next Steps

The study team proposes the following five broad recommendations for laboratories and agencies:

1. Participate in an interagency forum for sharing best practices (presupposing the creation of such a forum)
2. Facilitate facility and infrastructure planning processes and funding
3. Establish standard criteria and methods to prioritize facility and infrastructure investments
4. Expand opportunities to involve stakeholders and improve communications
5. Improve collection, quality, and use of data and metrics

These recommendations are based on the strategies already adopted by some laboratories and on the suggestions provided by the workshop participants and interviewees. Together, they constitute a plan for executive action. Adoption of the recommendations would enhance current planning, prioritization, and assessment practices for Federal security laboratory F&I.

Federal security laboratories already effectively use a variety of F&I planning, prioritization, and assessment processes; however, standardization could improve understanding and sharing of successful strategies. Agencies and laboratories must make their cases for F&I investments based on criticality of need. At the same time, guidance and resources from the executive-level leadership of the Federal Government would provide the impetus needed to enhance current practices.

Contents

1. Introduction

Federal laboratories of the Department of Defense (DOD), Department of Energy (DOE), and Department of Homeland Security (DHS) are integral to the science and technology enterprise and the national and homeland security missions of the United States. The facilities and infrastructure (F&I) of these "Federal security laboratories"[1]—the buildings and other structures where science and technology research and development take place—are critical to carrying out these missions.[2] The Federal security laboratory system comprises thousands of buildings and other structures, some which are operating in facilities not originally built as a laboratory and many of which are decades old and have not been refurbished or replaced by new buildings. Aging and deteriorating Federal security laboratory facilities and infrastructure threaten the ability of Federal agencies to successfully complete their national security missions (National Research Council (NRC) 2004a; Decker et al. 2012; Defense Science Board (DSB) 1994; Naval Research Advisory Committee (NRAC) 2010). Maintaining and constructing F&I will ensure that mission-critical capabilities are sustained to support the next generation of scientists and engineers to carry out Federal laboratory and agency missions.

A. Purpose

Against this backdrop, the Office of Science and Technology Policy asked the IDA Science and Technology Policy Institute (STPI) to undertake a pilot study to better understand F&I planning, prioritization, and assessment at selected Federal laboratories with national security missions. This study provides a descriptive snapshot of these activities at a small number of Federal security laboratories. Expanding this pilot to include additional laboratories would provide a more complete understanding of the broader science and technology laboratory enterprise.

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[1] DOE laboratories are generally known as the "national laboratories," DOD laboratories are generally known as "defense laboratories" or "service laboratories," and NNSA laboratories are generally known as "national security laboratories." Therefore, we use the broader term "Federal security laboratories" to encompass all the agencies' laboratories with a national security mission.

[2] The term "facility" is also used to describe large-scale scientific user facilities and instruments where an entire facility is the instrument, such as synchrotron light sources, which are not the focus of this study. We also do not address F&I supporting equipment, such as utilities, in this report.

B. Approach

The STPI study team reviewed relevant literature and Federal program documents, interviewed staff at 10 Federal laboratories and agencies, and convened a workshop attended by national security and F&I experts in the Federal Government and the private sector.

The research focused on the following themes:

- *Funding sources*: What are typical funding sources, and how are alternative finance mechanisms used?
- *Planning and prioritization*: How are F&I investment decisions planned and prioritized, and who is involved in the process?
- *Stakeholder involvement and communication*: How do stakeholders communicate, and how is stakeholder input integrated into the F&I planning process at the laboratories and agencies?
- *Data and metrics*: How are F&I needs assessed, what data and methods are used, and how do assessments inform investment decisions?

The 10 Federal security laboratories in this pilot study represent a mix of agencies and management structures. They include five Federally Funded Research and Development Centers (FFRDCs),[3] one University Affiliated Research Center (UARC),[4] and four Government-Owned, Government-Operated (GOGO) organizations. Of the laboratories chosen, six are operated by the DOD; three, by the DOE; and one, by the DHS. Table 1 lists the Federal laboratories examined in this study.

The primary mode of gathering information was through discussions with F&I personnel at Federal agencies and laboratories. Team members also spoke to other F&I stakeholders, including those at private architectural and engineering firms that facilitate planning and conduct studies of Federal, academic, and private sector laboratories. The team conducted follow-up discussions with laboratory personnel that had experience with alternative financing mechanisms.

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[3] The National Science Foundation maintains a master list of FFRDCs and provides an extensive definition of FFRDCs, referencing the recent update to the Federal Acquisition Regulations criteria for FFRDCs (35.017 (a). The definition reads in part (http://www.nsf.gov/statistics/ffrdclist/gennotes.cfm):

> An FFRDC meets some special long-term research or development need which cannot be met as effectively by existing in-house or contractor resources. FFRDCs enable agencies to use private sector resources to accomplish tasks that are integral to the mission and operation of the sponsoring agency. An FFRDC, in order to discharge its responsibilities to the sponsoring agency, has access, beyond that which is common to the normal contractual relationship, to Government and supplier data, including sensitive and proprietary data, and to employees and installations equipment and real property.

[4] A UARC provides or maintains engineering, research, or development capabilities essential to the DOD (DOD 2010a).

Table 1. Federal Laboratories in Pilot Study

Agency	Laboratory	Abbreviation	Subagency Managing Contractor	Type
DOD	Air Force Research Laboratory	AFRL	Air Force	GOGO
DOD	Army Medical Research Institute for infectious Diseases	AMRIID	Army	GOGO
DOD	Army Research Laboratory	ARL	Army	GOGO
DOD	Johns Hopkins University Applied Physics Laboratory	JHU-APL	Navy—Johns Hopkins University	UARC
DOD	Massachusetts Institute of Technology Lincoln Laboratory	MIT-LL	Air Force—MIT	FFRDC
DOD	Naval Research Laboratory	NRL	Navy	GOGO
DOE	Brookhaven National Laboratory	BNL	Office of Science—Brookhaven Science Associates*	FFRDC
DOE	Los Alamos National Laboratory	LANL	NNSA—Los Alamos National Security, LLC^	FFRDC
DOE	Sandia National Laboratories	Sandia	NNSA—Sandia Corporation#	FFRDC
DHS	National Biodefense Analysis and Countermeasures Center	NBACC	Science and Technology Directorate/Office of National Laboratories—Battelle National Biodefense Institute, LLC+	FFRDC

* Brookhaven Science Associates is a partnership between Battelle and the Research Foundation of State University of New York/Stony Brook University; see http://www.bnl.gov/bnlweb/admin/bsa.asp.

^ Los Alamos National Security is a partnership between Bechtel National, Inc. (BNI), the University of California, BWX Technologies, and Washington Group International; see http://www.lanl.gov/organization.

Sandia Corporation is a subsidiary of the Lockheed Martin Corporation; see http://www.sandia.gov/about/index.html.

+ Battelle National Biodefense Institute is a subsidiary of Battelle; see http://www.battelle.org/aboutus/locations_a/index.aspx.

Appendix A lists the agencies, offices, and other organizations included in the discussions. During these discussions, individuals were asked to answer questions from the structured discussion guide presented in Appendix B. A review of U.S. literature on Federal F&I informed the development of the discussion guide. Answers were based on individuals' experiences with F&I planning, prioritization, and assessment; they do not represent the official viewpoints of the individuals' organizations.

Most Federal F&I literature consists of papers or reports produced by government agencies and other organizations. None of the government-wide studies of the last decade in the literature review specifically focused on national security science and technology F&I. Reports by the Government Accountability Office (GAO), formerly the General Accounting Office, that look across Federal F&I have explored the Federal Real Property inventory managed by the General Services Administration and associated data issues (GAO 2003b, 2007). Several National Research Council (NRC) studies of asset management strategies have included performance models, metrics, life-cycle

assessments, and sustainability best practices (NRC 2004b, 2005, 2008, 2011a, 2011b). One government-wide analysis of the disposal of excess facilities has been performed (GAO 2009), as have several agency- or laboratory-specific reports for F&I at the DOE (NRC 2004a; GAO 2003c; GAO 2011c), the DOD (GAO 2008b, 2011b, 2011a), and the DHS (Shea 2006). In addition, the study team reviewed several open-source and internal program documents and data provided by the individuals in the discussions.

From this information, we synthesized recommendations to improve F&I planning, prioritization, and assessment. In February 2012, the STPI study team convened a workshop of 50 individuals, representing a cross-section of F&I experts from Federal agencies and laboratories and industry (primarily architectural and engineering firms) to discuss and vote on these recommendations. The recommendations synthesized from this workshop were an important source of the study's final recommendations.

C. Report Structure

The remainder of the report is organized as follows.

- Chapter 2 describes the typical funding framework for F&I and the known alternative mechanisms for financing F&I investment decisions.
- Chapters 3 through 6 cover the four main themes of our research: planning processes, prioritization criteria, stakeholder involvement and communication, and data and metrics. Each chapter begins with a description of the topic and then highlights particular challenges before exploring the strategies for improvement that emerged during discussions.
- Chapter 7 describes the workshop the STPI study team convened to discuss mechanisms to improve F&I prioritization, planning, and assessment. It also presents the results of the participants' voting on recommendations derived from the study team's discussions with Federal agencies and laboratory staff.
- Chapter 8 provides a summary of findings and proposes next steps.

Ancillary information is provided in the following appendixes:

- Appendix A lists the agencies, laboratories, and stakeholders included in discussions.
- Appendix B provides the guide used for the discussions.
- Appendix C summarizes planning guidance, processes, prioritization criteria, stakeholders, use of alternative financing mechanisms, types of data collected and trends in F&I data over time for each of the 10 Federal security study laboratories.
- Appendix D presents selected private sector F&I planning frameworks and models.
- Appendix E summarizes key legislation and regulations related to Federal laboratory F&I.
- Appendix F lists the workshop participants and their affiliated organizations.

2. Funding Framework

A variety of funding mechanisms are used to plan and prioritize future and existing F&I assets, with notable differences among the DOD, DOE, and DHS.

A. Funding Program Descriptions

Both overhead accounts and capital appropriations are used to fund F&I projects. For the Operations and Maintenance (O&M) of existing assets, each Federal laboratory research department or program receives a percentage of the program's total operating budget or charges a fee based on square footage to each program conducting research at the laboratory. Among the pilot laboratories, the percentage of the fee ranges from 2 to 9 percent. More detailed descriptions of selected funding streams follow.

1. Department of Defense Funding

Within the DOD, the military departments use the military construction (MILCON) program and the Defense Health Program to plan for capital acquisition and construction of future assets. Congressional budget line items or "earmarks" are also used to periodically fund construction of buildings for DOD laboratories, but these mechanisms have recently been in decline.[5] The Defense Base Closure and Realignment Commission (both the commission and actions taken as a result of the commission's recommendations are referred to as BRAC) process has played a significant role in funding new assets. Laboratory directors revitalize and recapitalize facilities primarily through the Laboratory Revitalization Demonstration Program (LRDP) or through discretionary funding provided under Section 219 of the National Defense Authorization Act for Fiscal Year 2009. These authorities were extended in the FY12 NDAA. Table 2 provides a summary of these and other funding mechanisms for F&I at the DOD laboratories.

[5] A line item is a separate line in the budget for a specific purpose. According to the Office of Management and Budget (OMB), an earmark is funding with attendant "congressional direction…that curtails the ability of the executive branch to manage its statutory and constitutional responsibilities pertaining to the funds allocation process" (http://earmarks.omb.gov/earmarks-public/).

Table 2. Department of Defense Facilities and Infrastructure Funding Framework

Authorization Account	Description
Military Construction (MILCON) and Medical MILCON Program/Defense Health Program	MILCON programming is the process of acquiring both the authority and resources necessary to meet facility requirements identified by the planning process. A construction project with an estimated cost greater than $750,000 with no limit. Projects are funded over a 5-year appropriation period.
MILCON Unspecified Minor Construction and Medical Unspecified Minor Construction/Defense Health Program	Unspecified Minor Construction projects are funded at a cost equal to or less than $2 million, or equal to or less than $3 million for life, health, or safety-threatening deficiencies.*
Capital Investment Decision Model for Defense Medical F&I	Capital Investment Decision Model allows TRICARE to consider enterprise-wide goals and allocate the total Medical MILCON funding *across* military departments. Representatives from each of the military facilities and medical departments serve on the Capital Investment Review Board and review, score, and negotiate funding for proposed projects.
Congressional Earmarks and Congressional Inserts	Congressional earmarks are obligations directed by Congress of money already programmed for DOD use (e.g., they tell the Services how to spend the money they already have) and can occur in both MILCON and O&M. Congressional inserts are funds for specific projects within the Service's Future Years Defense Plan and supported by the congressional committees for inclusion into the National Defense Authorization Act and the DOD Budget.
Defense Base Closure and Realignment Commission (BRAC)	The goal of the BRAC process is to reduce excess facilities and consolidate missions throughout the DOD. The BRAC has been a significant source of funding for F&I investments.
Section 219	Section 219 of the National Defense Authorization Act for Fiscal Year 2009 authorizes laboratory directors to use up to 3% of the laboratory's budget towards revitalizing and recapitalizing F&I.
Laboratory Revitalization Demonstration Program (LRDP)	LRDP authorizes, via 10 USC § 2805, the use of both O&M appropriations for unspecified minor military construction projects costing less than $2M or appropriations available for military construction not otherwise authorized by law or funds authorized under Section 219(a) for projects costing no more than $4M.
Research, Development, Test, and Evaluation (RDT&E) Appropriations	The RDT&E appropriation consists of the mission program budgets for all research, development, test and evaluation work performed by contractors and government installations and includes an installations and activities budget used to support the operation of research and development facilities. RDT&E funds are two year appropriations and may be used for repair and minor construction costing $750,000 or less, unless otherwise authorized by Congress (e.g., LRDP).
Lab manager-supported F&I financing	FFRDCs and UARCs compete for DOD funding, but UARCs are not eligible for MILCON funding. They also compete for funding and finance projects through their managers (e.g., Massachusetts Institute of Technology for Lincoln Laboratory and Johns Hopkins University for Applied Physics Laboratory).

* This is MILCON 3300 appropriations and is sometimes referred to as P-341. Unspecified Minor Construction projects are typically repairs that are too urgent to wait to be funded through the regular MILCON budget cycle, and are limited to no more than $2 million per site. The limit is raised to $3 million to correct a life, health, or safety-threatening deficiency.

a. Military Construction Programs

MILCON appropriations fund construction across the DOD enterprise. This includes a diverse range of buildings, such as barracks, hospitals, piers, laboratory F&I, roads, and utility systems. MILCON projects must be estimated to cost more than $750,000.

b. Medical Military Construction Program

MILCON projects for defense medical facilities, such as the Army's Medical Research Institute of Infectious Diseases (AMRIID), which is managed by the Medical Command (MEDCOM), receive a separate funding stream through the Defense Health Program. The planning and prioritization process is managed by the Office of the Assistant Secretary of Defense for Health Affairs.

c. Congressional Inserts and Congressional Earmarks

An important note regarding the MILCON program is that funding may be influenced by congressional inserts and congressional earmarks, which do not go through the formal MILCON prioritization process. Previous DOD budgets have included congressional inserts, which are MILCON requirements that have been authorized by Congress after the DOD has budgeted funds for a given fiscal year. Congress can also designate earmarks, directing the Services to obligate funds already programmed to fund specific projects in any agency's budget. In the case of the DOD, this is generally under the purview of the MILCON program, but can happen within the O&M program. Both the Senate and the House placed a moratorium on congressional earmarks in 2011 (U.S. Senate Committee on Appropriations 2011; Cowan 2012); however, some evidence indicates that earmarks have not been completely eliminated (Nixon 2012).

d. Defense Base Closure and Realignment Commission

The BRAC process has been a significant driving force, and a source of funding, for F&I investments. The goal of the BRAC is to reduce excess facilities and consolidate missions throughout the DOD. The first BRAC round occurred in 1989 and there have been four subsequent iterations, the most recent of which occurred in 2005. Sites receive BRAC funding to accommodate increased facility requirements as a result of facility closures or consolidation of missions. The BRAC has had a significant impact on the facilities of all the military laboratory systems. Two examples follow:

- BRAC 2005 consolidated the Air Force laboratories into multiple sites with its main facilities headquartered at Wright-Patterson Air Force Base (Blackhurst

2007). The Air Force Research Laboratory (AFRL) received approximately $350 million to execute this process.[6]

- The Army developed the concept of using the Army Research Laboratory (ARL) as a centralized corporate laboratory in the wake of the Army's 1989 BRAC closure of the Army Material Technology Laboratory in Watertown, Massachusetts. Army science and technology capabilities are now centered at two primary locations at Aberdeen and Adelphi, both in Maryland.

Although the BRAC provides funding for construction of new buildings, it does not provide funding for specialized equipment and other non-real property upgrades to existing buildings necessary to support the research program that will be transferred.

e. Section 219 Unspecified Minor Construction Authority and the Laboratory Revitalization Demonstration Program

Section 219 of the Duncan Hunter National Defense Authorization Act for FY 2009 (Public Law 110-417) allows laboratory directors to use up to 3 percent of the laboratory's budget at their discretion for a variety of purposes including revitalizing and recapitalizing F&I. At ARL, approximately half of the Section 219 authority funding is spent on F&I (about $15 million of the $30 million total).

Other F&I funds derive from LRDP. Revised in 2010, the LRDP authorizes the use of both O&M and Section 219 funds for unspecified minor construction.[7] Funding can support projects up to $2 million using O&M funds and up to $4 million per project using the Section 219 authority.

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[6] BRAC 2005 consolidated major portions of the Human Effectiveness Directorate moving from Brooks City-Base, TX, and Mesa Research Site, AZ, to Wright-Patterson AFB, OH. The laser and radiofrequency bioeffects efforts of the Bioeffects Division were moved to Fort Sam Houston in San Antonio, TX. BRAC 2005 also consolidated all of the Sensors Directorate, a division moving from Hanscom AFB, MA, to Wright-Patterson AFB, OH. The Space Vehicles division moved from Hanscom AFB, MA, to Kirtland AFB, NM, and the Information Directorate moved from Wright-Patterson AFB, OH, to Rome Research Site, NY. According to communication from Wayne Myers of AFRL, the laboratory received approximately $665 million to execute these moves. Funding was provided through MILCON, personnel, and equipment, among other programs.

[7] The language from Title 10 USC § 2805(d) is as follows:

(d) Laboratory Revitalization.—

(1) For the revitalization and recapitalization of laboratories owned by the United States and under the jurisdiction of the Secretary concerned, the Secretary concerned may obligate and expend—

(A) from appropriations available to the Secretary concerned for operation and maintenance, amounts necessary to carry out an unspecified minor military construction project costing not more than $2,000,000; or

(B) from appropriations available to the Secretary concerned for military construction not otherwise authorized by law or from funds authorized to be made available under section 219(a) of the Duncan Hunter National Defense Authorization Act for Fiscal Year 2009 (Public Law 110–417; 10 USC § 2358 note), amounts necessary to carry out an unspecified minor military construction project costing not more than $4,000,000.

f. Research, Development, Test, and Evaluation Appropriations

The Research, Development, Test, and Evaluation (RDT&E) appropriation consists of the mission program budgets for all research, development, test and evaluation work performed by contractors and government installations. The RDT&E appropriation includes an installations and activities budget used to support the operation of research and development facilities. RDT&E funds are 2-year appropriations and may be used for repair and minor construction costing $750,000 or less, unless otherwise authorized by Congress, such as for the LRDP program.

g. Federally Funded Research and Development Centers and University Affiliated Research Centers

Although FFRDCs, such as the Massachusetts Institute of Technology Lincoln Laboratory (MIT-LL), also compete for MILCON program funding, they are largely unsuccessful. MIT-LL received MILCON funding for one project in the last 15 years. Defense FFRDCs are highly dependent on their managers for financing F&I investments and must compete with the overall investment portfolio at their respective management entity or university.

The principal funding mechanism for UARCs, such as Johns Hopkins University Applied Research Laboratory (JHU-APL), is substantially different from government labs and FFRDCs since they tax their income stream to generate F&I construction, renewal, and maintenance funds. They manage the tax rate and the resulting investments akin to a business venture so that they remain affordable and competitive. JHU-APL noted that this difference in funding enables UARCs to respond quickly to their sponsor's needs. Yet, they also recognized that large, targeted congressional investments can create and maintain certain types of facilities (e.g., large or multi-user facilities).

2. Department of Energy Funding

The DOE laboratories in this study are overseen by the DOE Office of Science (DOE-SC) and the National Nuclear Security Administration (NNSA). They are FFRDCs managed by a third party under management and operations contracts. The DOE-SC and NNSA have similar funding frameworks, though the NNSA established two additional programs to support F&I.

a. Office of Science Laboratory Programs

In fiscal year 2010, approximately 38 percent of DOE-SC's $4.9 billion budget funded F&I operations and 14 percent funded construction (U.S. House of Representatives 2012). DOE-SC distinguishes three types of F&I funding:

- Projects under $10 million are categorized as General Plant Projects (GPPs) and Institutional General Plant Projects (IGPPs). GPPs are funded by research

program funding and are generally new construction projects. IGPPs are funded through an overhead charge on all research programs.[8]

- Projects over $10 million are designated as Science Laboratories Infrastructure line item projects.
- Funding for construction and operation of user facilities is provided by the six DOE-SC research programs. For example, the Basic Energy Sciences program typically funds user facilities across the DOE-SC laboratories in the annual range of $50 million to $150 million. In fiscal year 2012, $151 million (approximately 9 percent) of the Basic Energy Sciences program budget funded new construction for large-scale scientific user facilities (all funding was provided to the National Synchrotron Light Source at Brookhaven National Laboratory) (DOE 2012c). National, large-scale scientific user facilities[9] are open to all scientific users without regard to nationality or institutional affiliation, and no user fees are charged for non-proprietary research (DOE 2012b).

b. NNSA Laboratory Programs

The NNSA laboratories also receive GPPs, IGPPs, and congressional line items through the Readiness in Technical Base and Facilities program. These projects have monetary thresholds that are similar to those described for DOE-SC projects. The NNSA's Los Alamos National Laboratory (LANL) had 15 GPPs funded between 1997 and 2005 and 3 congressional line item projects funded from 2002 and 2006.

The NNSA has also implemented special F&I programs managed by NNSA headquarters. These programs receive a separate line of funding to implement capital improvements that renew or replace specific building components. The programs are described as follows:

- The Facilities Infrastructure Recapitalization Program (FIRP) is a capital renewal program to reduce deferred maintenance.[10] Due to FIRP's success, the NNSA is

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[8] IGPPs are institutional projects that serve the entire site and cannot be attributed to a single research program (DOE 2010a).

[9] The DOE published a separate plan for scientific user facilities in "Facilities for the Future of Science: A Twenty-Year Outlook" (http://www.cap.bnl.gov/mumu/polit/20-year-science-plan.pdf).

[10] According to the 2011 Federal Accounting Standards Advisory Board handbook (FASAB 2011):

> Deferred maintenance and repairs are maintenance and repair activities that were not performed when they should have been or were scheduled to be and which, therefore, are put off or delayed for a future period. Maintenance and repairs are activities directed toward keeping fixed assets in an acceptable condition. Activities include preventive maintenance; replacement of parts, systems, or components; and other activities needed to preserve or maintain the asset. Maintenance and repairs, as distinguished from capital improvements, exclude activities directed towards expanding the capacity of an asset or otherwise upgrading it to serve needs different from, or significantly greater than, its current use.

developing the Capabilities Based Facilities and Infrastructure program to take the place of FIRP and focus on supporting the laboratory's capabilities.

- The Roof Asset Management Program (RAMP), which, according to the NNSA website, is an agency-wide effort to rehabilitate or replace roofs,[11] is the NNSA's first multi-site construction program. In the RAMP, a roofing contractor made a single initial bid for all work to be conducted across NNSA laboratories and then produced multiple sub-bids on detailed needs, in an attempt to make it more cost-effective for the contractor and the laboratories. The resulting cost savings were estimated at $13 million (LMI 2010).

3. Department of Homeland Security Funding

The DHS classifies all program acquisitions, including assets, into three categories, each with its own approval and management process:

- Level 1—above $1 billion in life-cycle costs. These projects require approval by the DHS Deputy Secretary or the Under Secretary for Management.
- Level 2—between $300 million and $1 billion in life-cycle costs. These projects are typically managed by the Under Secretary for Management or the Deputy Under Secretary for Management.
- Level 3—less than $300 million in life-cycle costs. These projects are managed by the individual DHS directorates and offices (DHS 2008b).
- The DHS emphasizes the sustainability of a project by basing the acquisition categories on the program's life-cycle costs.[12] Sustainment costs typically represent 60 to 70 percent of the total acquisition's life-cycle costs (DHS 2008b).

The Directorate for Science and Technology, Office of National Laboratories (ONL) manages the DHS's research laboratory portfolio and executes two F&I programs: construction and laboratory operations (DHS 2012). Starting in 2009, the DHS's Chief Financial Officer and ONL began funding future F&I needs not covered by O&M funds through separate annual budget line items for new construction and infrastructure upgrades. The DHS worked with the OMB and Congress to implement a separate line item in the DHS annual budget. The scope of these projects typically exceeds $2 million.

B. Alternative Financing Mechanisms

The alternative mechanisms used to finance F&I projects fall into two major categories: (1) a third party provides the initial capital for a project that will be used by a

[11] See http://nnsa.energy.gov/aboutus/ouroperations/apm/infrastructureandfacilitiesmanagement.

[12] The DHS's single acquisition is tied to a program's overall acquisition life-cycle cost, which can include multiple acquisitions requests or projects. A capital asset project would be classified as Level 1 if it has a total life-cycle cost less than $1 billion but is integrated in a larger program with other types of acquisitions (e.g., services contracts) totaling more than $1 billion.

government entity, and the government entity pays the third party back over a period of time; and (2) a government entity leases a government-owned property to a third party in exchange for rent or other in-kind contribution. These financing mechanisms generally do not require congressional approval.[13]

1. Government-Use Projects

a. Energy Savings Performance Contracts and Utility Energy Service Contracts

Energy Savings Performance Contracts are partnerships between a Federal agency and an Energy Service Company (ESCO). The ESCO finances modifications of a Federal facility after conducting a comprehensive energy audit. The laboratory then uses the cost savings from the energy improvements to pay the ESCO back over the term of the contract. Contracts are limited to a term of 25 years. In 2011 two White House memorandums were issued that support the use of Energy Savings Performance Contracts.[14]

Utility Energy Service Contracts, which are similar to Energy Savings Performance Contracts, are contracts with utility companies to cover the capital costs of energy efficiency, renewable energy, and water efficiency projects.

b. Operating Leases and Capital Leases

Operating leases allow the government to lease an asset funded by a private entity for a specific period of time from that private entity. In an operating lease, the third party transfers only the right to use the property to the government. Capital leases, by contrast, treat the government as the owner of the property. A capital lease is defined as a lease that transfers substantially all the benefits and risks of ownership to the lessee (Lee 2003). OMB is responsible for determining whether a lease is an operating lease or a capital lease. If a lease is an operating lease, the agency must have budget authority for

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[13] No congressional approval is required for operating leases at DOE laboratories; however, Congress must be notified if there is a transfer of land (see Atomic Energy Act of 1954 Section 161(g)) or a transfer of land by sale or lease at a defense nuclear facility. Operating leases at DOD laboratories do require congressional approval (see http://web.mit.edu/newsoffice/2012/lincoln-laboratory-hanscom-facility-0425.html).

[14] One memorandum, dated August 16, 2011, "Supporting Energy and Sustainability Goal Achievement through Efficiency and Deployment of Clean Energy Technology," was to agency senior sustainability officers (http://www.whitehouse.gov/sites/default/files/omb/procurement/memo/supporting-energy-and-sustainability-goal-achievement-through-efficiency-and-deployment-of-clean-energy-technology.pdf); the other, dated December 2, 2011, on the subject "Implementation of Energy Saving Projects and Performance-Based Contracting for Energy Savings," was to the heads of executive departments and agencies (http://www.whitehouse.gov/the-press-office/2011/12/02/presidential-memorandum-implementation-energy-savings-projects-and-perfo).

only a single year's lease payment plus the amount that will cover the required notice period for terminating the contract. Typically Federal laboratories have agreed to a one-year notice requirement in their signed operating leases. Therefore, the government entity would need budget authority for two years' worth of lease payments. On the other hand, if the lease is determined to be a capital lease, the entity must have current budget authority for the entire cost of the lease over its lifespan.

The following six criteria for operating leases are laid out in OMB Circular A-11:

1. Ownership remains with the lessor during the lease term and is not transferred to the Government at, or shortly after, the end of the lease term.
2. The lease does not contain a bargain-price purchase option. A bargain-price purchase option is "an option in a lease agreement that allows the lessee to purchase the leased asset at the end of the lease period at a price substantially below its fair market value."
3. The lease term does not exceed 75 percent of the estimated economic life of the asset.
4. The present value of the minimum lease payments over the life of the lease does not exceed 90 percent of the fair market value of the asset at the beginning of the lease term.
5. The asset is a general purpose asset rather than being for a special purpose of the Government and is not built to the unique specifications of the Government lessee
6. There is a private sector market for the asset.

The first four of these stem directly from Financial Accounting Standards Board (FASB) regulations on operating leases and the last two are specific to government entities.[15]

c. Other Mechanisms

Other mechanisms include financing from States, universities, or other government agencies. For example, the General Services Administration (GSA) may provide funding for constructing a building that a laboratory or agency later leases from the GSA. Since the GSA funds construction that is done only on private land, this mechanism is not available to laboratories on military bases or other government-owned property.

2. Third-Party-Use Projects

Enhanced Use Leases (EULs) are long-term leases of government property whereby a government entity receives cash or in-kind contributions for income. The lease

[15] According to its website, FASB is a private organization that establishes financial accounting standards for nongovernment entities (http://www.fasb.org/jsp/FASB/Page/SectionPage&cid=1176154526495).

payments may be used for alteration, repair, and improvement of property or facilities; construction or acquisition of new facilities; payment of utility services; or real property maintenance services.

Under an EUL, a developer leases government property and then makes improvements; it can then be leased to any interested tenants. The government retains ownership of the property and the EUL developer only holds a lease interest.

3. Planning Processes

This chapter describes the formal F&I planning processes at the 10 Federal laboratories in the study. These planning processes help ensure that F&I decisions are based on relevant information and are reviewed by critical stakeholders. The particulars of these processes depend not only on the agency and laboratory, but also on the size, timing, and funding source for the proposed project.

The first section describes the major processes of DOD, DOE, and DHS laboratories. The second section discusses the challenges of these processes from the perspectives of the laboratories, and the last section presents strategies for improving the processes. Refer to the profiles found in Appendix C for details for each Federal security laboratory in the study.

A. Process Description

1. Planning Horizons and Documents

The F&I planning process is conducted along a range of time horizons to accommodate long-, mid-, and short-term mission strategies. Examples of planning documents used include:

- *Strategic Plans and Frameworks:* These are long-term strategic documents that identify the agency and laboratory's vision, objectives, and core capabilities across a time period of 10 to 50 years.
- *Master and Site Plans:* These are mid-term planning documents that cover a range of 5 to 10 years.
- *Annual and Campus Plans:* These are short-term documents that set annual performance expectations and plans for the upcoming fiscal year through the next 5 years.
- *Energy, Environmental, and Sustainability Plans:* These newer plans exist alongside traditional F&I planning documents. Energy, environmental, and sustainability considerations are typically included in the design and development of new construction and renovations of existing buildings. Laboratories have also set mid-term targets to meet new energy efficiency and sustainability-related Federal regulations as well as guide the management of energy and environmental resources throughout their F&I.

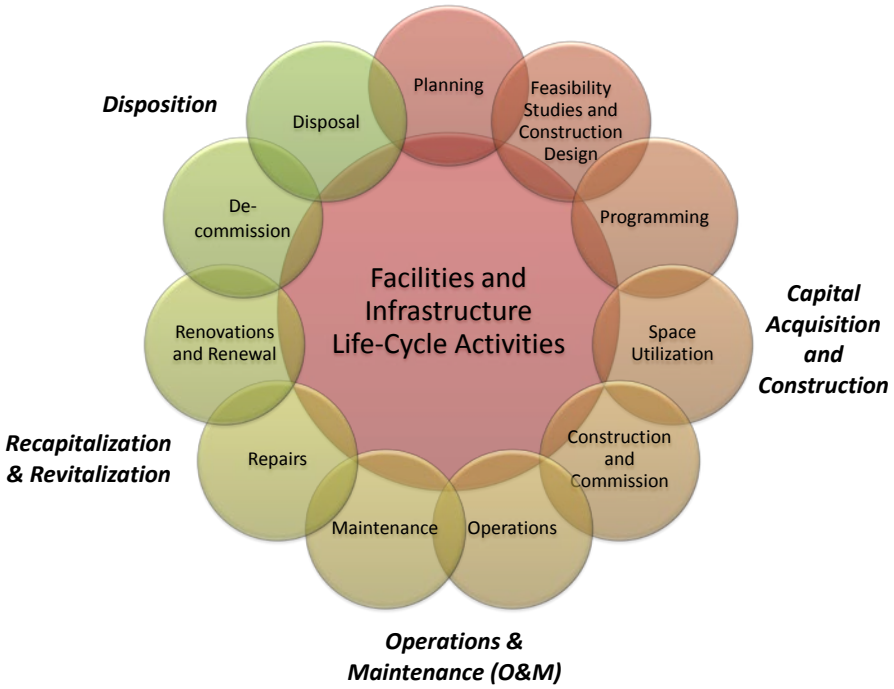
None of these planning documents are used universally across the Federal laboratories.

2. Real Property Life Cycle

Four main components of the F&I real property life cycle at the Federal laboratories indicate the activities involved:

- *Capital Acquisition and Construction* refers to planning, designing, building, developing, converting, or extending real property and the systems and components, such as utilities, that support the real property.[16]
- *Operations and Maintenance* (O&M) includes general maintenance and repairs that are necessary to prevent premature failure of components or to maintain the facility under normal operating conditions (GSA 2011).
- *Recapitalization and Revitalization* involves capital improvements that renew or replace building component (such as a new roof or foundation), meet new or higher standards, or accommodate new functions (Biedenweb 2010).
- *Disposition* includes the sale or demolition of excess or obsolete facilities.

Figure 1 depicts the F&I decision-making process. Because most of the laboratory staff who participated in discussions did not talk about disposition in detail, this report focuses primarily on the first three activities.



Source: Adapted from NRC (2008).

Figure 1. Facilities and Infrastructure Life-Cycle Activities

[16] This description is adapted from the definition for military construction in 10 USC § 2801 and § 2802.

B. Agency-Specific Processes

1. Department of Defense Processes

a. Military Construction (MILCON) Planning Process

The MILCON planning process includes top-down guidance and bottom-up prioritization. The Office of the Secretary of Defense (OSD) and headquarters of each military department issue guidance on capital investment strategies for the MILCON program that is passed down to the major commands, the installations, and the installation tenants, including the laboratories. Table 3 lists the major military commands, F&I supporting organizations, and installations for five of the six DOD laboratories in the pilot study.

Table 3. Major Military Commands, F&I Supporting Organizations, and Main Installations/Bases of Five DOD Laboratories

Laboratory	Major Command	F&I Supporting Organizations*	Main Installation/Base
Air Force Research Laboratory (AFRL)	Air Force Materiel Command	Air Force Civil Engineer Support Agency Air Force Real Property Agency	Wright-Patterson Air Force Base (AFB), OH; Kirtland AFB, New Mexico; Eglin AFB, Florida; Edwards AFB, California; Rome Research Site, Rome, New York
Army Medical Research Institute for Infectious Diseases (AMRIID)	Army Materiel Command	Army Installation Management Command Army Medical Command United States Army Corps of Engineers	Ft. Detrick, Maryland
Army Research Laboratory (ARL)	Army Materiel Command	Army Installation Management Command Research, Development and Engineering Command United States Army Corps of Engineers	Adelphi Laboratory Center & Aberdeen Proving Ground, Maryland
MIT Lincoln Laboratory (MIT-LL)	Air Force Materiel Command	Air Force Civil Engineer Support Agency Air Force Real Property Agency	Hanscom AFB, Massachusetts
Naval Research Laboratory (NRL)	Office of Naval Research	Naval Facilities Engineering Command^	Not applicable

Note: The table does not include Johns Hopkins University-Applied Physics Laboratory (JHU-APL), the sixth DOD laboratory in the study, because JHU-APL is entirely located on and managed by Johns Hopkins University.

* F&I supporting organizations refer to Direct Reporting Units in the Air Force and Army, which provide engineering services or manage real property and operations and maintenance at the installation. For the Navy, these services fall under the Naval Facilities Engineering Command (NAVFAC).

^ NAVFAC is one of 13 Navy shore establishment commands. The Navy also has 9 operating forces known as "commands" (e.g., U.S. Naval Forces Central Command, U.S. Naval Special Warfare Command).

At the laboratory level, individual DOD laboratories identify and propose one or more projects to their installation command. These projects follow the guidance set out by OSD and the respective military department's headquarters. The process typically involves recommendations from the laboratory's research division directors and corporate leadership.

Ultimately, the laboratory director will recommend a list of projects to be prioritized by the installation command. The installation command combines the laboratory projects with other installation projects (such as hospitals, schools, barracks, and other F&I), prioritizes them, and develops a ranked list. The installation-level list is provided to the department's major command to compete with all department-wide priorities and projects.[17] There are two exceptions to this, one in the Army and the other in the Air Force:

- Army research laboratories, such as ARL, propose their highest prioritized project to the Research, Development and Engineering Command (RDECOM),[18] which then ranks the submissions from all the Army research laboratories and submits a list of projects to their major command, the Army Materiel Command (AMC).
- AFRL headquarters at Wright-Patterson Air Force Base previously proposed projects separately from the rest of the installation, and, therefore, bypassed the prioritization process at the installation command level. AFRL's full project list was provided directly to the major command, the Air Force Materiel Command (AFMC). However, in 2011 AFRL was obligated to present its projects to and work with the installation command before the combined, prioritized list was sent to AFMC.[19]

A major command list is generated and submitted to the department headquarters for review. The department headquarters staff review, prioritize, and approve the projects, and provide a budget with the final list of MILCON projects to OSD.[20] OSD makes the final decision on the projects for the MILCON program. The MILCON list is then included in the DOD's Future Years Defense Plan and approved for inclusion into the President's proposed budget by the President, OMB, and Congress.

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[17] Information obtained from personal interviews with DOD laboratory and agency staff. See Appendix A.

[18] RDECOM was established in 2002 to integrate research, development and engineering capabilities across the Army enterprise. One of RDECOM's goals is to acquire, establish and sustain state-of-the-art facilities, equipment, and information technology infrastructure (RDECOM 2011).

[19] The F&I planning process changed when the Air Force headquarters began implementing an Asset Management approach using Activity Management Plans (AMPs) to provide a portfolio enterprise view of all Air Force assets. Refer to Appendix C for more information.

[20] These plans are submitted to the Director, Facility Investment and Management, Office of the Deputy Under Secretary of Defense (Installations and Environment).

b. Medical Military Construction Planning Process

The Medical Military Construction (Medical MILCON) process is similar to the bottom-up process for the regular MILCON program whereby laboratories propose projects to their installations and the installations combine and prioritize projects to present to the major command and the department headquarters.

However, the agency-level process underwent a significant change in 2009. Rather than having the military departments compete their projects separately for their respective budget allocation, the Office of the Assistant Secretary of Defense for Health Affairs implemented the Capital Investment Decision Model, managed by TRICARE.[21] The model allows TRICARE to consider enterprise-wide goals and allocate the total Medical MILCON funding across the departments.

Representatives from each military medical facility and medical department serve on the Capital Investment Review Board and review, score, and negotiate funding for proposed projects. The Senior Military Medical Advisory Committee, which includes each department's senior medical leadership and the Assistant Secretary of Defense for Health Affairs, is then responsible for reviewing and approving the portfolio submitted by the Board. Each military department's Surgeon General and TRICARE prioritize the projects in the portfolio and come to an agreement on the top needs across the defense military medical system.

c. Base Realignment and Closure Planning Process

The BRAC planning process is governed by the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510) as amended. The Secretary of Defense develops the proposed BRAC criteria used to evaluate military installations and make recommendations for closure or realignment. The criteria are published in the *Federal Register* and the Secretary of Defense accepts public comments and chooses to revise the proposed criteria as necessary.

After a final list of criteria is developed, the Secretary of Defense conducts the evaluations and provides a recommendations list to the BRAC, a group of eight to nine presidentially appointed members. The BRAC receives public comments through regional hearings, installation site visits, and individual meetings. After deliberations, the BRAC produces a final report with recommendations that is sent to the President and Congress for approval.

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[21] TRICARE is the health care program for Uniformed Service members, retirees, and their families worldwide.

d. Section 219 Unspecified Minor Construction Authority and the Laboratory Revitalization Demonstration Program Planning Process

Minor construction projects funded through the Section 219 authority and LRDP are reviewed and approved by laboratory leadership and executed through the Major Command.

- At AFRL, the headquarter Operations Support Division works closely with AFMC Installations and Mission Support to coordinate and staff all Section 219 and LRDP requirements projects. The approval process varies by funding size of the project.
- At NRL, projects less than $100,000 are approved by the Research and Development Services Division, while projects exceeding this threshold require approval by the NRL Director.
- For all DOD laboratories, each project over $2 million, including minor construction through Section 219 and LRDP projects, must be approved by the respective military department secretary. Projects between $2 million and $4 million also require congressional notification.

e. FFRDC and UARC Planning Processes

FFRDCs must coordinate with their laboratory management contractor when planning for F&I. For example, MIT-LL coordinates with the MIT Committee for the Review of Space Planning, which approves F&I project proposals on MIT property. Additionally, the MIT Corporation reviews the laboratory's annual budget. The Air Force provides approval for projects on base property.

UARCs must coordinate with their university management when planning for F&I. At JHU-APL, facilities staff coordinates with Johns Hopkins University (JHU) to plan for new facilities on the campus. Both MIT-LL and JHU-APL's laboratories have hired external architectural and engineering firms to help the facilities managers adopt an efficient decision-making framework based on industry practices. For example, JHU-APL hired RTKL Associates to conduct multiple iterations and updates to their master plans. (See Appendix D for further information about RTKL Associates and its planning methods.)

2. Department of Energy Processes

The DOE coordinates activities through each laboratory's site office, which oversees the management and operations contract. The main F&I planning mechanisms used at the agency level are the laboratory's Ten or Twenty-Five Year Site Plan[22] and Annual Plan. Ten or Twenty-Five Year Site Plans are used to communicate the

[22] The NNSA recently shifted to Twenty-Five Year Site Plans with the fiscal year 2013 submissions. These are now under review for approval by the headquarters offices.

laboratory's F&I needs and plans to meet the set of core competencies of each laboratory to the DOE-SC or NNSA.

a. DOE Office of Science Laboratory Planning Process

The DOE-SC planning process for scientific user facilities involves advisory councils and input from the DOE-SC's General Plant Projects (GPPs), Institutional General Plant Projects (IGPPs), and line-item prioritization (described in the next subsection). To obtain initial approval of the F&I concept, the laboratory will perform pre-conceptual planning to discuss strategic goals, safety planning, and design. They also produce a Mission Need Statement, which outlines the mission requirement and explains why the F&I is critical to meeting the mission need. The relevant DOE-SC research program conducts a Mission Validation Independent Project Review for projects costing $750,000 or more, and the DOE Office of Acquisition and Project Management (OAPM) reviews the Mission Need Statement for projects costing $100 million or more.

The DOE-SC leadership for Field Operations, Science Programs, and Safety, Security and Infrastructure review GPPs, IGPPs, and line items. They solicit input from the research programs' leadership, site offices, and laboratory Chief Operating Officers at an annual meeting to discuss the impact of the proposed projects on their programs. The agency's regional Field Office compiles the input and presents recommendations on projects to fund to the Director of DOE-SC, who provides approval for specific projects.

The DOE-SC laboratories use Councils and Prioritization Teams to obtain feedback on F&I plans. For example, Project Planning, Programming, and Budgeting Process at Brookhaven National Laboratory (BNL) is a formalized process that includes a consolidation team and a policy council, along with continuous site office involvement. The process and results are tracked through a prioritization system built by the architectural and engineering firm VFA, Inc. (See Appendix D for further information on VFA, Inc., and its planning methods.)

b. NNSA Laboratory Planning Process

For NNSA laboratories, GPP and IGPP approvals follow a process similar to that of the DOE-SC laboratories. Staff at Los Alamos National Laboratory (LANL) noted that the site office plays an integral role in reviewing and certifying F&I information for IGPPs and line item projects, but the site office's approval is not necessary for GPPs. Once the laboratory reviews and approves projects, the projects are included in the laboratory's Twenty-Five Year Site Plans and Annual Plans.

Line item projects funded through the Readiness in Technical Base and Facilities program are prioritized differently than DOE-SC laboratories and are reviewed through the Construction Working Group. Established in 2008, this working group is a collaborative

forum that involves NNSA leadership and representatives from all NNSA laboratories that discuss and independently score each of the proposed line item projects. The process is conducted over several months, culminating in a two-day meeting where members deliberate and prioritize the projects based on their scores. Laboratory and site office staff noted that the Construction Working Group helps them better understand the F&I needs across the enterprise, ultimately leading to more informed decisions and priorities.

At the laboratory level, the process to identify projects varies in the level of formality and type of feedback, as demonstrated by the following examples:

- *Simple Review Process:* At LANL and Sandia National Laboratories, the program offices submit their F&I needs, which are then prioritized by the facilities office and reviewed by laboratory leadership and the site office for inclusion in the Twenty-Five Year Site Plans and Annual Plans.
- *Use of Councils for Feedback:* There is a recent effort at LANL to increase participation in the F&I project approval process. In November 2011, the LANL Director announced the creation of the Laboratory Integrated Stewardship Council, which comprises the Associate Director of Capital Projects and other program leadership. The council will approve projects over $100,000 in an effort to better manage budget constraints that will impact future activities at the laboratory.

3. Department of Homeland Security Processes

The DHS uses the cyclic Planning, Programming, Budgeting, and Execution (PPBE) process to identify mission gaps and guide investment decisions in the annual budget and Resource Allocation Plan.[23] The planning component of the PPBE outlines the DHS's long-term strategic direction assuming no budgetary constraints, while the programming, budgeting, and execution components focus on budgetary resource allocations to fund, deploy, and support programs over the next 5 years.

As part of the PPBE process, the DHS established a streamlined acquisition life-cycle framework in 2008 composed of four phases (DHS 2008a):

- *Need:* The directorates and offices review a preliminary Mission Needs Statement to identify whether items in the statement are unique needs or are being addressed by other DHS activities. If the needs are approved as unique, the directorate submits a Mission Needs Statement to the DHS and the Joint Requirements Council.

[23] The Resource Allocation Plan is a budget request that allocates resources across DHS directorates and offices over 5 years.

- *Analyze/Select:* The DHS identifies alternatives to fulfill the mission need defined in the Mission Needs Statement and selects an option based on cost, schedule, and risk.
- *Obtain:* The DHS further refines logistics and funding through testing and evaluation to ensure the capability can operate as expected when deployed.
- *Produce/Deploy/Support:* The DHS reviews plans for production readiness, staffing, and funding and approves deployment.

The DHS also uses various supporting boards and working groups to aid F&I investment decisions. The Acquisition Review Board reviews and approves Level 1 and 2 projects at each phase of the acquisition life-cycle framework. Moreover, the Program Review Board reviews and makes recommendations on projects to the DHS Secretary; the Joint Requirements Council assesses the project's alignment with strategic requirements; and the Asset Review Board is responsible for managing the DHS real property portfolio (DHS 2008a). Groups external to the agency may also be consulted for input into F&I plans. For example, Office of National Laboratories (ONL) staff coordinated with Federal intelligence agencies and other potential customers when planning the National Biodefense Analysis and Countermeasures Center (NBACC) (DHS 2008a).

The DHS laboratories independently submit project proposals to ONL as part of the annual budget preparation. ONL reviews and approves all proposed projects. At NBACC, any facilities staff member can submit a project into the Engineering Change Order process. The Building Manager, Health and Safety Officer, and Infrastructure Operations Director review and decide whether to submit the project for inclusion in the ONL laboratory operations list or use the laboratory's operations or overhead funding to implement the project in the current or next budget cycle.

4. Alternative Financing Mechanism Planning Process

Many forms of alternative financing mechanisms are used throughout the laboratories; one DOD laboratory and multiple DOE laboratories have pursued alternative financing using operating leases. DHS laboratories have not used alternatively financed operating leases.

MIT-LL is the only DOD laboratory in the study that has successfully contracted an operating lease. The lease was used to fund the construction of their South Laboratory. The project was authorized through the National Defense Authorization Act for Fiscal Year 1988. The facility lease was for 40 years, but the building will be paid off in 2014. MIT-LL is proposing to build another facility using an operating lease. At the time of writing, October 2012, congressional approval for the Air Force to lease the land to MIT and OMB review of the new project were still pending.

DOE laboratories have more experience that DOD laboratories in using alternatively financed operating leases. According to laboratory personnel, the most recent approval of an alternatively financed operating lease was in 2009. The DOE's operating lease approval process is limited to projects costing $10 million or more and follows three phases (DOE 2010b):

- Phase 1: The management and operations contractor develops a project proposal that includes an assessment of the project's needs, risks, schedule, and costs.
- Phase 2: The program office and site office form a review team to assess whether the project meets DOE and OMB requirements and that it is fulfilling an identified laboratory mission need. Upon approval, the program office and site office present the proposal to the headquarters review team, consisting of the Office of Acquisition and Project Management (OAPM), the Office of the Chief Financial Officer, and the Office of the General Counsel.
  - OAPM convenes an external independent review and makes recommendations on revisions to the program office.
  - If the proposal is not recommended for approval, the program office can return the proposal to the site office to revise, terminate the proposal, or send the proposal directly to the DOE Deputy Secretary for approval.
- Phase 3: Upon headquarters approval, the DOE, including OAPM, the Office of the General Counsel, and the Chief Financial Officer, submits the proposal and additional review documentation to OMB for review of the scoring impact. The program office formally presents the project to OMB. If OMB approves an operating lease, the proposal is sent to the DOE Under Secretary for approval and implementation.[24]

C. Process Challenges

The following section generalizes the main challenges to F&I planning as synthesized from the laboratory and agency discussions. The anonymous quotations from F&I laboratory or agency staff serve to highlight the topics discussed.

[24] No congressional approval is required for operating leases at DOE laboratories; however, Congress must be notified if there is a transfer of land (see Atomic Energy Act of 1954 Section 161(g)) or a transfer of land by sale or lease at a defense nuclear facility. Operating leases at DOD laboratories do require congressional approval (see http://web.mit.edu/newsoffice/2012/lincoln-laboratory-hanscom-facility-0425.html).

1. Inconsistent Leadership Support at the Agency Level

Although the laboratories emphasized the strong laboratory leadership and support for F&I, some laboratory personnel felt they lacked representation in the agency-level decision-making process. While MILCON projects are proposed through a bottom-up process, there is no designated advocate to represent the DOD's Research and Development (R&D) assets at the service/agency headquarter offices, including OSD. Representatives from one DOD laboratory said they would prefer it if their Assistant Secretary were present during the MILCON decision-making process. Agency-level decisions are made through rankings and models, without further consultation or involvement from the laboratories to understand the context of the results. Additionally, DOD laboratories are often partly or wholly situated on military bases and thus compete with the installation command's F&I priorities. Agencies and installations tend to prioritize mission requirements over research activities, which drive the mission requirements to the top of prioritization lists. This situation tends to result in low laboratory project rankings, so few projects even reach the major command level. A similar situation occurs at NNSA laboratories that compete with the nuclear weapons plants for facilities and infrastructure funds.

2. Lack of Integration of Agency and Laboratory Processes

There is a need for more integrated F&I planning processes that unite the strategic, agency-level strategic plans with the laboratory-level tactical plans.

> *Within a constrained budget, I think we are doing reasonably well competing projects…. [However it] makes it much harder to tell the story because the [budget] process is every year and when we're talking about the 2025 timeframe, it becomes difficult.*

At the DOE, the Ten Year Site Plans are typically used to compile data calls and desired project lists for agency staff rather than being a useful F&I planning and budgeting tool at the laboratory level. The Ten Year Site Plans and other agency planning documents address F&I in a piecemeal way, making the connections to other infrastructure-relevant dimensions, including workforce and the research programs, difficult. Other laboratories noted the complete lack of a long-term strategic F&I plan (addressing 20 or more years) altogether.

Laboratory-level, short-term and long-term F&I planning horizons are disconnected and could be better integrated with one another. For instance, the F&I planning could be facilitated by addressing gaps between the annual and mid-term planning horizons. Moreover, the planning and appropriations timelines for MILCON projects through the DOD and for line item projects through the DOE are too long for effective F&I planning. According to staff at an NNSA laboratory, it takes an average of 10 to 15 years to obtain approval for a line item project.

3. Misunderstanding of Cross-Competencies within and across Agencies

There is a need for improved understanding of Federal laboratory cross-competencies within and across agencies to better leverage F&I investments.

Each laboratory's R&D priorities are dynamic. One example is the steady growth in Sandia's Work-for-Others program and cross-agency intelligence capabilities.[25] Sandia has welcomed diversification of its research competencies in order to complement and sustain the operations of its core missions and capabilities. By doing this, they are able to leverage cross-agency research program and F&I investments. However, current agency-level mechanisms hinder the creation of partnerships and the co-management of R&D assets. Research program funding is given to one laboratory although relevant competencies may exist at other laboratories in the agency or in laboratories of other agencies.

4. Lack of Interagency Coordination

Agency-level planning processes may include interagency participants and their feedback, but this is largely done on an ad hoc basis. Agencies are generally aware of large laboratory F&I proposals; however, opportunities for partnerships across agencies are not formally coordinated or reviewed.

5. Difficulty Meeting Limits of Special Allocations and Programs

F&I planning becomes more difficult with special allocations of funding and programs, such as congressional earmarks and the BRAC process. Often the congressional add-ins are not directly in line with a laboratory's top F&I priorities.

> *A congressional add-in gets inserted and sometimes it's not anything that we ask for. Often times [our] program needs are not funded but the ones that the congressional delegation wants are. There are also monetary limitations and trying to build facilities [within this] amount is challenging. In one case, the Director put additional investments into a congressional add-in facility to support capital equipment.*

Even when BRAC funding for new facilities is obtained, there are some disadvantages in receiving this funding, especially in servicing for a laboratory's O&M. Since the installation services staff has to be trained in new facility requirements, services are being spread thinner throughout existing facilities during this timeframe.

[25] The percentage of Sandia's non-nuclear weapons work through Work-for-Others agreements has increased from about 10 percent in the 1960s to about 60 percent presently, reflecting the evolution of Sandia's mission from primarily nuclear weapons to a laboratory with a broader national security focus.

6. Increased Need for Trained F&I Staff

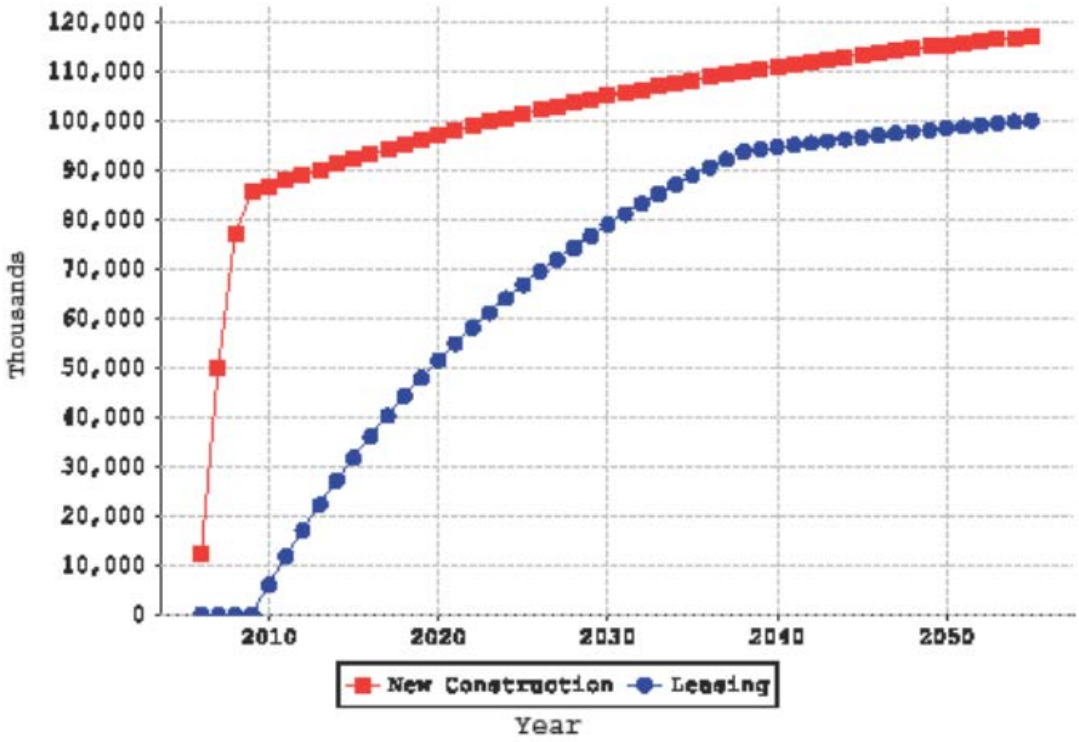
Trained F&I support and operations staff are needed to help develop comprehensive F&I master plans. At DOD laboratories in particular, the need is for engineering services and installation facilities or operations staff with adequate expertise specific to the laboratory's needs for master planning (e.g., in conducting cost modeling and providing analyses of alternatives). Laboratories across the DOD and DOE have contracted architectural and engineering firms to conduct the majority of their master planning. (See Appendix D for more information on architectural and engineering firms and laboratories that have used their services.) This approach is not an option for all laboratories for budgetary reasons.

7. Barriers to Gaining Alternative Financing Approval

Barriers to obtaining approval for alternative financing projects for F&I, such as operating leases, include cost concerns, difficulty obtaining OMB approval, and lack of experience. Given the lack of experience with operating leases among the 10 chosen laboratories, follow-up discussions were held with staff at three DOE laboratories that had successfully used this mechanism, Oak Ridge National Laboratory (ORNL), Pacific Northwest National Laboratory (PNNL), and Y-12 National Security Complex.

a. Cost Concerns

Evidence related to the cost-effectiveness of alternative financing mechanisms has been mixed. Personnel from one laboratory said they would not recommend Energy Savings Performance Contracts and Utility Energy Service Contract to others because their use on certain projects ended up being more expensive than expected. A 2003 GAO report concluded "the costs associated with these financing approaches may be greater than with full, up-front budget authority" (GAO 2003a). However, this conclusion was based on the assumption that the Federal Government's financing costs are always less than the private sector's. GAO did not identify additional costs due to the use of alternative funding mechanisms. According to staff at PNNL staff, the private sector can build conventional facilities in half the time and at two-thirds of the cost of a DOE line item. Figure 2 shows a comparison of the costs of new construction and alternative financing (in this case, leasing) of PNNL's Computational Sciences Facility.



Source: Pacific Northwest National Laboratory (2010a); based on 30% construction cost differential; 15% operational cost differential; $0 rent after 30 years; 6% discount rate.

Figure 2. Cost Comparison of New Construction and Alternative Financing (Leasing) for Pacific Northwest National Laboratory's Computational Sciences Facility (Cumulative Net Present Value)

But the cost-effectiveness of this form of alternative financing may depend on the lease payments terminating at some point. In one cost-effective deal at ORNL, the land reverted back to the government at the end of the contract. However, the DOE's General Counsel later determined that private entities are prohibited from giving land to the government. Instead, at the end of the contract, the government's rent payments end, but the private entity retains ownership of the building. Thus, at this point, the government is able to lease the building rent free. If the government must pay rent indefinitely, then the alternative financing project will be more expensive than a line item.

The former DOE Office of Cost Analysis found the construction time was shorter and the O&M costs lower for alternative financed projects, but the construction costs were higher than for line items (Gebeyehu-Houston 2010).

b. Difficulty Obtaining OMB Approval for Operating Leases

Although none of the DOE laboratories in this pilot study have received OMB approval for an alternatively financed project, other DOE laboratories have (see Table 4).

Table 4. Selected DOE Laboratory Alternative Financing Projects Since 2004

Laboratory	OMB-Approved Projects	Not OMB-Approved Project
Oak Ridge National Laboratory	Multi-Program Research Facility (2004)	Multi-Purpose Computational Data Center (2008)
Y-12 National Security Complex	Production Interface Building (2004) Public Interface Facilities (2004)	—
Argonne National Laboratory	Theory and Computing Sciences Facility (2005)	—
Los Alamos National Laboratory	—	Science and Engineering Complex (2010)
Idaho National Laboratory	—	Science and Technology Laboratory (2006)
Pacific Northwest National Laboratory	PNNL: Biological Science Facility & Computational Science Facility (2006)	—
Brookhaven National Laboratory	—	Housing Reconstruction (2006)

MIT-LL is in the process of proposing a new alternatively financed project, but has not yet received approval for the project. Laboratory staff members are concerned because OMB has historically scored alternatively financed projects as a capital lease, thereby requiring the DOD to allocate funds in a single budget year for the entire lease period (typically 15 or more years).

One potential explanation offered during discussions was that these projects bypass congressional authority. GAO's report on alternative financing seems to support this viewpoint in that it advocates full funding as the best way to maintain government-wide fiscal control (GAO 2003a).

Some F&I personnel thought the six criteria in Appendix B of OMB Circular A-11 for operating leases were difficult to achieve, particularly the required economic factors. (See Chapter 2, Section B for a list of six criteria.) Another barrier raised during the alternative financing discussions was the condition that the asset be a "general purpose asset rather than being for a special purpose of the Government and is not built to the unique specification of the Government lessee." This condition presents issues for R&D assets that have specific mission requirements; accordingly, alternative financing proposals have been more successful when used for office buildings or the like.

c. Need for Forward Projections and Plans for Lease Cost Recovery

Alternative financing requires that laboratories have a clear strategic plan to minimize risk and to avoid overbuilding, which strains laboratory financial resources. This requires internal discipline and understanding that long-run planning must accommodate changes in plans, such as having to pay off an operating lease earlier than expected.

> *There have been no successful [alternatively financed] projects at DOD for 20 years and no successful DOE projects in the last 5 years…. This is evidence of a systemic problem. The statutes and OMB Circular A-11 criteria have not changed in years. Yet, there is still confusion and frustration as to the path for successfully completing [an] F&I project. Without transparency in [OMB's] scoring results, there is little possibility of following the effective and efficient precedents. Clearly this is an issue of immediate concern…it is evident that written clarification, guidance, and assistance from the top is necessary for any of the Federal laboratories to move forward. Confusion and consternation regarding issues of funding and scoring are the real barriers to improving the F&I.*

d. Lack of Experience

Despite their being aware of the regulations relevant to alternative financing mechanisms, such as OMB Circular A-11, most Federal agency and laboratory staff indicated they would like the opportunity to learn more about these projects. In particular, facilities personnel that have not undertaken an alternatively financed project were interested in discussing the process with those who have been successful. There is currently no interagency venue for sharing expertise and best practices for alternative financing mechanisms. Certain topic-specific intra-agency forums exist, including the Federal Utility Partnership Working Group.

D. Strategies for Improvement

The discussions with the agency and Federal laboratory staff revealed six strategies that have or could improve the agency- and laboratory-level planning processes.

1. Agency and Laboratory Leadership Champions F&I Needs and Facilitates Cross-Agency and Laboratory Participation

Leadership at UARC laboratories, which tax their research income streams to generate funds for F&I maintenance and investments, generally understand the need to optimize their investments to stay competitive. Staff at JHU-APL thought this represented a fundamental difference between UARCS and other government laboratories and FFRDCs.

Agency and laboratory leadership also jointly collaborate, discuss, and evaluate F&I projects. The DOD's Defense Medical Facilities MILCON Capital Investment Decision Model and NNSA's Construction Working Group are two examples where this occurs. These decision-making models are effective ways to communicate and link F&I needs to current and future missions across the agency. Both the Capital Investment Decision Model and Construction Working Group facilitate agreement on the top F&I needs across the DOD and the NNSA enterprises, respectively.

> *[Through the Construction Working Group, we] listen to others' needs and think about the need of the complex. It becomes hard to keep your vote for your site when there is a greater need in another site. It forces you to think strategically, which is difficult but is of benefit to the NNSA complex.*

The NNSA Construction Working Group also serves as a way for laboratories and leadership to better understand the cross-competencies and unique capabilities across the NNSA laboratories. NNSA staff is developing a similar model to coordinate deactivation and decommissioning activities. The NNSA conducted two teleconferences and invited all stakeholders to participate in 4- to 8-hour sessions in which all proposed projects were reviewed and feedback on each one was provided. This process resulted in fewer complaints the following year about involvement and the prioritization of projects.

Thus, a best practice could be for agency's to make the F&I planning and prioritization process inclusive of F&I laboratory stakeholders.

2. Agencies Simplify Planning and Operations by Collocating Laboratory F&I

Colocation of laboratory F&I with other laboratories that have similar needs (e.g., security and utilities) can facilitate F&I planning and enable sharing of resources (e.g., utility needs and laboratory equipment).

- Interagency colocation provides efficiencies in managing, operating, and funding F&I projects. For example, U.S. Army Medical Research Institute for Infectious Diseases (AMRIID) and National Biodefense Analysis and Countermeasures Center (NBACC) are located on Fort Detrick's National Interagency Biodefense Campus (NIBC), an interagency partnership including the Army, the DHS, the National Institutes of Health, and the Department of Agriculture (NIBC n.d.). The centralization of biosafety facilities allows the laboratories to take advantage of cost efficiencies in local emergency response, specialized utility contracts, and physical security needs that are coordinated through Fort Detrick for the entire campus. According to NBACC interviewees, building the NBACC laboratory in another location without existent biosafety laboratory services would have increased costs by millions.

- The NNSA's Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratories (Sandia) have also partnered to coordinate a shared R&D space called the Livermore Valley Open Campus (LLNL n.d.). The campus will be used to enhance scientific collaborations among the laboratories, industry, and academia.

3. Agencies Set Aside Funding for F&I Projects in the Annual Budget

The DHS is the only agency that has a separate funding stream for F&I construction and infrastructure upgrades through ONL. The NNSA has implemented F&I programs, such as the Facilities and Infrastructure Recapitalization Program and the Roof Asset Management Program, to fund large-scale renovation and revitalization projects. Two agency-level offices at the DOD proposed that the agency could designate a laboratory construction fund within the MILCON program. Such funding could be pooled for several years and either rotationally distributed to laboratories or competed for annually.

4. Laboratories Develop an F&I Master Planning and Investment Framework

Two laboratories at the DOD and DOE have developed or are in the process of developing an F&I Master Planning framework that integrates laboratory and agency-level planning documents (mid- to long-range strategic and short-term tactical).

- MIT-LL is in the process of integrating F&I planning efforts and activities across various time horizons into a coordinated Facility Master Plan.
- Sandia has developed an Enterprise Process Model to streamline F&I planning and better integrate its customer needs with the NNSA's and the laboratory's mission. Moreover, Sandia is currently in the process of completing a 5-year F&I plan that is more closely aligned with anticipated budgets and will supplement planning tools already in place, such as the Ten Year Site Plan.
- At the agency-level, the NNSA is building an Integrative Planning Tool under the Enterprise Modeling Consortium that would integrate the Ten Year Site Plan and other structural reporting plans.[26] It is currently under development and being piloted across the agency to build confidence among users (NNSA 2011a). (Refer to Chapter 6, Section B.3.b for details on the Enterprise Modeling Consortium's modeling tools.)

[26] The Enterprise Modeling Consortium is an NNSA program that integrates models across the enterprise for stockpile program, critical skills, and infrastructure (NNSA 2011a).

5. Laboratories Develop and Use Internal and External Expertise in F&I Master Planning

DOD FFRDC and UARC laboratories are expanding or would like to expand their in-house facilities master planning capabilities.

- When hiring a facility master planner in 2009, MIT-LL recognized the need to create a position committed to managing the F&I needs across the laboratory and a mechanism to communicate those needs to the laboratory's leadership.
- JHU-APL facilities staff works directly with architectural and engineering contractors to update their master plans so that JHU-APL maintains responsibility and ownership in the master planning process. According to JHU-APL interviewees, the optimal system requires both competent in-house staff and access to external contractors, thereby drawing from the best of industry while retaining in-house ownership and continuity.

6. Laboratories Use Alternative Financing Mechanisms

Staff from the laboratories of each of the agencies in the pilot indicated they had used some type of alternative financing mechanism.

The DOD has used operating leases to save money. For example, according to MIT-LL, offsite leasing cost approximately $8 million per year in the late 1980s, and returning these functions to campus would save $88 million over 25 years.[27] The Defense Authorization Act of 1988 approved the construction of the South Laboratory using third-party financing. The Air Force leased the land to MIT-LL, MIT-LL subleased the land to a limited partnership set up for this purpose, and the limited partnership leased the building to MIT-LL. Lease payments are charged to the laboratory contract and end in October 2014. At that point, title will revert to the Air Force. A special termination clause allows the government to terminate the lease with notice. MIT-LL is in the initial stages of proposing another third-party financing deal to replace existing fabrication and engineering spaces and compound semiconductor and materials laboratories.

Several successful alternative financing construction projects at DOE laboratories have also used operating leases (see Table 4 in the previous section); the last was approved in 2009. However, not since 1990 has OMB approved an operating lease for building construction for the laboratories included in this study.

The DOE's PNNL staff commented that alternative financing has been an important mechanism in shaping its infrastructure. PNNL has a mix of federally funded, Battelle-

[27] In a presentation to the study team, MIT-LL cited correspondence from then-Assistant Secretary of the Air Force James P. Boatright to the Armed Services Committee in November 1987 and the House Appropriations Committee in August 1989 as the source of these figures.

funded,[28] and alternative financing buildings.[29] Two of PNNL's recent facilities, the Biological Sciences Facility and Computations Sciences Facility, are located on Battelle-owned land. Battelle initiated a long-term lease with Cowperwood Company, a real-estate development firm, to construct the two facilities. Cowperwood is providing use of the facilities to PNNL under a 35-year lease. Once the lease expires, ownership of the facilities will transfer to Battelle, and the buildings will be leased to the DOE rent free (PNNL 2010b).

According to the literature, Enhanced Use Leases (EULs) are useful for disposing of excess property by transferring the property's use to a private party. In the DOD in particular, EULs have been used this way to obtain a revenue stream. As of the end of FY 2010, 17 EULs were in place and 37 more were under review across the military departments (GAO 2011a).

Although DOD laboratories have not implemented EULs directly, DOD and other agency laboratories have benefited from these mechanisms. For example, the Army used its utility EUL authority for construction of a central utility plant (CUP) for the National Interagency Biodefense Campus. The CUP was located on underutilized property owned by the DOD at Fort Detrick. Fort Detrick and the Baltimore District Office of the U.S. Army Corps of Engineers selected Chevron Energy Solutions and Keenan Development Associates, LLC (Keenan), to develop and construct the CUP. Keenan established Keenan Fort Detrick Energy LLC to lease the land from the DOD and is responsible for selling the energy to the Army through an energy services contract. Chevron designed and built the CUP and is in charge of operating it. The plant serves the National Institutes of Health's National Institute of Allergy and Infectious Diseases Integrated Research Facility, NBACC, AMRIID, and Fort Detrick's Steam Sterilization Plant (NCPPP 2008). One DOD laboratory noted that EULs should have broader application and use by laboratories.

[28] Battelle operates PNNL for the DOE.

[29] PNNL used operating leases to construct several buildings, including the Biological Sciences Facility, Computational Sciences Facility, Environmental Technology Building, Information Sciences Buildings, the BioProducts Sciences and Engineering Laboratory, and National Security Building.

4. Prioritization Criteria

A. Criteria Descriptions

The prioritization criteria used in the F&I decision-making process at Federal security laboratories are as follows:

- *Health and Safety:* F&I projects that have health and safety deficiencies or do not meet health and safety regulations are typically prioritized over other projects.
- *Security:* Federal agencies provide laboratories with guidance to meet F&I national security requirements, such as installing fencing and locating facilities a specified, secure distance from the nearest roads.
- *Environmental Compliance:* All project proposals typically include analysis of environmental impact and compliance with Federal, State, and local regulations. For Federal regulations, such as the National Environmental Policy Act of 1969 and Council on Environmental Quality regulations, laboratories follow policies and procedures established by the agency and military departments. Laboratories consider environmental compliance in the earliest stages of planning and in the initial approval of the project's mission need.
- *Energy Efficiency and Sustainability:* Federal mandates require agencies and their Federal facilities to meet certain energy efficiency targets and sustainability requirements. (See Appendix D for select energy legislation and regulations.)
- *Impact to Mission and Research Programs:* Laboratories measure the impact to missions and research programs qualitatively or quantitatively. The impact of the proposed projects to the agency and laboratory's missions is often judged by the agency and laboratory leadership, facilities staff, and research program experts.

> *Although one particular building may have numerous projects that need to be improved, and are of critical nature, there becomes a limit to how much can be disrupted at one time within an occupied building without affecting the science being done within the building.*

- *Financial Costs and Building Condition:* Financial cost and building condition prioritization criteria are typically quantitative measures (see Chapter 6).
- *Space and Resources Optimization:* Laboratories assess how resources can be internally shared in order to implement proposed F&I projects, sometimes

resulting in centralizing equipment and space to optimize usage across the laboratory or with other laboratories.

Appendix C provides specific prioritization criteria used by each of the 10 Federal security laboratories in the study and Appendix D describes the prioritization criteria used at five private-sector companies.

B. Criteria Challenges

1. Examples of Challenges for Specific Criteria

Consider the following examples of challenges the prioritization criteria pose:

- *Health and Safety:* Health and safety requirements are particularly stringent at biosafety facilities and facilities handling high explosives and special nuclear material. Biosafety facilities are subject to inspection and certification by the Department of Health and Human Services Centers for Disease Control and Prevention and international organizations (e.g., World Health Organization). As an example, the biosafety facilities at NBACC and AMRIID must have ventilation backup systems in cases of infectious disease outbreaks, among other infrastructure and equipment.
- *Security:* Laboratories have difficulty meeting agency security requirements because compliance with requirements would often necessitate relocating buildings, which causes major disruptions to programs due to a lack of adequate temporary space to accommodate relocations.
- *Environmental Compliance:* Environmental zoning has become an issue for recapitalization and renovation of F&I at some laboratories. For example, at ARL Aberdeen Proving Ground's Spesutie Island, which is identified as a critical area in the Chesapeake Bay,[30] the planning process includes coordination with the Maryland Department of the Environment and the Chesapeake Bay's Critical Area Commission and incorporation of their priorities and requirements.
- *Energy Efficiency and Sustainability:* As an example, high-performance computing facilities have high cooling demands, so energy efficiency is an important aspect of sustainability and cost savings for these facilities.

[30] The Chesapeake Bay Critical Area is defined as "all land and water areas within 1,000 feet beyond the landward boundaries of tidal wetlands, the Bay and its tributaries," see http://www.dnr.state.md.us/criticalarea/compliance.asp.

2. Lack of Laboratory Representation in Developing Agency-Level Prioritization Criteria

Agencies typically develop F&I prioritization criteria in a top-down fashion. This is particularly true for the DOD's MILCON and BRAC programs. The DOE uses a combination of top-down and bottom-up prioritization, the former includes identifying the laboratory's capabilities and performance criteria to include in the annual plans and Ten Year Site Plans. Use of these top-down methods makes it difficult for the laboratories to make their perspectives on priorities heard.

3. Mismatch of Agency-Level Criteria and Agency Mission

Staff members at all of the pilot laboratories remarked that because agencies compete for funding, laboratory F&I needs are often prioritized below non-laboratory F&I or research program priorities.

> *There are a lot of different base tenants and what [the laboratory] does on the base is probably not a priority. This makes it difficult to compete with the priorities of the base. In some cases, it results in just trying to Band-Aid infrastructure problems.*

Three agency-level offices at the DOD noted that laboratory projects compete for funding with schools and worldwide installations that support military activities through the MILCON program. For example, when scoring each MILCON project, the Navy considers 12 functional shore-based capability areas, including the laboratories within Research, Development, Test and Evaluation (RDT&E) funding. Seven of those shore-based capability areas, including operations for Waterfront, Airfield, Utilities and Intermediate Depot Maintenance, are scored higher than RDT&E assets; two areas, Ordinance/Weapons Operations and Sailor and Family Readiness, are ranked equally; and two areas, Base Support and Logistics and Supply, are ranked below.

Further, criteria are not used adequately at military installations and agency headquarters. Installations need a better understanding of the F&I systems critical to R&D assets. This presents a problem when the installations also conduct the evaluations of the laboratory's F&I against agency criteria. Since projects must be approved by the installations, F&I projects, particularly O&M, are often ranked low or addressed only partially, leaving it up to the laboratories to subsidize these projects. At the agency-level, prioritization criteria lack specificity for laboratory F&I. For

> *The question is how to bring a coalition of people to support our WFO type of work. It is tough to get government to recognize the laboratories are supporting more than just their siloed work; and there is critical work being done for other agencies, such as in intelligence.*

instance, OSD's various F&I models used to prioritize projects in the MILCON program do not provide an R&D category code to properly account for costs associated with R&D assets.

Staff at one laboratory described difficulty explaining to agency leadership that funding for Work for Others (WFO) F&I needs would support the research necessary to sustain the agency program mission. WFO F&I projects are typically discounted in discussions with agency leadership and other laboratories that do not have large WFO portfolios.

C. Strategies for Improvement

Federal agencies and laboratories have recently incorporated three strategies in developing F&I prioritization criteria and frameworks, as described in the following subsections. In addition, a recent report provides a strategy to be considered (DOE 2011).

1. Laboratories Use Data-Driven and Qualitative Methods to Evaluate Criteria

- *Energy Efficiency and Sustainability:* LANL has installed state-of-the-art, energy-efficient computing racks. LANL, Sandia, and NRL carefully consider the placement of new computing equipment to optimize space and energy consumption.
- *Impact to Mission and Research Programs:* Examples of strategies to address new programs' impact on mission and ongoing programs follow:
  - MIT-LL developed the disruption index to indicate the degree to which a new project or alternatives to the project would interrupt current operations and research programs.
  - NRL evaluates the disruption to ongoing research program as another consideration when prioritizing F&I projects.
  - JHU-APL measures impact to its mission as the risk associated with the continuity of its customers' research programs.
- *Financial Cost and Building Condition:* The effective use of life-cycle costs and financial and economic analyses to analyze F&I alternatives, in particular, varies across the Federal agencies and laboratories. Both DOD and DOE laboratories hire architectural and engineering contractors to perform these analyses. However, these can also be done in-house.
- *Space and Resources Optimization:* A recent report by the DOE Inspector General recommended that a risk-based process be used for determining remediation priorities (DOE 2011).

2. Agencies Involve Laboratory Representatives in Developing New Criteria

The NNSA involves the laboratory's site offices in the development of and revisions to prioritization criteria used by the Construction Working Group. This collaborative process has helped NNSA laboratories better understand each laboratory's F&I needs and reach agreement on the selection of F&I projects. However, the participative process is lengthier than top-down decisions on criteria since each site office comments and revises criteria over several months of discussion. The NNSA is expanding this process to collaboratively develop criteria for its F&I disposition program (NNSA 2011b).

3. Agencies Assign Weights to Prioritization Criteria

Some agencies and laboratories explicitly assign values of importance to criteria to aid in prioritization of different factors. For example:

- The Air Force's MILCON process evaluates projects based on five criteria, the highest weighted criterion (at 50 percent) is the major command priority, while mission dependency; facility condition; life, health, and safety; and demolition are weighted 20 percent or less.
- The Army's MEDCOM established the Facility Experience Index to consider aesthetics when evaluating F&I. The aesthetics index is based on a questionnaire completed by facility managers and patients that are weighted 75 and 25 percent, respectively. Although the aesthetics index is applicable only to medical treatment facilities (as relevant to the public's perception of the quality of their care), it provides an example of how MEDCOM is applying various concepts, methods, and tools to assess its F&I needs.
- The NNSA's Construction Working Group uses a combination of weighted and unweighted criteria when evaluating projects. A 45-percent weight is given to supporting mission deliverables; a 30-percent weight, to improving safety, environmental, security, and readiness; and a 25-percent weight, to supporting operational and business goals. Urgency as a criterion does not carry any weight but provides Construction Working Group members with context as to whether the project is needed but can be delayed.

This can also lead to low prioritization of laboratory F&I as in the NRL example discussed previously.

4. Laboratories Use Prioritization Frameworks to Help Align Criteria to Mission Goals

Brookhaven National Laboratory (BNL) uses criteria as "gates for decision-making" as an F&I prioritization framework. BNL categorizes proposed F&I projects as green, yellow, or red, depending on how well they meet the four "gates" of missions need,

timing, definition, and funding so that F&I projects that are green across all four gates are prioritized at the top of the list. Projects may not need to be green across all four criteria, but the framework allows BNL to make an informed decision on projects that are ready to fund versus those that may need further discussion (BNL 2010).

5. Stakeholder Involvement and Communication

A. Stakeholder Descriptions

Based on input from the 10 Federal laboratories, F&I stakeholders in the planning, prioritization, and assessment processes include Federal research staff, private research customers, architectural and engineering firms, State and local governments, Congress and congressional committees, the Office of Management and Budget, agency working groups involved in environmental and safety monitoring and regulations, and local communities. These stakeholders are briefly described in this section. Appendix C presents details about stakeholders specific to each of the 10 Federal security laboratories in the study.

1. Federal Research Staff

Scientific research staff must communicate their F&I needs for their projects to the laboratory F&I staff and leadership.

2. Public Research Customers

Federal laboratories can provide research services for, share facilities and equipment with, and receive funding from other Federal agencies and offices. The DHS funded the construction of the National Infrastructure Simulation and Analysis Center, which focuses on research in modeling, simulation and analysis, at Sandia.[31] The laboratory's staff comprises researchers from the DHS, Sandia, and LANL. Throughout the DOD laboratories, military departments will contract across the DOD laboratories to conduct research, testing, and evaluation services. The NNSA laboratories perform research services for and share equipment with other DOE programs.

3. Private Research Customers

Federal laboratories partner with non-Federal research customers to share use of the laboratory's F&I. This is done through resource use or research partnership agreements, such as Work for Others (WFO) and Cooperative Research and Development Agreements, respectively. Resources from non-Federal research customers, although typically not a large portion of the laboratory's overall research

[31] For further information on the National Infrastructure Simulation and Analysis Center, see Sandia National Laboratories. NISAC, http://www.sandia.gov/nisac.

portfolio, can support the laboratory's F&I, including funding for major equipment (e.g., water chillers and electric generators) that would otherwise be installed using recapitalization and revitalization funds.

4. Architectural and Engineering Firms

Federal laboratories contract with architectural and engineering firms that assist with all phases of F&I site planning, design, and execution.

Laboratories typically hire architectural and engineering firms that have experience working with other Federal laboratories as well as laboratories in the academic or private sectors. Architectural and Engineering firms provide an external perspective and communicate with laboratory leadership and staff to evaluate F&I projects and integrate industry best practices into an otherwise internal process. Firms that have developed master planning models that align with Federal laboratory missions include: Flad Architects, RTKL Associates, Payette Associates, and VFA, Inc. (see Appendix D). The frameworks are guidelines with flexibility based on the laboratory's needs, research, culture, and workforce that are later integrated into their framework as criteria when evaluating F&I projects.

> *The first and perhaps most important step in initiating the…master planning process is goal setting. Without understanding the long term vision and goals for an institution and its facilities, the…master plan could face challenges in implementation…We do not impose a one-size-fits-all process on our clients.*

5. State and Local Government

State and local governments provide input on upcoming F&I projects and also must approve permits for projects that may impact the local environment. NNSA staff noted that each NNSA laboratory has a public affairs office that communicates with State governments and issues frequent press releases. For example:

- LANL coordinates with the county to provide electrical infrastructure and emergency response to their site.
- Sandia works with the State of New Mexico Finance Authority to finance the development of a new facility.

Laboratories communicated frequently with State and local government authorities. However, for DOD laboratories, the military installations serve as an intermediary to guide the laboratory's communication (e.g., Installation Management Command and the Directorate for Public Works for the Army).

6. Congress and Congressional Committees

Agency and laboratory-level staff are often required to brief Congress and their staff about their F&I plans and programs[32] and they take advantage of other opportunities throughout the year to do so. For example:

- One agency-level office emphasized that Congress is an important F&I stakeholder since congressional members can direct installations on how to distribute their funding and redirect priorities.
- Another agency-level office routinely briefs congressional staffers on F&I plans.
- Staff from a third agency-level office commented that they brief the House and Senate Committees on Armed Services and Appropriations when submitting the agency's annual budget.
- One laboratory receives congressional pressure to maintain or lower its overhead rates despite the need to tax research programs in order to fund growing O&M expenses.

7. Office of Management and Budget

OMB plays an integral role in reviewing the business proposals for Federal laboratory F&I projects, including costs analyses and the consideration of alternatives. OMB also evaluates and makes recommendations on F&I projects included in an agency's annual budget and those that are to be funded by alternative financing mechanisms (see Chapter 2, section B). Both agency-level and laboratory staff may communicate new F&I projects to OMB through formal briefings or by providing information to informal requests. OMB's Capital Programming Guide outlines the agency's involvement during multiple phases of a project, from the planning and budgeting phase to the acquisitions and management phases.

8. Agency Working Groups

DOE laboratories participate in agency-sponsored working groups, such as the Energy Facility Contractors Group (EFCOG). Established in 1991 by a group of DOE management and operations contractors, this group is a volunteer organization for sharing best practices and lessons learned (EFCOG 2010). The EFCOG is composed of 12 working groups that address acquisition management, deactivation and decommissioning, facility engineering, environmental safety and health, and sustainability and infrastructure. Membership of the group is open to management and operations contractors and their subcontractors, vendors, and consultants and includes about 90

[32] For example, see the section "National Commission for Review of Research and Development Programs of the United States Intelligence Community," http://uscode.house.gov/download/pls/50C15.txt.

private companies such as IBM, AECOM, 3M, and Booz Allen Hamilton. However, participation is not limited to these organizations as personnel from across Federal agencies, including the DOD, have been invited to participate in working group meetings.

9. State and Local Communities Involvement

Laboratories are keenly aware that they are part of the local and State communities and involve them in information gathering and as part of the decision-making process (Snodgrass 2012). Though, the classified nature of national security work may not always make this possible. BNL guidelines clearly outlines the laboratory's approach (BNL 2005):

> Experience has also shown that many minds, working together from a range of perspectives, can often come up with a better solution for any problem. It may take extra time at the beginning of a project to involve more people in decision making, but it will usually save time and money before the process is over.

B. Challenges to Stakeholder Involvement and Communication

1. Ineffective Communication within Laboratories

The F&I needs of research staff can be difficult to coordinate. For example, researchers have installed major equipment without contacting the program director or facility staff. Such situations can lead to less than optimal placement of major equipment that can negatively impact access to other scientific equipment or infrastructure.

2. Communication Issues between Laboratories and Agency-Level Oversight Offices

Some FFRDC laboratory personnel mentioned conflicting oversight by Federal agencies and regulatory bodies, such as the Defense Nuclear Facilities Safety Board. They also stated there are or have been tensions among site offices and the management and operations contractors. For instance, staff at one laboratory noted that the site office, the management and operations contractor, and laboratory leadership do not agree on which projects (particularly on alternative financing mechanism projects) should be championed by the site office. Moreover, the site office's oversight responsibilities have tended to overlap with those of the management and operations contractor, creating frustration among staff involved in the F&I planning process. Staff from another laboratory mentioned previous problems communicating with their site office. However, both the site office and the management and operations contractor agreed that the current relationship between them is at its best point in 20 years due to the open communication lines and a timely exchange of information.

3. Ineffective Communication Channels External to Laboratory

Several laboratories across the DOD and NNSA and two agency-level offices at the DOD mentioned their concern with the lack of organization among laboratories and the lack of available communication channels to agency-level staff, Congress, OMB, and other F&I planning stakeholders. For example:

- Some laboratory staff asserted that there was a lack of effective communication channels with agency-level staff and Congress. For one DOD laboratory, a particular challenge that lengthens the planning process is interacting with State and local governments since all communication must be conducted through the installation.

> *As long as the science can get done, there is a tension between investments in science and infrastructure. You need to convince the science decision-makers by making the case that F&I investments need to be made. If you can't make that case, then you probably shouldn't make investment.*

- The lack of effective communication channels was echoed by an agency-level office at the DOD. Staff at one office noted the absence of collaborations and a coalition among laboratory directors. They expressed the need to develop a coalition among their laboratories to better communicate their R&D asset needs to agency-level decision makers.
- Staff at two laboratories, one DOD and one NNSA, mentioned they encounter challenges when discussing alternative financing projects with agency-level staff and OMB. In discussing alternative-financing mechanisms at three other DOE laboratories, staff also emphasized that they would like to expand their participation in agency discussions with OMB.

4. Lack of Compelling Messages

Similarly, staff at an agency-level office noted the need to improve the laboratory's communication of R&D asset requirements to the agency. The office encounters difficulties when presenting laboratory F&I needs to Congress since a business plan with a clear objective and plan for funding, expected deliverables, and a means to measure performance is often missing or unclear.

5. Competition among Laboratories

Due to the sensitive or proprietary nature of laboratory management and operations, many laboratories across the DOD, DOE, and DHS mentioned that competition is a factor when sharing best practices and other F&I-related information.

The planning and prioritization process typically does not include external reviewers, making it difficult to benchmark against and adopt industry practices. Further, staff from one laboratory stated that, in the past, they have been hesitant to share data through agency-initiated programs, such as the Enterprise Modeling Consortium, and initially did not participate in the program. According to these personnel, NNSA laboratories are particularly competitive. Staff at several laboratories proposed that some information, such as workforce-related data, would never be shared across its agency because of the low trust levels in how the agency and other laboratories would use the information.

6. Lack of Formal Exchange of Best Practices across Agencies

Although there are various formal and informal avenues to exchange best practices on R&D asset management within an agency (e.g., EFCOG), there is no cross-agency paths. Several laboratories across the DOD, DOE, and DHS and one agency-level DOD office expressed the need to develop a more formal F&I management community of practice to facilitate the exchange of best practices, including master planning, data standardization, benchmarking, and external reviews.

For example, staff from one agency-level office and one laboratory stated they are interested in implementing alternative financing projects and are in need of a mechanism to learn from successes at other Federal laboratories.

C. Strategies for Improvement

Four strategies were mentioned during discussions that could be considered to improve the communication across the laboratories, agencies, and relevant F&I stakeholders. Of these, two laboratory strategies are specific to FFRDC laboratories managed through management and operations contracts.

1. Agencies Coordinate with Laboratories and Guide the Development of a Clear, Strategic Vision

Two recent developments to increase communication and partnerships across the DOD, DOE, and DHS are noteworthy.

- In July 2010, the secretaries from the DOD, DOE, and DHS and the Director of National Intelligence developed the "Governance Charter for an Interagency Council on the Strategic Capability of DOE National Laboratories as National Security Assets."[33] The interagency council serves to review the science and technology capabilities across the DOE laboratories for supporting government-

[33] The interagency council has been codified in H.R. 4310 Title 10 of the FY 2013 National Defense Authorization Bill, which passed the House of Representatives on May 23, 2012, but has not yet passed the Senate.

wide national security missions. The interagency council also presents a formal mechanism for agencies to support research needs across the Federal agencies.

- In November 2011, the Navy headquarters office established the Naval Laboratory and Centers Coordinating Group (NLCCG), a coordinating body created to promote communication among leadership in the Navy's laboratories and research centers. The NLCCG covers various management and operations dimensions, including facilities, workforce, and technical research capabilities. The Navy headquarters staff expressed their hopes that the NLCCG would also serve as a mechanism to advocate and better communicate a consistent message of F&I needs to the Navy and other DOD agency staff as well as other R&D asset stakeholders.

2. Laboratories and Agencies Develop Communities of Practice through Formal and Informal Meetings

F&I personnel from laboratories and agencies meet with their counterparts at formal interagency or intra-agency working group meetings and informally at relevant professional society conferences.

- Laboratory personnel attend annual and bi-annual meetings where staff can exchange best practices in management and operations with other FFRDCs and UARCs. Although not all FFRDC or UARC laboratories attend these meetings every year, the laboratories found the forum provides an opportunity to communicate challenges and possible solutions.
- The DOE's EFCOG promulgates best practices in management and operations for energy contractors working with DOE laboratories. This group also provides a formal means to leverage industry experience and benchmark across laboratories. Moreover, NNSA laboratories and NBACC indicated they maintain a community of practice through memberships and networking in F&I trade associations or relevant R&D organizations.
- At MEDCOM and the DHS, the exchange of management and operations best practices for biosafety laboratories is done informally or through conferences.

3. Laboratory F&I Managers Interact with Researchers to Ensure Optimal Planning and Implementation of F&I and Equipment

JHU-APL involves researchers within the laboratory in the F&I planning process. They do this by forming subcommittees that include subject matter experts so that the F&I staff understand their perspectives and the subject matter experts obtain an enterprise view of the overall planning. Customer satisfaction is a high priority for JHU-APL F&I staff.

4. Laboratories Establish Timely Mechanisms to Communicate with F&I-Related Stakeholders

LANL has established a formal and timely mechanism to engage with the local community and State and local government regulators on a monthly basis when planning large construction projects that may impact local communities. The meetings provide an opportunity for LANL to receive feedback on upcoming projects.

5. Laboratory Management and Operations Contractors Regularly and Cooperatively Engage with the Site Office

LANL emphasized the continuous engagement between the management and operations contractor and the site office has led to better understanding of the process and information to present for approval of F&I projects. The site office is highly integrated into the approval process and is aware of LANL's plans and upcoming F&I proposals, resulting in improved coordination and management of R&D assets.

6. Data and Metrics

A. Introduction

The final piece of this study looked at F&I assessment at the 10 Federal security laboratories in the study. Laboratories and agencies collect F&I data, generate metrics and maintain real property databases to inform their planning and resource allocations in their annual budgets. They use F&I data and metrics to prioritize and forecast investments necessary to operate, sustain, and modernize F&I and benchmark F&I across comparable laboratories within the agency. Appendix C provides examples of data and metrics that each of the 10 Federal security laboratories and agencies collects as well as available F&I trend data.

B. Descriptions

Infrastructure data are the information gathered on existing infrastructure and facilities. Data refers to information that is directly measured or gathered. Age, value, condition, and estimated upgrade or repair costs are all examples of data. Metrics are parameters or measures of quantitative assessment used to reflect infrastructure condition and determine future needs. Metrics are the ways that the data are combined or used to compare assets or prioritize projects. The ratio of deferred maintenance in a facility to its total replacement value (known as the Facility Condition Index) is an example of a metric. Data and metrics are not mutually exclusive. Age, deferred maintenance, and condition estimates are all data that are often used as metrics, since they can be used to compare or prioritize assets and repairs. Data and metrics derive most of their use in comparison, whether looking across assets or monitoring trends. The Federal Real Property Council (FRPC) and the Federal Accounting Standards Advisory Board (FASAB) issue guidance on many of the commonly used F&I metrics.[34]

[34] The FRPC (http://www.gsa.gov/portal/category/21274) was established in 2004 with the responsibility to develop a strategy to implement Executive Order No. 13327, *Federal Real Property Asset Management*. The FASAB was created in 1990 as a Federal advisory committee and produces a handbook on accounting standards for Federal entities (http://www.fasab.gov/wp-content/uploads/2011/03/FASAB_FACTS_03_2011.pdf).

1. Facilities and Infrastructure Data Collection and Databases

a. Condition Assessments

Condition assessments are performed by qualified personnel that collect data and analyze the state of the R&D F&I, including age, design, construction methods, and materials. There are various types of F&I condition assessments. Some assessments extend beyond the building condition or are focused on a specific building component.

The Army's Engineer Research and Development Center's (ERDC) BUILDER data management system incorporates the Knowledge-Based Condition Survey Inspection (KBCSI) framework to support F&I data collection. KBCSI is not a detailed or specialized assessment, but it provides sufficient F&I data for short- and long-term planning. KBSCI is based on three main types of inspections; each is faster but less accurate than the next. The KBSCI methods aim to use the most appropriate inspection to satisfy the F&I data need and proposes that inspections be scheduled based on the building and component importance, current and remaining service life, and rate of deterioration, among other building dimensions (ERDC 2006).

BNL's space utilization assessment measured the condition of the buildings as well as how the building is used. The assessment includes collection and measurement of square footage per occupant and usage efficiency.

The NNSA conducts roof assessments at all eight of their sites as a part of RAMP. Assessments are conducted at each site on a periodic basis to monitor changing conditions and assess the agency's investments. Since RAMP was focused only on roofing, the NNSA hired a specialized roof contractor, which led to data that the NNSA identified as trustworthy.

Alternatives to walkthrough assessments include automatically tracking work orders and monitoring potential containment breaches using automatic sensors on F&I supportive equipment. Automatic data-gathering systems, known as Building Automation Systems, have the advantage of collecting data in real-time and being standardized (NRC 2011b). How often assessments are conducted depends on the laboratory, agency requirements, and the availability of funding. The frequency ranges from one-off assessments for specialized laboratory or research functions, such as information technology, to annual data collection and frequent assessments based on the F&I need.

2. Database Management Systems

The following subsections provide two examples of F&I database management systems used by the DOD and DOE. No DHS F&I database management systems were identified.

a. Department of Defense Databases

BUILDER is a data management system developed by the Army's ERDC's Construction Engineering Research Laboratory and endorsed by the DOD for use across all military departments. BUILDER serves as an inventory tool and provides information on condition, functionality, mission dependency, and general F&I information to generate work schedules for future maintenance. Conveniently, F&I staff conducting condition assessments can use a pen-based electronic clipboard to enter data directly into BUILDER's Remote Entry Database during inspections. Moreover, the IMPACT modeling tool within BUILDER forecasts maintenance, repair, and replacement work requirements over the next 10 years. BUILDER has been used by the Navy for 2 years and is being tested throughout the Air Force and Army (ERDC 2010).[35] The Smithsonian Institution has expressed interest in the BUILDER system.[36]

The military departments also maintain individual data management systems. The Army's Web Real Property Planning and Analysis System (WebRPLANS) maintains real property data, personnel data, and agency-level requirements. WebRPLANS is used in the Army's Real Property Master Plan and to justify MILCON and other F&I funding projects. WebRPLANS also contains the Installation Status Report application, which is used by the Installation Management Command and Army headquarters to evaluate installation condition and performance in the areas of infrastructure, environment, and services (U.S. Army 2007).

b. Department of Energy Databases

The DOE mainly uses the Facilities Information Management System (FIMS) database to collect F&I data. FIMS is used as an inventory tool and includes F&I data related to condition, utilization, disposition, mission dependency, and maintenance (DOE 2012d). Standard and ad-hoc reporting tools are built into FIMS to provide users with flexibility in analyzing F&I data.

3. Modeling and Benchmarking

Facility condition models can be used at the individual laboratory level or across laboratories to provide an enterprise view of the laboratories at an agency. In either case, the models provide estimates of repair needs, competencies and abilities of staff, and repercussions of changes in F&I budgets for future years throughout the laboratory enterprise. In addition to F&I needs, some models include other enterprise concerns such

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[35] The Air Force completed a trial of a BUILDER roofing assessment module in 2009, see ERDC. BUILDER Sustainment Management System (http://erdc.usace.army.mil/cerl/builder-sustainment-management-system).

[36] Discussion with OSD staff, October 3, 2012.

as supply and demand for workforce capabilities and personnel retention. These models can be used to prioritize projects and to apportion funding across laboratories.

The subsections that follow provide two examples from the DOD and NNSA. No DHS F&I modeling tools were identified.

a. Department of Defense Models

Prior to 2011, OSD used or began development of three F&I models to standardize F&I cost requirements across the military departments (Table 5). The models were developed by two architectural and engineering contractors, R&K Solutions, Inc.[37] and Whitestone Research Corporation (see Appendix D), and incorporate cost factors based on industry standards for specific types of F&I. The Facilities Sustainment Model uses industry data from RSMeans, a provider of construction costs data.[38] For F&I types that have no counterparts in the private sector, the cost factors are derived from the military departments and historical data (Thornhill 2011). The main input into the models is F&I data reported by the military departments in the Real Property Inventory records and maintained in the DOD's Facilities Assessment Database.

Table 5. DOD Facilities and Infrastructure Models

Model and Implementation Year	Description
Facilities Sustainment Model, 2003 (still in use)	Forecasts the annual investments necessary to maintain F&I in good working order over a 50-year service life. The model includes O&M and major repairs or replacement of F&I components, such as heating and cooling systems. It excludes other tasks related to F&I operations, such as landscaping, cleaning, waste disposal, and utilities (DOD 2010c).
Facilities Operation Model, 2005 (no longer in use)	Forecasts the annual investments necessary to operate F&I. The model is used as a budgeting tool for the Future Years Defense Plan and annual budget. F&I are categorized within 12 primary functions, such as utilities, fire protection and prevention, and real property management and engineering services (DOD 2005, 2012).
Facilities Modernization Model, 2010 (no longer in use)	Forecasts the annual investments necessary to modernize F&I. The model includes only modernization and excludes sustainment. Previously, the DOD used the Facility Recapitalization Metric, which is calculated based on a 67-year recapitalization benchmark for all F&I types. The model uses algorithms specific to an F&I type to generate the modernization requirement based on Replacement Plant Value, depreciation, expected service life, and residual value at the end of the expected service life .

[37] About R&K Solutions: http://www.rksolutions.com.

[38] RSMeans is the leading national cost estimating system across public and private sectors. About RSMeans: http://rsmeans.reedconstructiondata.com.

In 2011, OSD stopped using two of the three models. The Facilities Sustainment Model is the only model currently in use. OSD no longer uses the Facilities Operation Model and the Facilities Modernization Model for the following reasons:[39]

- The *Facilities Operation Model* consists of various functions, of which utilities makes up the dominant components of the model. The military departments recognized that they obtained more accurate and reliable estimates of future utility costs by using a 3-year average of actual utility costs. Another third of the model consisted of emergency services, such as firefighting needs, for which the DOD had already established well-defined staffing requirements. OSD realized that the calculation of staffing costs based on geographic location and function provided just as good or better estimates for these services than their modeling efforts. The remaining model components, such as custodial and landscape services, were areas in which installations and commanders could take larger risks, and thus modeling this function was not as valuable for installation operations.
- The *Facilities Modernization Model* received some opposition from the DOD Under Secretary of Defense Comptroller and other agency leadership. The model forecast the future condition of and investments needed to modernize and replace a facility based on the future condition, but it did not help understand current condition or generate installation requirements useful in planning and budgeting.

b. Department of Energy Models

Facilities throughout the DOE, including the NNSA, are assessed through the Condition Assessment Survey program. The Condition Assessment Survey program consists of a physical assessment of assets, a web-based database that projects repair, replacement, and deferred maintenance costs, similarly based on data from RSMeans (DOE 2012a). Facility managers and inspectors enter the data into the Condition Assessment Information System, which is linked to FIMS and it sends deferred maintenance data to FIMS. Facility staff use the projected annual deferred maintenance cost data to develop their budget requests.

Another initiative that incorporates modeling is the NNSA's Enterprise Modeling Consortium. The NNSA established the Enterprise Modeling Consortium in order to integrate and enhance data and models used across the eight management and operations sites into an enterprise-wide model. The integrated modeling results provide decision support analysis to the NNSA's leadership regarding weapons system programmatic, F&I, and workforce investments in the nuclear security enterprise. The model is also used to analyze the impacts and possible risks or consequences of weapons system program

[39] Discussion with OSD staff, October 3, 2012.

decisions (NNSA 2011a). Although NNSA laboratories provide their own site models to the Enterprise Modeling Consortium, the consortium has also served as a forum to create collaboration among the laboratories to develop new models.

Within the F&I element, the Enterprise Modeling Consortium has planned four projects (NNSA 2011a):

- *Life-cycle portfolio model*: This model captures the full life-cycle cost from acquisition through disposition for the entire NNSA real property portfolio and includes micro-building and equipment models for all NNSA sites.
- *Master planning model*: This project develops a suite of modeling tools to model the interdependencies of F&I projects and scenarios for changing duration and funding levels of projects.
- *Risk metrics*: This project surveys industry practices and develops risk metrics that will be integrated into the F&I model to predict an asset's ability to meet mission needs in the future.
- *Business case analyzer*: The business case analyzer evaluates trade-offs and alternatives in sustainment, recapitalization, and construction projects and helps identify a project's key factors, costs, capabilities, risks, and contingency plans.

Although, some Enterprise Modeling Consortium models are being tested at one NNSA laboratory, the F&I element models were not funded in fiscal year 2012 and future funding for the program remains uncertain.[40]

c. Benchmarking

Benchmarking of the data is typically done by comparing infrastructure data across Federal, industry, and university laboratories to estimate how the laboratory's condition compares to similar laboratories. Benchmarking can be done against data collected in past years or estimates of projected costs. Other benchmarking efforts are conducted across but internal to the agency performing the benchmarking, such as the DOE-SC's Mission Readiness Peer Review (discussed in section D.3 of this chapter).

[40] Email correspondence with the NNSA headquarters office, September 14, 2012.

4. Facilities and Infrastructure Metrics

The most commonly used F&I metrics can be divided into several categories based on the condition, use, costs, needs, relationship to mission, and sustainability dimensions being measured. These categories and their metrics are as follows:

1. Condition of a facility.
    a. *Age* is the number of years the building has been operational. This metric is best used alongside other condition metrics since an asset may have been recapitalized and improved once or multiple times since it became operational. An estimate of the expected or remaining service life in years is a more accurate estimate of condition than age.
    b. *Condition Index (CI)* is defined as the repair needs of a facility over the total replacement plant value.
    c. *Facility Condition Index (FCI)* is defined as the deferred maintenance of a facility over the total replacement plant value, often expressed as a percentage (NRC 2011b).
    d. *Asset Condition Index (ACI)* is one minus the Facility Condition Index (NRC 2004a).[41]

    (The ACI and FCI are closely linked, although they are not defined or reported consistently across agencies and laboratories.[42] In 2008, the GAO released a report that stated that there is no standardized definition of "repair needs," which is one of the factors used to compute the ACI, and that some agencies used it synonymously with "deferred maintenance" (GAO 2008b). No information on whether the term has been strictly defined since 2008 could be found.)
2. Use of a facility:
    a. *Asset Utilization Index (AUI)* is a percentage (from 0 to 100) of the space used in the facility. The AUI can be calculated for various asset categories, such as offices, laboratories, housing, and warehouses (FRPC 2011).
    b. *Facility Experience Index (FEI)* is a rating that describes the aesthetic condition of the facility. A health care consultancy called The INNOVA

[41] Note that this report uses the U.S. Coast Guard Office of Civil Engineering definition of "Facility Condition Index." The different NASA definition is not discussed in this report (NRC 2004a).

[42] Although annual reporting requirements call for laboratories to provide the FCI, when the study team requested condition index data from laboratories and agencies, the agency provided the ACI for laboratories.

Group[43] developed the FEI to assess MEDCOM's medical treatment facilities (Kiyokawa 2012).

3. Costs of operations and deficiencies:
    a. *Operating cost per square foot* is the total annual funding, normalized per square foot, necessary to support the laboratory's F&I in terms of O&M, utilities, cleaning, and roads/grounds expenses (ERDC 2011). This standard metric is used to compare the bottom-line performance of F&I over time.
    b. *Replacement Plant Value* (RPV), which is also known as Plant Replacement Value, is the cost of replacing an asset at today's standards (GSA 2010a).
    c. *Deferred maintenance* is defined as the repair and maintenance activity that has been put off or deferred and has not been scheduled (FASAB 2011).
    d. *Needs Index* sums deferred maintenance and the funding needed for capital renewal requirements divided by the RPV (NRC 2004a).
4. Needs of a facility in terms of the time needed to recapitalize.
    a. *Recapitalization Rate,* which is the inverse of annualized capitalized expenses in recapitalization over the RPV, resulting in the number of years it will take at the current rate of spending on recapitalization to entirely recapitalize an asset.
5. The relationship between an asset and its mission.
    a. *Fitness for Mission Index* combines the FCI with the Needs Index to provide a measure of what is needed to make the asset fully functional.
    b. *Mission Condition Index* adjusts the ACI by a factor that represents how well an asset can support its mission (NRC 2004a).
    c. *Mission Dependency Index (MDI)* is a score (0 to 100) that measures the mission criticality of an asset. It was developed by the Navy, Coast Guard, and the National Aeronautical and Space Administration and is used for all DOD F&I (Grussing et al. 2010). MDI is based on a four-part questionnaire to determine two risk factors: the mission intra-dependency within (MDw) and the mission inter-dependency between (MDb) various F&I and their functions (Antelman, Dempsey, and Brodt 2008). MDw and MDb scores are determined by mapping responses to questions to a matrix of values (Figure 3).

[43] About The INNOVA Group: http://www.theinnovagroup.com.

1) *MDw Interruption and Relocation Ability*: How long could the functions supported by the F&I be interrupted without adverse impact to the mission? (Q1) If the F&I were no longer functional, could you continue performing your mission by using another facility or setting up temporary facilities? (Q2)

2) *MDb Interruption and Relocation Ability*: How long could the services provided by the F&I be interrupted before impacting mission readiness? (Q3) How difficult would it be to replace or replicate the services provided with another? (Q4)

MD_w

Q2: Relocate-ability	Q1: Interruptability of Function: None (Available 24hrs/7 days)	Briefly (≤ 24 hrs)	Short (1 to 7 days)	Prolonged (> 7 days)
Impossible	6.00	5.50	4.67	3.67
X Difficult	5.10	4.43	3.43	2.60
Difficult	4.90	4.23	3.23	2.40
Possible	4.00	3.00	2.00	1.00

MD_b

Q4: Replace-ability	Q3: Interruptability of Function: None (Available 24hrs/7 days)	Briefly (≤ 24 hrs)	Short (1 to 7 days)	Prolonged (> 7 days)
Impossible	6.00	5.50	4.67	3.67
X Difficult	5.10	4.43	3.43	2.60
Difficult	4.90	4.23	3.23	2.40
Possible	4.00	3.00	2.00	1.00

Source: Naval Facilities Engineering Command (2012).

Figure 3. Mission Dependency Index (MDI) Calculation Matrices for Mission Intra-Dependency (MDw) and Inter-Dependency (MDb)

d. *Building Functionality Index* is based on an assessment similar to a condition assessment, but instead of examining the condition in terms of repair needs, the asset is examined in terms of the function it performs and its fitness for changing missions (Grussing, Uzarski, and Marrano 2009).

e. *Building Performance Index* is a ratio of the physical building condition index and the building functionality index (NRC 2011b).

6. Sustainability includes Federal Leadership in Energy and Environmental Design (LEED) certification standards and targets for energy efficiency, such as high-performance sustainable buildings.[44]

a. LEED rates a building based on environmental sustainability such as water savings, energy efficiency, materials selection and indoor environmental quality. In 2011, GSA upgraded the LEED requirement for new Federal

[44] LEED certification requirements were developed by the U.S. Green Building Council in 2000 and are updated periodically. For additional information, see the U.S. Green Building Council's website at http://www.usgbc.org/

building construction and substantial renovation projects to the Gold level, the highest certification level (GSA 2010b).[45]

b. The DOE's high-performance sustainable buildings goals address provisions in Executive orders related to achieving efficiencies in environmental, energy, and transportation resources.[46]

C. Challenges to Using Data and Metrics

1. Challenges Related to Facility Condition Assessments

a. Cost

One challenge in collecting data is the high cost of conducting facility condition assessments. Assessments are time consuming and require considerable staff commitment, forcing them to compete with other priorities which may be given preference when budgets are tight.

This situation leads to difficulties in keeping data updated and accurate. All agencies require laboratories to annually update F&I data in their respective databases\ management systems in the same time period. These databases provide only a "snapshot" of the F&I for that year since resources are not available to make them real-time reporting instruments. If maintenance has been performed after the snapshot, the database will not reflect it, leading to an inaccurate picture of the F&I condition. Decision makers should refrain from using data taken between the reporting dates. When data may be needed by staff in real time, precautions should be taken to ensure it is complete and accurate. Some laboratories conduct assessments only every 3 or 5 years, while still others lack the resources to conduct regular assessments at all.

> *[The building condition metric is] based on periodic inspections, each building is assigned a numerical condition score from 0 to 100...However, since the process is extensive, costly, and time-consuming, the scores are not always reflective of the current building condition…Although we consider this criteria, we rely equally, or more, on our current expert in-house knowledge of the building condition.*

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[45] While GSA requirements are for buildings on nongovernment-owned land, GSA requirements are generally followed across the government.

[46] For further information on high-performance sustainable building goals, see Whole Building Design Guide, "Policy Background," available at http://www.wbdg.org/references/fhpsb_policy.php and \ Executive Order No. 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* and Executive Order No. 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*.

Deferred maintenance must be reported consistently to be a useful metric. In addition, some deferred maintenance items are more important than others. For example, replacing a light fixture may not be as urgent as a correcting a fault in an HVAC system. However, such distinctions are not currently captured in the metric.

b. Choosing In-House versus External Contractors

Some laboratories contract with architectural and engineering firms to conduct assessments independently or with their in-house facility staff. Other laboratories depend on their military department engineering services to assess F&I. Maintaining the capability to conduct infrastructure assessments in-house (as opposed to hiring a contractor) has its advantages and disadvantages. One laboratory indicated that having the in-house capability allows the assessment team to build up expertise on the unique characteristics of the laboratory that leads to more informed decision-making. In addition, a laboratory with an in-house assessment capability can better understand and use contractors' assessments.

Staff at one laboratory expressed concern that not being directly involved in the F&I condition assessments isolates the laboratory's F&I staff from knowledge of the asset's condition, making them less effective in responding to deficiencies.

But having an external contractor conduct the assessments can be beneficial as well. Contractors may provide consistency, impartiality, and improved accuracy in data collection, particularly in specialized areas where in-house F&I expertise may be lacking. However, the agency structure providing engineering services, such as for DOD laboratories, and budget uncertainties may make it difficult to use contractors consistently, if at all, or provide adequate funds for complete assessments of all F&I.

2. Challenges Related to Databases

Facilities Information Management System (FIMS) data, although improving, is not necessarily complete and is sometimes misused. FIMS is validated annually by Federal oversight staff at each laboratory and every 2 to 5 years by a headquarter-level external review. Deficiencies are tracked to correct and revalidate areas failing the initial validation. However, there are various reasons why FIMS is not being used as intended:

- FIMS users may not understand the definitions and requirements for the various fields and may be likely to misuse the data by misinterpreting its meaning and significance beyond that which was intended. This is a user problem common to all databases.
- Laboratory staff may have misconceptions of the use of FIMS for daily maintenance decisions or strategic F&I investments. FIMS is not intended to serve those purposes rather it is an agency-level database designed to collect data

for reporting the Federal Real Property Council and other external entities. This helps explain why DOE laboratories are filling this gap by implementing their own site-level databases and management systems. Additionally, NNSA laboratories plan to better integrate some of their site-level database management systems with FIMS.

- In the process of fulfilling its reporting function, FIMS collects high-level data on deferred, actual, and required maintenance, replacement plant value, and other parameters that are useful for the development of high-level metrics. However, some NNSA staff members believe these metrics are not sufficient for measuring the condition of the F&I.

3. Lack of Transparency in Assessments

F&I data collection and the calculation of metrics can lack transparency. Many laboratories require that F&I data be collected and validated through their supporting entities within their military departments (e.g., the Navy's Naval Facilities Engineering Command and the Army's Installation Management Command). There can also be subjectivity in conducting assessments if there is motivation to over- or underreport maintenance and other facility repairs. In addition, F&I data may not be collected or be incorrect. For example, during one agency's most recent baseline assessment, several buildings were found to be improperly assigned to Army installations.

4. Unintended Consequences of F&I Data Collection

Some systems use aggregated asset-level information to provide an overall rating for a building (e.g., BUILDER and the Army's Installation Status Report). If the building has a high rating, then it is ranked low on the F&I priority list even though the building may have failing critical components. Other systems are used for building-level granularity when they are intended to give only a portfolio view.

Laboratory staff are also hesitant to share their data. In some cases, laboratories may not benchmark against or engage with others that do similar work because they are in competition for contracts, and such data could potentially provide an advantage. At some laboratories, there is concern that the infrastructure data provided could be used by agency headquarters to interfere with the laboratories' management of their own facilities. From the agency-level perspective, Federal officials have an obligation to understand the condition of facilities and to hold the laboratory staff and contractors accountable for their delegated stewardship of the real property. In this sense, laboratories have an obligation to provide the agency headquarter offices with F&I information necessary to develop a shared understanding of F&I condition and work collaboratively to protect and sustain the government's F&I investments.

5. Challenges Related to Models

GAO has criticized the DOD for not verifying F&I data in the Facilities Assessment Database and using inaccurate cost factors that result in unreliable forecasts (GAO 2008a). Although the DOD has made some progress to address data accuracy concerns, a recent study comparing the DOD and other modeling forecasts with actual costs from 2007 to 2010 showed an approximate +/–30-percent error with the DOD's models compared with a +/–10-percent error using other models implemented by the individual military departments (Thornhill 2011). Some factors that may contribute to the DOD model errors include the inability to capture changes to Federal policies (such as energy efficiency and sustainability requirements), price increases for oil and electricity commodities, and current age and condition of the F&I. Certain DOD laboratory personnel noted deficiencies in data and accuracy found in the models and therefore view the agency-level models as untrustworthy and do not use them in their F&I planning.

6. Challenges Related to Benchmarking

Benchmarking against other laboratories may not be useful for laboratories that have unique missions, requirements, or capabilities. For example, the Army Medical Research and Materiel Command (AMRMC) and NBACC have containment laboratories, which are expensive to maintain. Containment facilities may have large variability in construction and operating costs, depending on the biosafety level and research equipment being used. In addition, some laboratories own assets where the entire facility is the R&D equipment and where comparable F&I data may be unavailable (e.g., synchrotron light source or hypersonic wind tunnel).

7. Difficulty Capturing Effect of F&I on Mission

Another challenge is defining and quantifying the ability of an asset to carry out its mission and relating it to the mission of their parent organization. Commonly used metrics such as FCI and deferred maintenance may capture the overall condition of an asset, but not how capable an asset is to carry out its particular mission. According to staff at two laboratories, this link between an asset's condition and its capability to support its mission is not captured in most widely used metrics and, in some cases, cannot easily be incorporated into the decision-making process.

> *The most critical issue is Mission Readiness—"we are not doing our job unless we are supporting science." We report FCI, but it is not used [at the laboratory]. There is no mission readiness component to FCI, so it does not tell you how to prioritize maintenance projects. FCI only tells you the basic structural capability of a building, but not whether it has the right hoods or the vibration level you need to do science.*

Quality and functionality are not synonymous, and a building may be in perfect condition but not suited for its purpose or may not have been originally built to accommodate research.[47] This was specifically highlighted in interviews as a problem for medical research F&I and micro-electronic laboratories, where treatment requirements and research equipment, respectively, can change rapidly, and quickly render a state-of-the-art building obsolete.[48]

Both laboratories and agencies struggle with applying the appropriate metrics to capture F&I's impact on the mission. The MDI is a subjective ranking based on input from the facility's users of how important a building is to the laboratory's mission. It is useful at the individual asset level, but it accounts for only the general mission of the laboratory, not how capable a building is for supporting its intended use.[49] The Fitness for Mission Index used by the NNSA is described as a combination of the FCI and the Needs Index to reconcile how well a building has been preserved with what must be added to the building. It does not provide a threshold whether an asset is "good enough," and is only used as a figure of merit to generally describe the asset's condition.[50]

Some F&I data the laboratories deem important (such as researcher preferences and quality of life) are no longer formally collected or considered in F&I investment decisions. Laboratory personnel perceive these dimensions as directly related to attracting, recruiting, and retaining staff since modernizing and recapitalizing F&I positively impacts the quality of life and competitiveness with other laboratories.

D. Strategies for Improvement

Four strategies were proposed by various laboratories that might be used to overcome the challenges in collecting data and using metrics. While no single strategy may fit the needs of all laboratories, the methods described here have been found by staff of at least one laboratory to be helpful.

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[47] Some Air Force Research Laboratory facilities are operating in facilities originally built as an airman dining hall and a vehicle maintenance shop. Problems arise since the facility may not be totally adequate for the research conducted or located near the main portion of operations of the program.

[48] On the other hand, an old building that has been upgraded to accommodate state-of-the-art equipment enables high-quality research or, in the case of hospitals, modern care.

[49] Within the Air Force, the MDI represents the dependency and severability of the asset to the Air Force mission and not the laboratory's mission or even the installation's mission.

[50] NNSA staff members noted that as they gain experience with the Fitness for Mission Index, they plan to integrate it with facilities and weapons reliability models and develop a correlation among Fitness for Mission Index, recapitalization rates, FCI, and metrics for infrastructure risk to mission.

1. Laboratories and Agencies Provide High-Level Guidance on the Importance of Regularly Collecting and Updating Data and Metrics

Data and metrics are important for tracking the quality of F&I over time and for consistent decision-making. Agencies and laboratories have established guidelines to standardize F&I definitions and collection of data. In addition, Federal guidelines on F&I accounting and reporting have been established through the FRPC, FASB, and FASAB. However, discussions with laboratory and agency staff showed room for improvements given continuing variability in how F&I data and metrics are collected and interpreted across laboratories and agencies.

2. Agencies Use Long-Term Modeling Tools for Scheduling Maintenance and Assessment

Automatically scheduling assessments on an asset-by-asset basis can reduce the cost of assessments, since not every asset must be assessed every year. Thus, instead of annual condition assessments of all assets, only the assets that are scheduled for an assessment or are in poor condition need to be inspected. This flexibility in performing assessments is incorporated into the BUILDER data management system, which models the remaining lifetime of specific assets, automatically updates models after data from additional assessments are entered, and uses the models to automatically produce updates on scheduled maintenance (ERDC 2010).

3. Laboratories and Agencies Engage in Benchmarking or Other Data-Sharing Efforts

Benchmarking is conducted using external contractors with expertise in R&D facilities, peer reviews, or comparison with other laboratories. Facilities and infrastructure data can be proprietary or sensitive, as laboratories may be competing for contracts and the F&I data could provide a laboratory with an advantage. One option is to therefore have an external entity lead the benchmarking effort and ensure the anonymity to protect this sensitive information.

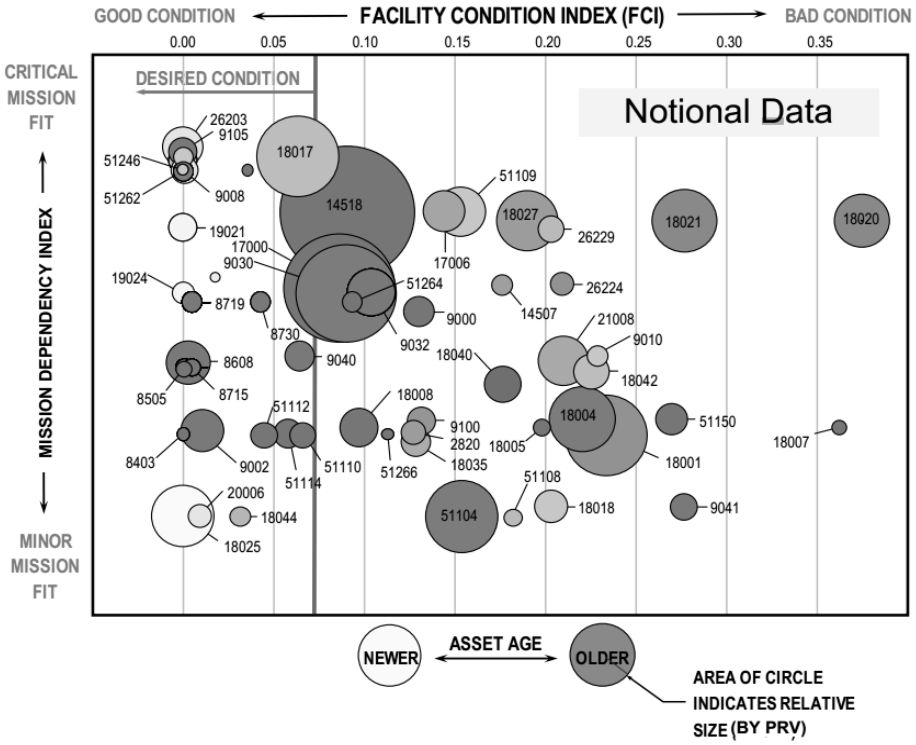
Peer review practices, such as the Mission Readiness Peer Review within the DOE–SC, is a strategy employed at the agency level, since a peer review process does not require uniformity in data elements and definitions in the same way as data-to-data benchmarking. DOE-SC's Mission Readiness Peer Review sends F&I personnel from DOE-SC laboratories to assess the F&I process of other DOE-SC laboratories. Instead of attempting to compare laboratories' data, the Mission Readiness Peer Review assesses the mission readiness process itself and whether it is aligned with the laboratory's mission objectives. Laboratories involved in the peer review team are asked to evaluate whether the process is comparable to one that would be produced by their own laboratory.

Since 2010, the DOE-SC has conducted the Mission Readiness Peer Reviews at 6 of their 10 DOE-SC laboratories. BNL's peer review, for example, included Lawrence Berkeley National Laboratory, Argonne National Laboratory, Oak Ridge National Laboratory, and Pacific Northwest National Laboratory. The DOE-SC is currently updating the Mission Readiness Peer Review process and developing a new schedule for the rest of its laboratories.

Laboratories use other innovative methods to compare their F&I with dissimilar characteristics. NBACC and JHU-APL select comparison laboratories based on their research area to improve the accuracy of the benchmark. Other laboratories informally visit and communicate with F&I staff from other Federal, academic, and private sector laboratories.

4. Laboratories and Agencies Use Integrated Metrics

Multiple metrics can be used to provide a complete picture of the asset and its value to the laboratory's or agency's missions. For example, the Air Force Civil Engineer Support Agency (AFCESA) uses the MDI in conjunction with condition, age, and value for each asset to provide a portfolio-level perspective of its F&I (U.S. Air Force 2011). Figure 4 is a graphic representation using notional data.



Source: U.S. Air Force (2011).

Figure 4. Mission Dependency Index (MDI) Integrated with Facility Condition Index (FCI), Asset Age, and Replacement Plant Value (RPV) Using Notional Data

7. Facilities and Infrastructure Workshop

A. Introduction

For information beyond that gathered from discussions with F&I staff at the Federal laboratories and agencies in the pilot study, the STPI team convened a workshop on February 22, 2012. A cross-section of 50 F&I experts from Federal agencies and laboratories and private industry participated (see Appendix E for workshop participants). This workshop was a unique opportunity for F&I professionals from Federal security laboratories to interact, discuss common issues, and share best practices.

Prior to the workshop, participants were given white papers on challenges and best practices for (1) prioritization and funding and (2) collecting and using metrics. The white paper on prioritization and funding explored F&I processes across the agency and within the laboratory, traditional funding for F&I projects, and alternative financing mechanisms. The white paper on collecting and using metrics discussed data, analysis tools, and database management systems used for quality assessments.

The STPI team also provided participants with a list of policy recommendations that were based on discussions with F&I staff at the Federal laboratories and agencies. The recommendations were organized into four themes:[51]

- Prioritization and Planning
- Funding Sources
- Science and Technology (S&T) Stakeholder Input
- Data and Metrics

These themes roughly align with the grouping of recommendations for next steps proposed in Chapter 8.

[51] The categorization evolved as the study team analyzed the totality of information collected for the study.

B. Summary of Proceedings

The workshop combined formal presentations by F&I experts in the morning with a World Café[52] participatory discussion in the afternoon to maximize content and participation. Presentations on prioritizing and funding, collecting, and using metrics and looking to the future were given by representatives from the DOD laboratories, DOE-SC laboratories, NNSA laboratories, and the agency headquarters offices. Panel chairs led a discussion following presentations on each topic.

For the World Café, each workshop participant was randomly assigned to one of four groups that travelled together to each theme table. They spent time at each theme table discussing the recommendations, revising them, and adding to them as needed. At the last table, each group reviewed collected comments from all groups and presented a synthesis to workshop participants. Participants then voted on the top recommendations for improving F&I prioritization, planning, and assessment.

C. Voting Results

Participants cast up to three votes for recommendations in each of the four World Café themes (12 votes total). Participants could use none or all of their votes, and they could cast more than one vote on a single recommendation. Figures 5 through 8 indicate the votes for the top three recommendations for each of the four themes.

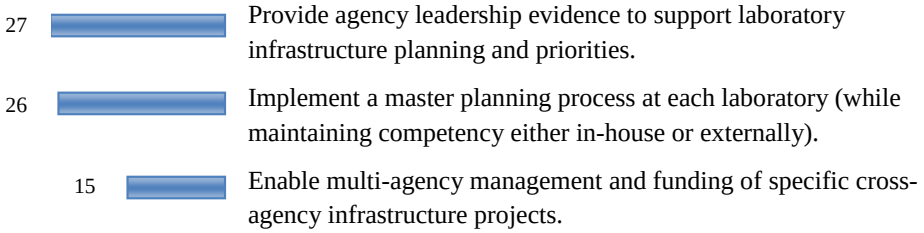


Figure 5. Prioritization and Planning Theme (87 Total Votes)

[52] The World Café is based on a systematic method to seek input from workshop participants. A large group of participants are divided into smaller groups that will move from table to table, with participants at each table answering the same question. Each round lasts about twenty minutes. Each table has a specific question or theme to address and prepares a summary of their conclusions or recommendations. After each group has completed the round of tables/questions, there is a broad group discussion. See the World Café website for more information: http://www.theworldcafe.com/method.html.

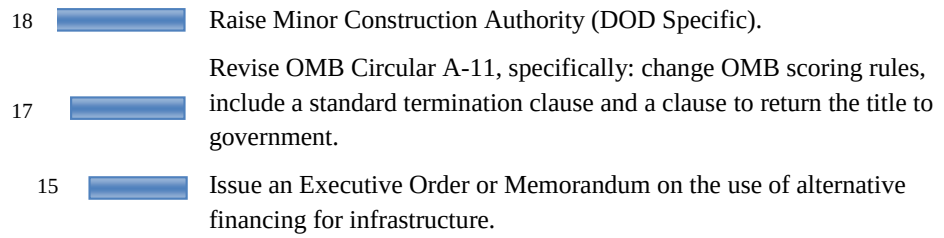


Figure 6. Funding Sources Theme (84 Total Votes)

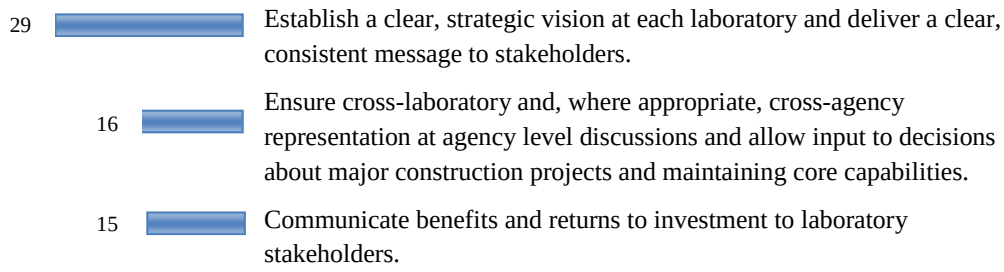


Figure 7. S&T Stakeholder Input Theme (87 Total Votes)

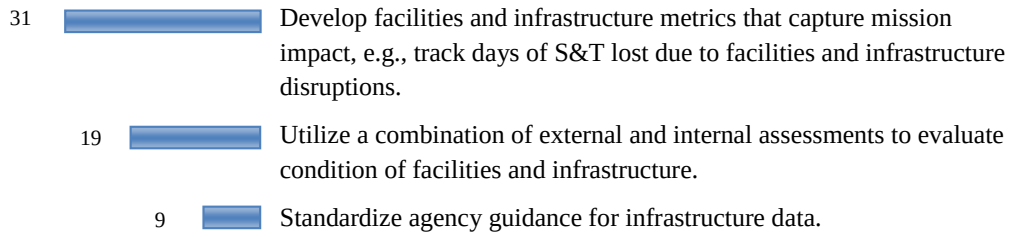


Figure 8. Data and Metrics Theme (83 Total Votes)

The findings from the workshop confirmed and helped to refine the insights obtained from the literature and interviews. In addition, the voting results were considered in developing recommendations for near-term executive action discussed in the next chapter.

8. Summary and Next Steps

A. Summary

For this study, STPI researchers used multiple methods to identify and document the planning, prioritization, and assessment used by F&I staff at the DOD, DOE, and DHS and a selection of 10 of their laboratories. The methods included reviewing government documents, interviewing agency and laboratory stakeholders and external experts, and conducting a workshop.

Based on the information obtained from each of these methods, the team identified four areas in which F&I staff face challenges. The team also identified strategies undertaken by the selected laboratories in an attempt to overcome challenges in each of the four areas. Tables 6 and 7 summarize these challenges and strategies.

Table 6. Summary of Challenges to Planning, Prioritization, and Assessment of Facilities and Infrastructure at Federal Security Laboratories

Area	Challenges
Planning Processes	Inconsistent leadership support at the agency level
	Lack of integration of agency and laboratory processes
	Misunderstanding of cross-competencies within and across agencies
	Lack of interagency coordination
	Difficulty meeting limits of special allocations and programs
	Increased need for trained F&I staff
	Barriers to gaining alternative financing approval
Prioritization Criteria	Challenges for specific criteria
	Lack of laboratory representation in developing agency-level prioritization criteria
	Mismatch of agency-level criteria and agency mission
Stakeholder Involvement and Communication	Ineffective communication within laboratory
	Communication issues between laboratories and agency-level oversight offices
	Ineffective communication channels external to laboratory
	Lack of compelling messages
	Competition among laboratories
	Lack of formal exchange of best practices across agencies
Data and Metrics	Challenges related to facility condition assessments
	Challenges related to databases
	Lack of transparency in assessments
	Unintended consequences of F&I data collection
	Challenges related to models
	Challenges related to benchmarking
	Difficulty capturing F&I's impact on mission

Table 7. Summary of Strategies for Improving Planning, Prioritization, and Assessment of Facilities and Infrastructure at Federal Security Laboratories

Area	Strategies
Planning Processes	Agency and laboratory leadership champions F&I needs and facilitates cross-agency and laboratory participation
	Agencies simplify F&I planning and operations by collocating their F&I
	Agencies set aside funding for F&I projects in the annual budget
	Laboratories develop an F&I master planning and investment framework
	Laboratories develop and use internal and external expertise in F&I master planning
	Laboratories use alternative financing mechanisms
Prioritization Criteria	Laboratories use data-driven and qualitative methods to evaluate criteria
	Agencies involve laboratory representatives in developing new criteria
	Agencies assign weights to prioritization criteria
	Laboratories use prioritization frameworks to help align criteria to mission goals
Stakeholder Involvement and Communication	Agencies coordinate with laboratories and guide the development of a clear, strategic vision
	Laboratories and agencies develop communities of practice through formal and informal meetings
	Laboratory F&I managers interact with researchers to ensure optimal planning and implementation of F&I and equipment
	Laboratories establish timely mechanisms to communicate with F&I-related stakeholders
	Laboratory management and operations contractors regularly and cooperatively engage with the site office
Data and Metrics	Laboratories and agencies provide high-level guidance on the importance of regularly collecting and updating data and metrics
	Agencies use long-term modeling tools for scheduling maintenance and assessment
	Laboratories and agencies engage in benchmarking or other data-sharing efforts
	Laboratories and agencies use integrated metrics

B. Next Steps

Based primarily on the strategies listed in Table 7, but also on the voting results from workshop participants, and discussions with agency and laboratory staff, the study team suggests the following steps be taken by laboratories and agencies to improve the F&I planning, prioritization, and assessment processes:

1. Participate in an interagency forum for sharing best practices (presupposing the creation of such a forum)
2. Facilitate facility and infrastructure planning processes and funding
3. Establish standard criteria and methods to prioritize facility and infrastructure investments
4. Expand opportunities to involve stakeholders and improve communications
5. Improve collection, quality, and use of data and metrics

These recommendations encompass multiple proposed activities, as outlined in the subsections that follow.

1. Participate in an Interagency Forum for Sharing Best Practices across the Agencies and Laboratories

As previously described, some laboratories and agencies have developed strategies to address the challenges involved in planning processes, prioritization criteria, stakeholder involvement and communication, and data and metrics. The study team did not evaluate these strategies and therefore cannot authoritatively comment on their effectiveness. However, discussions with F&I staff and workshop participants alike indicated a desire to learn more about strategies or best practices from their peers. Presently, no forum exists for sharing facilities and infrastructure best practices across agencies with laboratories devoted to national security or for pursuing development of multi-agency projects. Thus, the primary recommendation to emerge from the laboratory visits and the workshop was to create an interagency forum for Federal security laboratory facilities and infrastructure.

OSTP could establish the forum as a new subcommittee of the National Science and Technology Committee. Alternatively, OSTP could explore the possibility of leveraging or expanding existing interagency and agency-level committees, working groups, or councils. Existing forums that could be expanded to incorporate F&I topics and other agencies include the Council on the Strategic Capability of DOE National Laboratories as National Security Assets (NRC 2012), the National Interagency Confederation for Biological Research (U.S. Army 2012), and the Energy Facility Contractors Group (EFCOG 2010).

This forum could not only be a place to share best practices, but also focus on the specific F&I areas (discussed in subsequent subsections), facilitate the funding and management of multi-agency projects, and increase understanding of existing capabilities. The forum would ensure cross-agency representation where appropriate to allow input to decisions about major construction projects and maintaining core capabilities. In addition, the forum could explore which capabilities already exist within the private sector, international partners, or in other Federal agencies. Prior to making new facilities and infrastructure investments, laboratories and agencies could determine whether the capabilities exist elsewhere and to what extent they could be leveraged through partnerships.

2. Facilitate Facility and Infrastructure Planning Processes and Funding

Planning processes allow laboratories and agencies to ensure F&I decisions are based on the appropriate information and are reviewed by critical stakeholders. The

particular process is not only dependent on the identity of the agency and laboratory, but also on the size, timing, and source of funding for the proposed project.

In addition to sharing planning-related strategies, such as developing master planning and investment frameworks, growing in-house staff, and working with architectural and engineering contractors, the interagency forum (recommended in the previous subsection) or individual laboratories and agencies could also address the following specific actions:

- Encourage agency leadership to champion F&I needs and facilitate cross-agency and laboratory participation in the planning process.
- Explore the possibility of Congress or agencies expanding or establishing new set-aside funding for laboratory F&I in the annual budget. For example, the forum could discuss options to raise the monetary limits to the DOD authorities for Section 219 or LRDP. Another avenue of discussion is creating a R&D-specific MILCON authority. Under the current MILCON approval system, R&D facilities must compete with all other military construction, such as schools, housing, hospitals, and on-base military buildings. If an R&D-specific portion of MILCON were set aside, laboratory facilities and infrastructure needs could be addressed more directly. These options will require collaboration to discuss how to implement such a proposal and the impacts of the proposed changes within the agencies and their annual budgets planning.
- Discuss collocating F&I with other laboratories and agencies to simplify planning and leverage infrastructure for operations, including security and utilities. An example of collocated F&I is the National Interagency Biodefense Campus, a partnership involving the Army, the DHS, the Department of Agriculture, and the National Institutes of Health.
- Facilitate alternatively financed F&I projects. Most laboratory staff the study team talked to indicated they were interested in using alternative financing mechanisms as one part of the portfolio of financing instruments used to modernize and revitalize their laboratory F&I. However, only a handful of laboratories have used these mechanisms for large projects. Suggestions for facilitating alternatively financed projects include establishing a Task Force to assess revisions to OMB Circular A-11; issuing an Executive order or Presidential memorandum supporting the use of alternative financing; and publishing a guidebook describing the steps necessary for approval and implementation. There has been previous executive action in this area; the administration bolstered

alternative financing mechanisms in a Presidential memorandum issued in December 2011 supported the use of Energy Savings Performance Contracts.[53]

3. Establish Standard Criteria and Methods to Prioritize Facility and Infrastructure Investments

Prioritization criteria and frameworks provide laboratories and agencies with a documented structure for determining which projects to pursue. This is particularly critical in a budget-constrained environment. Some of the criteria are based on data and metrics collected to delineate which F&I are in need of immediate attention, but others are based on regulatory requirements and mission necessities. Staff members at laboratories and agencies that have adopted formal methods for ranking or weighting criteria assert that it not only facilitates better decision-making but also makes decisions more transparent.

Individual laboratories and agencies or a new interagency forum could discuss criteria-specific strategies and address the following specific actions:

- Encourage agencies and laboratories to share innovative practices and work together to develop prioritization criteria.
- Discuss how the use of prioritization frameworks and weights could be used to better align criteria to mission goals.

4. Expand Opportunities to Involve Stakeholders and Improve Communications

Most agencies among those studied have a process to involve stakeholders in the information and decision-making processes. Others would benefit from a process even though it may take more upfront resources. Stakeholders should be thought of quite broadly to include laboratory F&I staff and researchers, agency personnel, management and operations contractors, cross-agency and higher level offices (such as OMB), and the local community (including local and State government regulators). Such a process would guide the development of a strategic vision for F&I, promote acceptance and buy-in of F&I investments, and ensure optimal planning and implementation of facilities, infrastructure, and equipment.

Other than sharing strategies through F&I managers interacting with researchers and using mechanisms for communicating with various F&I stakeholders, individual laboratories and agencies or a new interagency forum could pursue the following specific actions:

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[53] The December 2, 2011 memorandum, "Implementation of Energy Savings Projects and Performance-Based Contracting for Energy Savings," is available at http://www.whitehouse.gov/the-press-office/2011/12/02/presidential-memorandum-implementation-energy-savings-projects-and-perfo.

- Encourage agencies to coordinate with laboratories and guide the development of a clear strategic vision for Federal security laboratories.
- Discuss methods for laboratory contractors and their site offices to cooperatively engage.

5. Improve Collection, Quality, and Use of Data and Metrics

Laboratories and agencies collect F&I data, generate metrics and maintain real property databases to inform their planning and resource allocations in their annual budgets. They use F&I data and metrics to prioritize and forecast investments necessary to operate, sustain, and modernize F&I and benchmark F&I across comparable laboratories within the agency.

Individual laboratories and agencies or a new interagency forum could discuss strategies, such as long-term modeling tools and integrated metrics, and address the following actions:

- Encourage agencies and laboratories to provide high-level guidance on the importance of collecting and maintaining data and metrics.
- Engage in interagency benchmarking and other data-sharing efforts.
- Standardize facilities and infrastructure data and metrics definitions. The standardization of metrics and data definitions across laboratories and agencies would facilitate the sharing of information and benchmarking and clarify ambiguity over whether one laboratory's deferred maintenance is defined the same way as another's. Standardization would also facilitate benchmarking and alternative methods of sharing and comparing F&I information and processes (such as peer review processes), as there would be a common understanding of what each data element or metric represents.
- Develop facilities and infrastructure metrics that capture mission impact. Laboratories and agencies could work together to develop facilities and infrastructure metrics that better capture mission impact. The link between an asset's condition and its capability to support its mission is not captured in most widely used metrics, and often cannot be incorporated into the decision-making process at all. Both laboratories and agencies struggle with applying the appropriate metrics to capture the effect of F&I on mission.

C. Concluding Comment

Federal security laboratories already effectively use a variety of F&I planning, prioritization, and assessment processes; however, standardization could improve understanding of and sharing of successful strategies. Agencies and laboratories must

make their cases for F&I investments based on criticality of need. At the same time, guidance and resources from the executive-level leadership of the Federal Government would provide the impetus needed to enhance current practices. Taken together, the recommendations outlined in this chapter constitute a plan for executive action.

Appendix A.
Pilot Study Discussions

The pilot study included discussions with a total of 95 individuals:

- 60 facilities and infrastructure staff members and leadership from the 10 Federal laboratories in the study (Table A-1)
- 3 facilities and infrastructure staff members from 3 additional Department of Energy (DOE) laboratories on the topic of alternative financing mechanisms (Table A-2)
- 25 staff members from 13 agency- or military command-level offices, 9 offices in the Department of Defense (DOD), 4 offices in the DOE, and 1 office in the Department of Homeland Security (DHS) (Table A-3)
- 7 individuals from 5 private architectural and engineering firms (Table A-4).

Table A-1. Federal Security Laboratory Discussions

Agency	National Laboratory or Headquarters	Office	Type	Date
DOD	Air Force Research Laboratory	Air Force	In person	December 9, 2011
	Army Medical Research Institute of Infectious Diseases	Army	Phone; in person	January 24, 2012
	Army Research Laboratory	Army	In person	December 20, 2011
	Naval Research Laboratory	Navy	In person	December 14, 2011
	Johns Hopkins Applied Physics Laboratory	Navy	In person	December 21, 2011
	MIT Lincoln Laboratory	Air Force	In person	December 5, 2011
DOE	Brookhaven National Laboratory	Office of Science	In person	December 6, 2011
	Los Alamos National Laboratory	National Nuclear Security Administration	Phone In person	January 30, 2012; February 6, 2012
	Sandia National Laboratories	National Nuclear Security Administration	Phone In person	November 15, 2011 February 8, 2012 January 31, 2012
DHS	National Biodefense Analysis and Countermeasures Center	Science and Technology Directorate	In person	January 23, 2012

Table A-2. Additional Federal Laboratory Discussions on Alternative Financing Mechanisms

Agency	National Laboratory, Facility, or Headquarters	Office	Type	Date
DOE	Oak Ridge National Laboratory	Office of Science	Phone	April 5, 2012 May 22, 2012
	Pacific Northwest National Laboratory	Office of Science	Phone	May 22, 2012
	Y-12 National Security Complex	NNSA	Phone	May 22, 2012

Table A-3. Federal Agency and Office Discussions

Agency	Department/Office/Division	Type	Date
DOD	Air Force Office of the Assistant Secretary of the Air Force for Acquisition, Science, Technology and Engineering (SAF/AQ)	In person	Jan 18, 2012
	Army Medical Research and Materiel Command (AMRMC)	Phone; in person	an 24, 2012
	Army Medical Command (MEDCOM)	Phone	Apr 3, 2012
	Army Research, Development, and Engineering Command (RDECOM)	In person	Dec 20, 2012
	Navy Office of the Deputy Assistant Secretary of the Navy (Research, Development, Test and Evaluation)	In person	Jan 6, 2012
	Office of the Secretary of Defense (OSD)/Office of the Assistant Secretary of Defense for Health Affairs (ASD[HA])	Phone	Apr 9, 2012
	OSD/ Office of the Assistant Secretary of Defense for Research and Engineering (ASD[R&E])	In person	Dec 12, 2011; Feb 8, 2012
	OSD/Office of the Under Secretary of Defense for Acquisition, Technology and Logistics (USD[AT&L]/Office of the Under Secretary of Defense (Installations and Environment) (DUSD[I&E]), Directorate of Facilities Investment and Management	In person	Dec 1, 2011; Apr 25, 2012
	OSD, Office of the Director, Operational Test and Evaluation (DOT&E)	Phone	Apr 5, 2012
DOE	Office of Science, Safety, Security and Infrastructure, Facilities and Infrastructure Division (SC-31.2)	Phone	Oct 19, 2011
	Office of Management, Office of Engineering and Construction Management (OECM),* Office of Property Management (MA-65)	Phone	Nov 30, 2011; May 29, 2012
	National Nuclear Security Administration (NNSA)/ Office of Infrastructure and Facilities Management	In person	Nov 10, 2011; Nov 18, 2011
	NNSA/Stockpile Services Division (NA 122.1), Enterprise Modeling Consortium	In person	Dec 7, 2011
DHS	Science and Technology Directorate, Office of National Laboratories (ONL)	In person	Nov 21, 2011

* OECM is now the Office of Acquisition and Project Management (OAPM).

Table A-4. Architectural and Engineering Firm Discussions

Firm	Type	Date
Flad Architects	Phone	Mar 13, 2012
Payette Associates	Email	Apr 9, 2012
RTKL Associates	Phone	Apr 3, 2012
VFA, Inc.	Email	May 18, 2012
Whitestone Research Corporation	Email	Apr 2, 2012

Appendix B.
Discussion Guide

The guide for discussions with agency, laboratory, and other organization staff members covered seven topics: personnel and office information, infrastructure planning process, infrastructure data, infrastructure quality assessment, best practices, unique characteristics, and relevance to national security. The discussion guide included a total of 43 questions.

Introduction: Personnel/Office Information

We are interested in information regarding the interviewee's position and office environment in which they work.

1. Briefly tell me about your position and background:
   a. What is your title?
   b. Can you tell us how long you have been in your present position and then describe your current responsibilities?
   c. Can you describe your education and previous professional experiences related to your current position including?
2. Briefly, tell me about your office and staff:
   a. How many staff work on facilities and infrastructure (F&I) management in your office?
   b. Can you describe what you think are important educational, experiential or skill set backgrounds in your staff?
   c. Are there capabilities relevant to F&I management for which you see a growing need but are currently unavailable in your office? If so, what are they?
   d. What is (or describe) the mission of the facilities and infrastructure office?

Infrastructure Planning Process

Participants: We are interested in understanding who is involved in the F&I planning process (including internal and external participants).

3. What individuals or groups, within the laboratory are involved in the infrastructure planning process?
    a. How are they involved and what are their roles?
    b. Do you believe that the process for obtaining input within the laboratory could be improved? If so, why and how?
4. What individuals or groups, within the agency are involved in the infrastructure planning process?
    a. How are they involved and what are their roles?
    b. Do you believe the process for obtaining input within the agency could be improved? If so, why and how?
5. Which government participants, including Congress, individuals or groups, from outside of the agency are involved in the infrastructure planning process?
    a. How are they involved and what are their roles?
    b. Do you believe the process for obtaining input from government participants outside of the agency could be improved? If so, why and how?
6. Which participants, including individuals or groups, from outside of the government are involved in the infrastructure planning process?
    a. How are they involved and what are their roles?
    b. Do you believe the process for obtaining input from stakeholders outside of the government could be improved? If so, why and how?
7. [IF NOT ANSWERED ABOVE] Do you solicit feedback internally or externally on the F&I prioritization decisions?
    a. If so, from whom? And, does the feedback influence the final prioritized decisions?

Decision-Making and Prioritizing: We are interested in understanding F&I decision-making, including milestones, major decision points, and the prioritization process.

8. Can you describe the major phases or decision points in the F&I planning process?
    a. Do you consider various planning horizons? If so, how?

b. Does the decision-making process vary by the financial or areal size of the F&I project? If so, what are the cutoffs and how does the process change?

c. How are lab-specific F&I plans integrated into the overall planning process at the agency level?

9. What types of F&I investments exist (or how does DOE/DOD/DHS categorize F&I investments)?
   a. Does the decision-making process vary by investment type? If so, how?
10. Can you describe the specific criteria used to prioritize F&I projects or strategies?
    a. Are all criteria given equal weight in the decision? If not, can you describe these differences?
    b. Is future workload an aspect considered when prioritizing F&I projects? If so, how is it considered?
    c. [FOR HQ ONLY] How are competing F&I plans and projects from different labs prioritized?
11. What are important cost considerations when prioritizing projects?
    a. Specifically, how are life cycle costs considered?
    b. How are operations and maintenance costs factored into the F&I prioritization?
12. Is there a required or standard budget percentage devoted to F&I across labs within your agency or department (e.g. NNSA, DOE, DOD)?
13. [FOR HQ ONLY] How are the final F&I decisions incorporated into the agency's annual budget requests?
14. How do you make trade-offs among facility projects and other organizational objectives or programs?

Sources of F&I Funding: We are interested in Federal and non-Federal sources or mechanisms for F&I funding and their influence in the F&I planning process.

15. Are public-private partnerships utilized to fund F&I projects?
    a. If so, who are the public or private actors involved? Can you describe further or provide examples?
16. What types of (external to agency) Federal funding mechanisms are used to support F&I sites or projects, if any?
    a. If any, who are the Federal actors involved? Can you describe further or provide examples?

b. Does the use of external-Federal funding change the F&I planning process?

c. Does the use of non-Federal funding change the F&I planning process?

17. Do you believe there are ways to improve the use of Federal or non-Federal sources or can you suggest other mechanisms to provide F&I funding? If so, can you explain?

Infrastructure Data

We are interested in understanding the lab or agency's use of and collecting F&I-related data.

18. What data do you collect to track F&I investments?
19. How often are the F&I data collected and how long is the data maintained?
20. [FOR LABS ONLY] Do you share the F&I data with HQ or others outside your agency? With who and for what purpose?
21. [FOR HQ ONLY] Do the laboratories share all F&I data with your office (or do you have direct access to all F&I data)? How often do they share or do you access the F&I data?
22. [FOR HQ ONLY] Do you share the F&I data with others outside your agency? With who and for what purpose?
23. Are there standardized software or tools used to collect, store, or analyze F&I data within the lab? Across laboratories at your agency? Across the government?
24. Do you verify the accuracy of the F&I data that is collected? If so, how and how often?
25. Do you use sources of F&I data external to your laboratory? What sources? How are they used?

Infrastructure Quality Assessment

Assessment: We are interested in F&I assessment frameworks, including criteria to assess F&I condition and mission relevance, used by labs and agencies.

26. What performance measures, criteria, or frameworks are used?
    a. How do you assess the value and condition of your infrastructure?
    b. How do you assess facilities and land holdings utilization? (e.g. Asset Utilization Index (DOE))
    c. How do you assess maintenance and operating costs?

d. How do you assess the ability of your infrastructure to meet your mission, goals, and objectives?

e. How do you assess workforce retention and attraction of customer funding?

f. How do you assess sustainability, such as water and energy use?

27. [FOR LABS ONLY] Do you collect performance measures outside of what is required by HQ and if so, what are they?

28. How often are the assessments (discussed above) performed?

29. Are performance measure targets used to gauge the effectiveness of facilities management? If so, how?

30. Are the performance measures and assessments used to inform the F&I planning process? If so, how?

Incentive Structures: We would like to know if F&I-based incentive structures are in place at the lab or agency.

31. Are there incentive structures for effective F&I planning, management, and/or sustainment?

    a. If so, can you describe these?

    b. Who provides these (the agency, lab, or other organization)?

    c. Who receives these (individuals, the lab, and/or agency)?

Best Practices

We would like to understand perspectives on best practices that laboratories and the headquarter agency recognize and use in the planning process and quality assessments.

Planning Process

32. What best practices from industry, academia or other government laboratories or agencies have you incorporated into your planning processes?

33. Are there any other best practices for planning processes you would like to incorporate? If so, what are they and why have they not been incorporated?

Quality Assessment

34. What best practices from industry, academia or other government laboratories or agencies have you incorporated into your infrastructure quality assessment?

35. Are there any other best practices for infrastructure quality assessment you would like to incorporate? If so, what are they and why have they not been incorporated?

36. Can you point to any time-series data that show where your best practices have had a significant impact?

Sharing of Best Practices

37. Are there formal or informal mechanisms to share F&I planning or assessment best practices:
    a. Across the lab?
    b. With other national labs?
    c. With the headquarter agency and offices?
    d. With other Federal agencies?

Characteristics Unique to Lab

38. Do you incorporate additional F&I procedures or data collection and analysis not mandated by DOE/DOD/DHS or other Federal regulations or guidelines?
39. Are there any unique qualities of your lab or agency that affect F&I data collection, performance measures or planning processes?

Opinion on Infrastructure and Relevance to National Security

40. What is your opinion regarding the current state of the F&I planning process:
    a. At the labs?
    b. At the agency?
41. What is your opinion on balancing goals towards national security with cutting edge R&D into the F&I planning process?
42. What is your opinion as to the ability of your lab's F&I to support national security related S&T research?
43. Is there anything else that you would like to share with respect to F&I at your lab, agency or in general?

Appendix C.
Federal Laboratory Profiles

This appendix provides information tables in the following areas for each of the 10 Federal laboratories in the study:

- Long-term (where time $t > 10$ years), mid-term (5 years $< t < 10$ years), and short-term ($t < 5$ years) planning guidance and documents influencing facility and infrastructure (F&I) investment decisions
- Agency- and laboratory-level planning process and prioritization criteria
- Stakeholders and communication among those involved in making F&I decisions
- Use of Federal and non-Federal partnerships and alternative financing mechanisms
- Types of data, metrics, and models used to assess and benchmark F&I, including trends in data over time on size in gross square feet (GSF), age, condition, utilization, and funding (if provided by the agency or laboratory)[1]

[1] Funding sources were estimated based on funding allocations as stated in the laboratory's Ten Year Site Plan. Total Funding and Total Operating Costs may be different based on the agency's reporting definitions for funding source and when the total was reported. Unless otherwise specified, all metric definitions except Total Funding are based on Federal Real Property Council (FRPC) guidance (see http://www.gsa.gov/graphics/ogp/2011_RealPropInventory_User_Guidance.pdf).

Air Force Research Laboratory (AFRL)

Table C-1. Planning Guidance and Documentation for AFRL

Long-Term (t > 10 years)	Mid-Term (5 years < t < 10 years)	Short-Term (t < 5 years)
DOD Quadrennial Defense Review Report; Defense Installations Strategic Plan	DOD Future Years Defense Program (FYDP) Plan; Air Force Strategic Plan, Air Force Smart Operations for the 21st Century (AFSO21), AF Activity Management Plans	Infrastructure Plan

Table C-2. Planning Process and Prioritization Criteria for AFRL

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
Military Construction (MILCON): • Air Force Headquarters sends a call for projects to major commands, such as AFMC • AFMC sends the call to the Installation Commanders and AFRL leadership • Installation Commanders prioritizes all projects at the installation to submit to AFMC • AFMC/CC approves prioritized list to Air Force Headquarters • AFRL/CSH and AFMC/A2/5 advocate for requirements through AFMC MILCON Facility Panel • Final list is staffed approved by AFMC/CC and sent to HAF/A7C • Air Force Headquarters prioritizes and approves Section 219/LRDP:	Current Mission Military Construction (MILCON): • Major Command priority (50%) • Mission dependency (20%) • Facility condition (15%) • Life/Safety/Health (5%) • Demolition (10%) New Mission Military Construction (MILCON): • Mission Impact • Procurement Timeline • Basing Process • Panel Priority • Demolition	Military Construction (MILCON): • AFRL sends call for projects to the Technical Directorates • Technical Directorates, working with the Installation Base Civil Engineer (BCE) provide info to enter in AF management database (ACES) and identify requirements to AFRL • AFRL/CSH consolidates and provides list of projects to AFRL's Lab Support Operations (LSO) Council • AFRL Lab Support Operations (LSO) prioritizes requirements identified by Technical Directorates to submit to AFMC/A7 Section 219/LRDP: • AFRL requests Section 219/LRDP requirements from Technical Directorates	Minor Construction/LRDP and Sustainment, Restoration, and Modernization: • Impact to Mission/ Operational Effectiveness • Safeguard Life and Property • Support • Necessary

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
• AFRL submits projects to HAF/A7C who staff package to SAF/IE and once approved, HAF/A7C notifies AFRL/CSH Sustainment, Restoration, and Modernization: • HAF/A7C approves Sustainment Repair >$5M and all Restoration and Modernization requirements via AF Comprehensive Activity Management Plan (AFCAMP)		• Technical Directorate facility managers work with installation BCE to submit a BCE Work Request and work with BCE staff to enter info in AF management database (ACES) • Requirements are submitted by Technical Directorates to AFRL/CSH and prioritized by AFRL Research and LSO councils • Technical Directorates work with AFRL/CSH, installation BCE staff, and AFMC to coordinate project information to obtain required information in AFI 32-1032 • When requirement is certified by AFMC/A7, AFRL/CSH staffs approved proposals to HAF/A7CP to obtain SAF/IE approval (if MC is >$750k) • HAF/A7C staffs the package for SAF/IE final approval and notifies AFRL/CSH upon approval Sustainment, Restoration, and Modernization: • Technical Directorate facility managers work with installation BCE to submit a BCE Work Request and work with BCE staff to enter necessary info in AF management database (ACES) • Requirements extracted from ACES into AFMC MAJCOM Comprehensive Activity Management Plan (MCAMP) • Technical Directorates with AFRL/CSH who works with AFMC Programmers and AFMC MCAMP Activity Owners to	

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
		advocate for requirements • AFMC Asset Management Integrated Working Group (AMIWG) submits prioritized list of Sustainment, Restoration, and Modernization requirements for incorporation into AF Comprehensive Activity Management Plan (AFCAMP) • HAF/A7C prioritizes Restoration and Modernization as well as Sustainment Repair > $5M for 3400-funded Sustainment, Restoration, and Modernization	

Table C-3. Stakeholder Involvement and Communication for AFRL

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
Air Force Headquarters staff, Deputy Assistant Secretary of the Air Force (Installations) (SAF/IEI); Civil Engineer (AF/A7C); Program Division (AF/A7CP)	Provides guidance on and approval of investment strategies Advocates for resources through AF, OSD, OMB, and Congress	Lab Support Operations (LSO) Council: AFRL (Vice Commander), Chief Scientist, and Technical Directorate Deputy Directors	Provides guidance and council on laboratory support operations and prioritizes F&I projects
AF Scientific Advisory Board	Provides advice on AF strategic plans Conducts reviews of R&D including facilities	Technical Directorate Integration and Operations Divisions	Engages Directorate customers and proposes projects for Minor Construction and Sustainment, Restoration, and Modernization Works with installation BCE staff to program requirements

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
Air Force Materiel Command (AFMC)	Provides guidance and prioritizes F&I projects	AFRL-Headquarters Operations Support Division (AFRL/CSH)	Interfaces with Headquarters AFMC and AFRL Reviews MILCON/LRDP documentation and submits project proposal to Air Force Headquarters
		Installation Base Civil Engineer (BCE)	Works with Technical Directorates to coordinate and submit project requirements

Table C-4. Partnerships and Alternative Financing Mechanisms for AFRL

Partnerships		Mechanisms		
Laboratory Partnerships Within Agency	Interagency Partnerships	Operating Leases	Energy Saving Performance Contracts	Other Partnerships
None identified	*None identified*	*None identified*	Agreement with Honeywell to install chiller equipment	*None identified*

Table C-5. Data and Metrics for AFRL

Assessment	Data and Metrics	Management Systems	Models
None identified	Replacement Plant Value; Facility Condition Index (FCI)*; Q-Rating^; RPA Utilization Index#; RPA Annual Operating Costs**; Activity Management Plans; Air Force Real Property Asset Database	Automated Civil Engineer System (ACES)	Laboratory-level: • Facility Sustainment Model • Plant Replacement Value Agency-level: • Facility Sustainment Model

* The Air Force treats the FCI as a function of all programmed sustainment, restoration and modernization requirements for a facility, including the replacement of damaged or obsolete facilities, divided by the Replacement Plant Value. This does not include preventative maintenance or minor sustainment repair but does include major deferred repair and replacement sustainment costs.

^ The Q-Rating is similar to the Asset Condition Index.

The RPA Utilization Index is similar to the Asset Utilization Index.

** The RPA Annual Operating Cost is similar to the Annual Operating Cost; it includes recurring maintenance and repair costs and utilities, but excludes telecommunication costs, cleaning or janitorial costs, and road and grounds expenses.

U.S. Army Medical and Materiel Command (AMRMC)/U.S. Army Medical Research Institute for Infectious Diseases (AMRIID)

Table C-6. Planning Guidance and Documentation for AMRMC and AMRIID

Long-Term (t > 10 years)	Mid-Term (5 years < t < 10 years)	Short-Term (t < 5 years)
DOD Quadrennial Defense Review Report; Army Long Range Planning Guidance; Army Stationing and Installation Plan; The Army Plan; MEDCOM Strategic Master Plan	DOD Future Years Defense Program (FYDP); Renewable Energy Master Plan	*None identified*

Table C-7. Planning Process and Prioritization Criteria for AMRMC and AMRIID

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
Military Construction (MILCON): • The Army Office of the Surgeon General through their Planning and Programming Division provides guidance and criteria to Army Chief of Staff for Facilities\Health Facility Planning Agency (HFPA) • HFPA provides guidance to Army medical installations • Army Installation Management Command (IMCOM) Headquarters and IMCOM regions review project information and certify projects • HFPA prioritizes installation projects to submit to Assistant Secretary of Defense (Health Affairs) Defense Medical Facilities Office (ASD (HA)/DMFO)	Military Construction (MILCON): • Mission alignment • Patient life safety • Age and condition • Capacity and demand imbalance • Effective resource utilization	Military Construction (MILCON): • United States Army Medical Research Institute of Infectious Diseases (AMRIID) identifies F&I projects and provides F&I data to the Army Medical Research and Materiel Command (AMRMC) • AMRMC hires architectural and engineering firms (e.g., VFA, Inc.) to provide data on F&I deficiencies • AMRMC prioritizes and develops a master list of F&I projects and tracks maintenance costs to develop the budget request	Military Construction (MILCON): • Mission • Cost-benefit analysis • Space utilization • Capacity analysis • Functional alignment • Researcher requirements • Bio-safety levels

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
• Capital Investment Review Board (CIRB) reviews and scores projects • Senior Military Medical Advisory Committee (SMMAC) reviews the portfolio and makes the final decision on approving projects and budget			

Table C-8. Stakeholder Involvement and Communication for AMRMC and AMRIID

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
Army Office of the Surgeon General: Assistant Chief of Staff for Facilities/Director Facilities; Deputy Director Facilities; Planning and Programming Division	Provides guidance and criteria for developing Army health facility projects Reviews and prioritizes Medical MILCON projects with input from regional commands Develops and maintains the Future Years Defense Program (FYDP) for Medical MILCON	Army Medical Research and Materiel Command (AMRMC): Director Facilities Transformation Engineering and Management; AMRMC Strategic Facilities Executive Steering Committee	Develops a master list of F&I projects and tracks maintenance costs to develop the budget request Strategic Facilities Executive Steering Committee prioritizes AMRMC-wide MILCON projects for submittal to the Army Office of the Surgeon General
Assistant Secretary of Defense (Health Affairs) Defense Medical Facilities Office (ASD (HA))/(DMFO)	Approves DOD-wide medical program projects for funding; Submits a project list to OSD for approval	United States Army Medical Research Institute of Infectious Diseases (AMRIID)	Provides a list of F&I projects and information and data on space utilization, capacity analysis, and cost-option studies to AMRMC
Army Medical Command (MEDCOM)	Provides guidance to medical commands and helps develop health facility master plans Prioritizes projects with medical commands and IMCOM regions to submit to HFPA	Architectural and Engineering firms: VFA, Inc.	Provides analysis of F&I deficiencies and input into projects identified for the master plan
Army Chief of Staff for Facilities\Health Facility Planning Agency (HFPA)	Prioritizes projects to submit to Assistant Secretary of Defense (Health Affairs) DMFO		

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
Army Installation Management Command (IMCOM) Headquarters and IMCOM regions	Reviews project information and certifies and submits DD Forms 1391 to DMFO and enters information into the web-based Proposal Submission Tool		
Capital Investment Review Board (CIRB): representatives from the TRICARE Management Activity and each of the Service medical departments	Reviews and scores projects for all Services based on quantitative criteria defined through the Capital Investment Decision Model (CIDM)		
Senior Military Medical Advisory Committee (SMMAC): Service senior leadership and Assistant Secretary of Defense (Health Affairs)	For the Medical MILCON program, approves projects and submits the medical MILCON budget to the DOD Comptroller		

Table C-9. Partnerships and Alternative Financing Mechanisms for AMRMC and AMRIID

Partnerships		Mechanisms		
Laboratory Partnerships Within Agency	Interagency Partnerships	Operating Leases	Energy Saving Performance Contracts	Other Partnerships
None identified	*None identified*	• A central utility plant (CUP) construction contract with Chevron and Keenan Development Associates for NIBC* • Considered for gateway center located central to NIBC facilities	*None identified*	Utility services contract with Chevron to supply power and backup generation to NIBC*

* The National Interagency Biodefense Campus (NIBC) developed a public private partnership to construct a central utility plant and provide power to NIBC. The partnership was coordinated through the US Army Corps of Engineers (USACE) and Fort Detrick with Keenan Fort Detrick Energy LLC (a partnership between Keenan Development Associates and Chevron Energy Solutions).

Table C-10. Data and Metrics for AMRMC and AMRIID

Assessment	Data and Metrics	Management Systems	Models
Work orders; contracts with VFA, Inc. to collect data	Replacement Plant Value (RPV); Facility Condition Index (FCI); Functionality Index, and Facility Experience Index (FEI)	Defense Medical Logistics Standards Automated Information System; Installation Status Report (ISR)	Installation Status Report (ISR)

Table C-11. Laboratory and Facilities and Infrastructure (F&I) Data for AMRMC and AMRIID, FY 2011

Metric	Value	Metric	Value	Metric	Value
Facilities		Condition and Utilization		Budget and Funding	
Total Site Square Footage	*Not provided*	Condition Index	*Not provided*	Total Annual Operating Costs	*Not provided*
Buildings	*Not provided*	All Buildings		Replacement Plant Value	*Not provided*
Trailers	*Not provided*	Administrative Buildings		Annual Deferred Maintenance	*Not provided*
Leased Square Footage	*Not provided*	Trailers		Operations and Maintenance	*Not provided*
Excess Facilities Disposition	*Not provided*	Utilization Index	*Not provided*	Construction and Acquisition	*Not provided*
Number of Total Buildings	*Not provided*	All Buildings		Funding by Source	
Average Age of Buildings	*Not provided*	Administrative Buildings		DOD	*Not provided*
Oldest building	*Not provided*	Trailers		DOE	*Not provided*
Newest building	*Not provided*			NNSA	*Not provided*
				DHS	*Not provided*
				Work for Others	*Not provided*
				Other	*Not provided*

Army Research Laboratory (ARL)

Table C-12. Planning Guidance and Documentation for ARL

Long-Term (t > 10 years)	Mid-Term (5 years < t < 10 years)	Short-Term (t < 5 years)
DOD Quadrennial Defense Review Report; Army Long Range Planning Guidance; Army Stationing and Installation Plan; The Army Plan; Garrison Real Property Master Plan (RPMP) Long Range Component (LRC)	DOD Future Years Defense Program (FYDP); AMC Strategic Plan; RDECOM Strategic Plan; RPMP Digest, RPMP Short Range Component (SRC)	ARL-Aberdeen Proving Ground Short-Term Plan

Table C-13. Planning Process and Prioritization Criteria for ARL

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
Military Construction (MILCON): • Army Headquarters provides Army Guidance to ACSIM • ACSIM sends guidance to major commands, such as AMC • AMC delivers guidance to RDECOM • RDECOM combines and prioritizes the top projects from each lab and provides a prioritized list to AMC • RDECOM's Technology Integration Focus Teams and Board of Directors advise the 6.1-6.3 S&T portfolio is optimized across strategic priorities • AMC makes a Commander list (1-N) of prioritized projects and sends to ACSIM to compete with all Army-wide priorities • AMC can send the list to IMCOM	MILCON and Minor Construction/ LRDP: ISR Rating: • Facility Mission (F Rating) • Quality (Q Rating) • Quantity (C Rating)	Military Construction (MILCON): • RDECOM's Technology Focus Teams (TFT) review the Army's technical capability gaps • ARL Director makes the ultimate decision on F&I investments Minor Construction/LRDP: • ARL's Office of the Director solicits infrastructure project proposals Directorates • Office of the Director performs an initial review of submittals through site visits and prepares a prioritized list of recommendations for the Director • ARL Director reviews the recommendations, conducts further assessments during site visits and meet with ARL leadership to finalize	All F&I Investments: • Mission Critical • Addresses a key Army technical capability gap • Fits into Directorate mid- to long-term planning • Links to the ARL Director's Strategic Research Initiative topic areas Other considerations: • Environmental compliance/zoning

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
• ACSIM prioritizes all projects and recommends projects to the Assistant Secretary of the Army (Installations and Environment) • Program Review Board provides recommendations on projects • Assistant Secretary of the Army (Installations and Environment) receives input from the Installation Management Board of Directors and other Army Headquarters staff • Deputy Assistant Secretary of the Army (Installation and Housing) approves projects for program budget execution Minor Construction/LRDP & Sustainment, Restoration, and Modernization: • IMCOM Garrison/DPW approves projects • Secretary of the Army (Sec Army) approves projects over $2M		funding allocations Sustainment, Restoration, and Modernization: • Laboratory Operations Facilities staff submit work requests to Garrison/DPW • DPW prioritizes Laboratory Operations and other Wright Patterson Air Force Base tenants and approves work requests based on a priority list • ARL makes a decision to contract work through the U.S. Army Corps of Engineers' Army's Multiple-Award Task Order (MATOC) or ARL	

Table C-14. Stakeholder Involvement and Communication for ARL

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
Army Headquarters	Provides Army with MILCON and Program and Budget Guidance Consolidates projects recommended by the PRB Submits projects for review by the Installation Management Board of Directors and prioritization by the Deputy Chief of Staff	ARL Director and corporate leadership	Prioritizes project proposals from Directorates (MILCON, minor construction, and O&M)
Installation Management Board of Directors: Vice Chief of Staff of the Army and Assistant Secretary of the Army (Installations and Environment)	Reviews projects consolidated by Army Headquarters from PRB recommendations	ARL Directorates	Propose minor construction and O&M projects to ARL leadership
Program Review Board (PRB): ACSIM; Assistant Secretary of the Army, Financial Management and Comptroller; Deputy Chiefs of Staff; Chief Information Officer; Chief of Chaplains (CCH); and The Surgeon General (TSG)	Assists ACSIM in analyzing construction needs and recommends appropriate funding levels for projects included in the Program Objective Memorandum and Future Years Defense Program (FYDP) Makes a recommendation to fund a projects in the current or later Program Objective Memorandum year	Laboratory Operations staff	Conduct the Installation Status Report (ISR) ratings for ARL and submit to the DPW
Assistant Chief of Staff for Installation Management (ACSIM)	Provides major commands with Army Guidance Advices the Assistant Secretary of the Army (Installations and Environment) Prioritizes projects that will be briefed to the PRB Serves as the MILCON project manager	Army Garrison: Directorate of Public Works (DPW)	Approves minor construction and O&M projects Prioritizes O&M and Sustainment, Restoration, and Modernization projects if funded by IMCOM Garrison provides engineering and environmental services to support all facilities on the installation but is not funded to do so* Provides a consolidated ISR to ACSIM based on category codes

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
RDECOM, including Technology Integration Focus Teams and Board of Directors	Provides strategic support and advise on projects to sustain, modernize, acquire F&I, equipment and IT infrastructure and prioritizes projects for AMC	State and local governments: State of Maryland Department of the Environment (MDE)	DPW represents installation with State agencies (there is no direct interface between State agencies and ARL)
Army Materiel Command (AMC)	Prioritizes projects to send to ACSIM and makes a formal presentation of its program to Army HQ and the Planning Review Board		
Army Installation Management Command (IMCOM) Headquarters and IMCOM regions	Reviews project information and certify and submit DD Forms 1391 to ACSIM		
Army Corps of Engineers	Certifies DD Form 1391 submitted to IMCOM regions		
Deputy Assistant Secretary of the Army (Installations and Environment)	Has primary responsibility for Army installations, environment, safety and occupational health; Sets the strategic direction, standards, and policies, and recommends projects for programming and funding		
Deputy Assistant Secretary of the Army (Installation and Housing)	Approves projects for funding and programming		

* A Common Level of Support (CLS) for a certain amount of services is allocated to each tenant on the base and each tenant pays for any services that exceed the CLS.

Table C-15. Partnerships and Alternative Financing Mechanisms for ARL

Partnerships		Mechanisms		
Laboratory Partnerships Within Agency	Interagency Partnerships	Operating Leases	Energy Saving Performance Contracts	Other Partnerships
None identified	*None identified*	*None identified*	*None identified*	*None identified*

Table C-16. Data and Metrics

Assessment	Data and Metrics	Management Systems	Models
Baseline assessment of facilities done by walk-through	Installation Status Report (ISR) score; Recapitalization rate, recapitalization costs; age, square footage	Real Property Planning and Analysis System (RPLANS)-Installation module (INSTRPLANS); Region module (RGNRPLANS); Headquarters module (HQRPLANS); and Facility Planning System (FPS) module;	Laboratory-level: Installation Status Report (ISR) Agency-level: Facility Sustainment Model

Table C-17. Laboratory and Facilities and Infrastructure (F&I) Data for ARL, FY 2011

Metric	Value	Metric	Value
Facilities		Condition and Utilization	
Total Site Square Footage	2.7M GSF*	Installation Status Report	
Buildings	*Not provided*	ISR Quality-1 Rating as % of GSF	66%
Trailers	*Not provided*	ISR Quality-2 Rating as % of GSF	18%
Leased Square Footage	70.2K GSF	ISR Quality-3 Rating as % of GSF	15%
Excess Facilities Disposition	*Not provided*	ISR Quality-4 Rating as % of GSF	2%
Number of Total Buildings*	244	Condition Index	*Not provided*
Average Age of Buildings	79 years	Utilization Index	*Not provided*
Oldest building	95 years	Budget and Funding	
Newest building	1 year	Replacement Plant Value (DOD)	$609.2M
		Replacement Plant Value (BRAC)	$1,262.0M

Source: Army Research Laboratory.

* Buildings include those in Adelphi Laboratory Center (ALC), Aberdeen Proving Ground (APG), White Sands Missile Range (WSMR), Army Research Office (ARO), and Simulation and Training Technology Center (STTC).

Johns Hopkins University-Applied Physics Laboratory (JHU-APL)

Table C-18. Planning Guidance and Documentation for JHU-APL

Long-Term (t > 10 years)	Mid-Term (5 years < t < 10 years)	Short-Term (t < 5 years)
DOD Quadrennial Defense Review Report; Long-Range Site Development Plan	Master Plans; Strategic Plan	Rolling 3-Year Plan on infrastructure needs and capital projects; Climate Change Implementation Plan

Table C-19. Planning Process and Prioritization Criteria for JHU-APL

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
Military Construction (MILCON): • Not eligible for MILCON program • As a UARC, does not need to work with the Navy to approve or execute projects Projects >$500,000 and <$5M: • JHU-APL prepares a quarterly report for JHU Projects >$5M: • Johns Hopkins University (JHU) Building and Grounds Committee approves projects over $5 million through the Request for Approval process • The committee meets 5 to 6 times per year to hear presentations and review projects across JHU's nine divisions	Projects >$5M: • Need • Conformance to esthetics • Design • Construction methodology • Schematics • Budget • Schedule • Efficiency of cost, design, and operation	All Projects: • JHU-APL uses the Project Management Institute (PMI)* process for all F&I projects • Long-Range Site Development Planning Team and the Facilities and Construction Team identifies projects and needs over five to eight years and reviews projects • Teams form subcommittees to review projects based on F&I needs • Teams produce and update the Master Plan and invites SME Teams as external evaluators to review projects or plans as needed • Architectural and engineering firms are contracted to help JHU-APL's facilities staff be 'smart buyers' and support master planning and F&I assessments • Executive Council (EC) and the Operations Forum provide oversight and approve projects	All Projects: • Risk (continuity of mission and programs) • Safety • Financial costs • Urgency

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
		• Sponsors have their own funding for O&M and can approve and execute O&M projects including installing equipment for specialized facilities	

* PMI provides management frameworks, guidance, and standards for project and portfolio management. For further information on PMI guidance, see PMI (2008a, 2008b, 2008c, 2008d) and standards available at: http://www.pmi.org/PMBOK-Guide-and-Standards/Standards-Library-of-PMI-Global-Standards.aspx.

Table C-20. Stakeholder Involvement and Communication for JHU-APL

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
Johns Hopkins University (JHU) Buildings and Grounds Committee	Provides approval and financing for F&I projects over $5 million (recently changed from $2 million)	Executive Council (EC): Department leadership and Assistant Director of Operations	Provides oversight over the F&I planning process Approves projects based on recommendations from Operations Forum, SME Teams, and architectural and engineering firms
		Operations Forum: Assistant Director of Operations and other operations executives	Provides oversight for the F&I planning process
		Subject Matter Expert Teams: Department leadership and scientific expertise and external scientists and organizations	Provides a forum where the views of the Laboratory including sponsors are heard
		Support teams: Long-Range Site Development Planning Team, the Facilities and Construction Team, and various subcommittees	Identify S&T needs and support the development of the Master Plan, infrastructure renewal, legacy buildings, and other F&I issues
		Architectural and engineering firms/contractors: Henry Adams; VFA, Inc.; RTKL Associates; among others	Conduct F&I assessments and work with JHU-APL facility engineers to inform the master planning process and provide development scenarios

Table C-21. Partnerships and Alternative Financing Mechanisms for JHU-APL

Partnerships		Mechanisms		
Laboratory Partnerships Within Agency	Interagency Partnerships	Operating Leases	Energy Saving Performance Contracts	Other Partnerships
None identified	*None identified*	*None identified*	*None identified*	• JHU can finance large-scale projects • Sponsors finance and install supportive equipment

Table C-22. Data and Metrics for JHU-APL

Assessment	Data and Metrics	Management Systems	Models
Preventative maintenance shutdowns of 50% of buildings to perform maintenance on critical equipment conducted twice annually; annual reviews of infrastructure	Master plans survey infrastructure condition (FCI), conducted every 5 years; Customer satisfaction	Johnson Controls Building Automation Systems for monitoring and maintenance; Fire/Evaluation Alarm System (continuous preventative maintenance system); Accounting and Finance System	Campus Building Capital Renewal Funding Model (predicts building deterioration); FCI Projections

Table C-23. Laboratory and Facilities and Infrastructure (F&I) Data for JHU-APL, FY 2011

Metric	Value	Metric	Value
Facilities		Condition and Utilization	
Total Site Square Footage	2.8M GSF	Condition Index	11.0%
Buildings	2.8M GSF	Mission Critical	Not tracked
Trailers	3.7K GSF	Mission Dependent, Not Critical	Not tracked
Leased Square Footage	419.5K GSF	Not Mission Dependent	Not tracked
Excess Facilities Disposition	0.0 GSF	Utilization Index	Not tracked
Number of Total Buildings	37	Mission Critical	Not tracked
Average Age of Buildings	23 years	Mission Dependent, Not Critical	Not tracked
Oldest building	57 years	Not Mission Dependent	Not tracked
Newest building	0 years		

Source: Johns Hopkins University Applied Physics Laboratory.

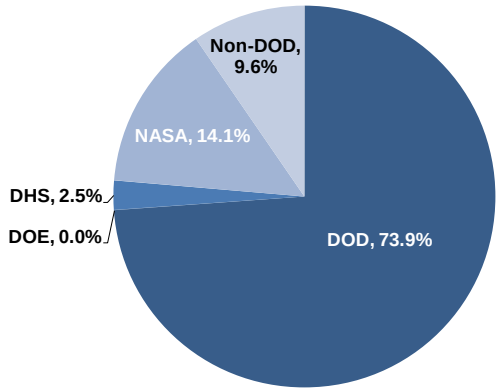
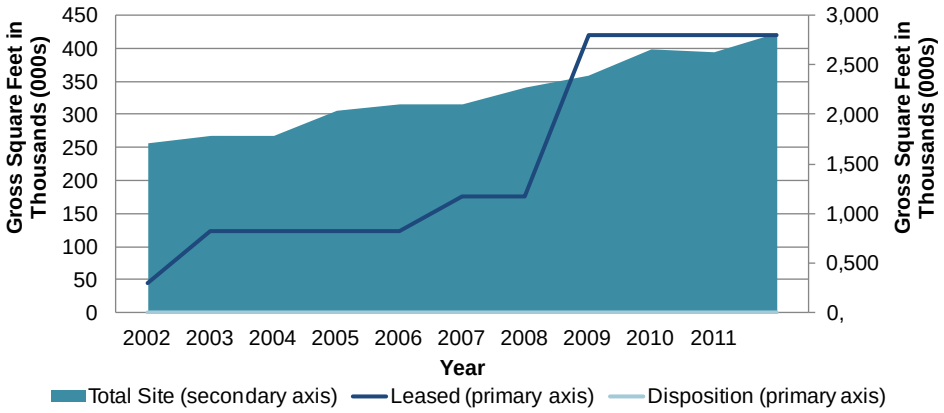
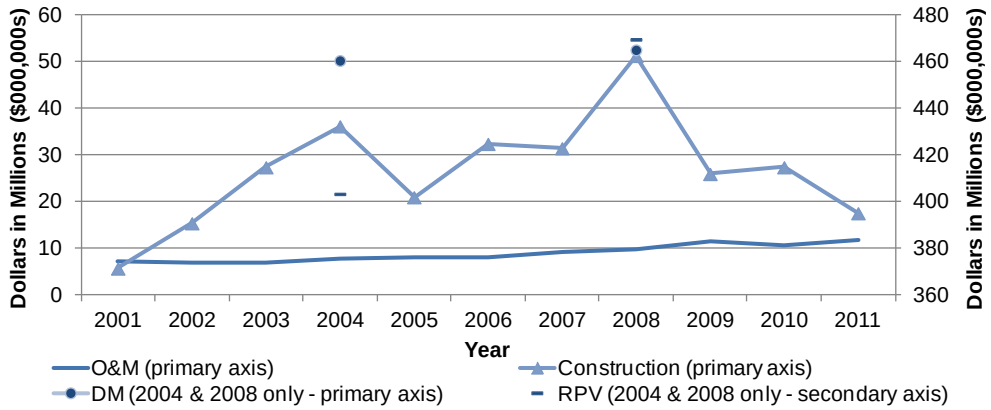


Figure C-1. Funding Sources (Total Funding FY 2011: $1.1 billion)



Source: Johns Hopkins University Applied Physics Laboratory.

Figure C-2. Total, Leased, and Disposition Gross Square Feet by Year for Johns Hopkins University-Applied Physics Laboratory



Source: Johns Hopkins University Applied Physics Laboratory.

Figure C-3. Facilities and Infrastructure (F&I) Funding for Operations and Maintenance (O&M), Deferred Maintenance (DM), Construction, and Replacement Plant Value (RPV) by Year for Johns Hopkins University-Applied Physics Laboratory (Total Operating Cost FY 2011: $1.1 billion)

Massachusetts Institute of Technology-Lincoln Laboratory (MIT-LL)

Table C-24. Planning Guidance and Documentation for MIT-LL

Long-Term (t > 10 years)	Mid-Term (5 years < t < 10 years)	Short-Term (t < 5 years)
DOD Quadrennial Defense Review Report; Strategic Plan; Facilities Master Plan	Facilities Master Plan; Energy Master Plan	Campus Plan

Table C-25. Planning Process and Prioritization Criteria for MIT-LL

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
Military Construction (MILCON): • Not successful at MILCON projects, last funded in 1988 to supplement phases of an alternative financing project (although, since then, Hanscom Air Force Base has received funding for five MILCON projects) Large F&I Projects (>$5M): • Government External Red Teams reviews and recommends projects less than $25M • DOD Joint Advisory Committee reviews and approves MIT-LL's strategic plans and projects in the range of $150M • Other support for large projects, including legislative initiatives, is provided by the Air Force General Counsel, Air Force Real Property Agency, Air Force Materiel Command, and Office of the Under Secretary of	Medium and Large F&I Projects: • Contribution to strategic plan • Impact to technical mission	All Projects: • Division or Department Business Managers submit an electronic form with a work request to the Capital Projects Office (CPO) • CPO reviews requests and updates the Master List weekly • CPO provides the Master List to the Director's Office (DO) monthly meeting for approval Small F&I Projects: • The DO conducts a first-pass validity test • If the request is approved, the project proceeds to the DO meeting the next month for action on 2nd pass approvals • Division leadership can sign off on the 2nd pass before being presented at the monthly meeting • The 2nd pass reviews the space	Small F&I Projects (<$500K): • Safety/Hazard • Immediate attention • Additional space needed • Financial costs • Disruption to programs • Security risk Medium ($500K-$5M) and Large F&I Projects ($5M): • Safety/Hazard • Relocation • Available square footage • Zoning e.g., hazardous materials • Building functional use • Functional adjacency (program needs) • Split of function • Financial costs • Disruption to programs

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
Defense for Acquisition, Technology and Logistics		request with due diligence and location options • If the 2nd pass is approved, the project is implemented by the CPO • All renovation projects are approved by MIT's CRSP Renovations Subcommittee Medium and Large F&I Projects: • DO determines the readiness of the projects and approves projects • Large projects are typically reviewed by the Laboratory Steering Committee and/or the Director commissions an External Red Team • Annual construction plans are prioritized and approved by the MIT-CRSP	

Table C-26. Stakeholder Involvement and Communication for MIT-LL

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
DOD Joint Advisory Committee	Reviews the MIT-LL Strategic and Master Plans Reviews plans for large-scale project proposals Approved the West-Lab legislative initiative	MIT-LL Advisory Board	Approves the MIT-LL Strategic and Master Plans
Air Force Real Property Agency	Works with CPO and MIT-LL leadership to draft a Business Case Analysis (BCA) for large-scale project proposals Provides feedback on development plans	External Red Teams: composed of government representatives external to MIT-LL	Commissioned by the MIT-LL Director to review large-scale project plans

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
Air Force Materiel Command	Reviews briefings and development plans for large-scale project proposals	Capital Projects Office (CPO)	Meets monthly to review project proposals from Divisions and presents projects to the Director's Office (DO) for approval
Air Force General Counsel	Reviewed MIT-LL's West-Lab legislative initiative	Laboratory Steering Committee: Director; Associate Director; Chief Operating Officer; Division leadership; MIT VP for Research	Reviews briefings of large-scale project plans
DOD Office of the Under Secretary of Defense for Acquisition, Technology and Logistics	Sponsored MIT-LL's West-Lab legislative initiative as a pre-legislation items	Director's Office (DO)	Reviews and approves small projects and determines the readiness of medium and large projects
		MIT Committee for the Review of Space Planning (CRSP)	Renovations Subcommittee meets biweekly and reviews and approves MIT-LL's requests for space and space change, the Subcommittee can decide whether the project will be reviewed by the full CRSP
		Architectural and Engineering Firms/Contractors: Payette Associates	Develops MIT-LL's site plan

Table C-27. Partnerships and Alternative Financing Mechanisms for MIT-LL

Partnerships		Mechanisms		
Laboratory Partnerships Within Agency	Interagency Partnerships	Operating Leases	Energy Saving Performance Contracts	Other Partnerships
Pursuing proposal to use AFRL F&I available from BRAC 2005 from AFRL at Hanscom Air Force Base	*None identified*	South Lab Model—third-party financing with special termination clause approved by the National Defense Authorization Act of 1988, combined with MILCON funding Drafting legislative language for the New West Lab construction ($330M)	*None identified*	*None identified*

Table C-28. Data and Metrics for MIT-LL

Assessment	Data and Metrics	Management Systems	Models
Risk assessments of equipment and work requests	Age of facility, Condition Index, Deferred Maintenance	*None identified*	*None identified*

Table C-29. Laboratory and Facilities and Infrastructure (F&I) Data for MIT-LL, FY 2011

Metric	Value	Metric	Value	Metric	Value
Facilities		Condition and Utilization		Budget and Funding	
Total Site Square Footage	2.3M GSF	Condition Index	*Not provided*	Total Annual Operating Costs	*Not provided*
Buildings	2.3M GSF	All Buildings		Replacement Plant Value	$1.65B
Trailers	0 GSF	Administrative Buildings		Annual Deferred Maintenance	$92M
Leased Square Footage	121K GSF	Trailers		Operations and Maintenance	*Not provided*
Excess Facilities Disposition	0	Utilization Index	*Not provided*	Construction and Acquisition	*Not provided*
Number of Total Buildings	41	All Buildings		Funding by Source:	
Average Age of Buildings	44 years	Administrative Buildings		DOD	*Not provided*
Oldest building	68 (1944)	Office/light lab		DOD	*Not provided*
Newest building	1 (1994)			NNSA	*Not provided*
				DHS	*Not provided*
				Work for Others	*Not provided*
				Other	*Not provided*

Naval Research Laboratory (NRL)

Table C-30. Planning Guidance and Documentation for NRL

Long-Term (t > 10 years)	Mid-Term (5 years < t < 10 years)	Short-Term (t < 5 years)
DOD Quadrennial Defense Review Report; Defense Installations Strategic Plan; Navy Strategic Plan; Navy Capability Plans; Corporate Facilities Investment Plan	DOD Future Years Defense Plan (FYDP); Naval Science & Technology Strategic Plan; Corporate Facilities Investment Plan	Master Plan; Corporate Facilities Investment Plan

Table C-31. Planning Process and Prioritization Criteria for NRL

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria*	Process	Criteria
Military Construction (MILCON): • ASN(I&E) provides guidance • Commander, Navy Installations Command (CNIC) coordinates the Team Planning and Programming Process • NAVFAC Regional Commanders validate and prioritize projects from installations into an Integrated Priority List • CNI/NAVFAC staff meet through the Shore Management Infrastructure Group and assess and score projects • RMIG reviews and prioritizes the projects and obtains feedback from the NAVFAC Regional Commands • CNI and CNO staff make a final assessment of projects to fund • CNO approves and submits the projects to the Navy Comptroller	Military Construction (MILCON): • Impact on mission • Life-cycle costs • Building condition	Military Construction (MILCON): • Research division representatives provide data on current and future needs of assets • NRL leadership convenes a Corporate Facilities Investment Plan Committee of NRL scientists and facilities staff to identify technology and asset gaps and needs • Corporate Facilities Investment Plan Committee advises, and Director of Research prioritizes projects to be included in the NRL MILCON Integrated Priority List Minor Construction and Sustainment, Restoration, and Modernization: • Facilities staff from the R&D Services Division prioritize projects • Sustainment, Restoration, and Modernization projects less than	Minor Construction and Sustainment, Restoration, and Modernization: • Facility and operations failure/building condition/Deferred Maintenance • Safety and risk • Mission requirements to support a S&T project objective • Mission dependency index • Sequence of renovation in Corporate Facilities Investment Plan or Master Plan • Facility space disruption • Affordability

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria*	Process	Criteria
Minor Construction and Sustainment, Restoration, and Modernization: • Deputy Assistant Secretary of the Navy approves projects over $5M and Assistant Secretary of the Navy (Research, Development, and Acquisition) approves projects over $2M		$100,000 are approved by the R&D Services Division • NRL Director of Research reviews and approves Sustainment, Restoration, and Modernization projects costing $100,000 or more and all Minor construction projects. • Minor Construction and Sustainment, Restoration, and Modernization greater than $100,000 is executed through NAVFAC. Small Sustainment, Restoration, and Modernization sometimes accomplished through maintenance contractor	

* NRL staff stated that although the MILCON scoring models changed over time, the one thing that seems consistent is that of about twelve objective capability areas in the recent Navy MILCON scoring, RDT&E is consistently ranked near the bottom of the list. Several areas are relatively static: Waterfront Ops, Airfield Ops, and Expeditionary Ops are consistently ranked above all others areas, followed by Utilities, Training, and Intermediate Depot Ops Maintenance. RDT&E is typically ranked below these areas.

Table C-32. Stakeholder Involvement and Communication for NRL

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
Office of the Chief of Naval Operations and CNIC staff	For MILCON projects: Reviews and prioritizes Incorporates feedback from Regional Commanders and RPRGs	NRL Director of Research	Approves all Minor Construction and Sustainment, Restoration, and Modernization projects above $100,000
Assistant Secretary of the Navy (Installations and Environment) (ASN(I&E))	Reviews and approves proposed MILCON projects	R&D Services Division (RDSD)	Approve Sustainment, Restoration, and Modernization projects less than $100,000 Provide a prioritized list to the Director of Research of all Sustainment, Restoration, and Modernization greater to or equal than $100,000
Commander, Navy Installations Command (CNIC) and Naval Facilities Engineering Command (NAVFAC)	For MILCON: Scores and prioritizes projects from NAVFAC Regional Commanders into a Draft MILCON Integrated Priority List (IPL)	Corporate Facilities Investment Plan Committee: Scientific and Research Division leadership and facilities office staff	Convenes at the Director's discretion to produce Corporate Facilities Investment Plan
Regional Commanders*	Reviews projects proposed by the Installations through RPRGs Prioritizes projects into an IPL Presents projects to the Regional Mission Integration Group (RMIG) Reviews the Draft MILCON IPL	Technical Divisions	Provides data for proposed projects to Director of Research RDSD then receives lab renovation priorities from the Director of Research staff
Real Property Requirements Generators (RPRGs); NRL is RPRG for NRL projects	For MILCON: Provides requirements to the Installations Reviews with the NAVFAC Regional Engineer the Draft MILCON IPL and prepares feedback		

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
Naval Laboratory and Centers Coordinating Group (NLCCG): Deputy Assistant Secretary of the Navy (Research, Development, Test and Evaluation) (DASN [RDT&E]), laboratory and center leadership	Serves as the coordinating body across NRL and the Warfare Centers and System Centers to foster technical capability, communication, cooperation, and collaboration		

* Some Regional Commanders are double hatted to the NAVFAC and CNIC.

Table C-33. Partnerships and Alternative Financing Mechanisms for NRL

Partnerships		Mechanisms		
Laboratory Partnerships Within Agency	Interagency Partnerships	Operating Leases	Energy Saving Performance Contracts	Other Partnerships
None identified	*None identified*	*None identified*	*None identified*	*None identified*

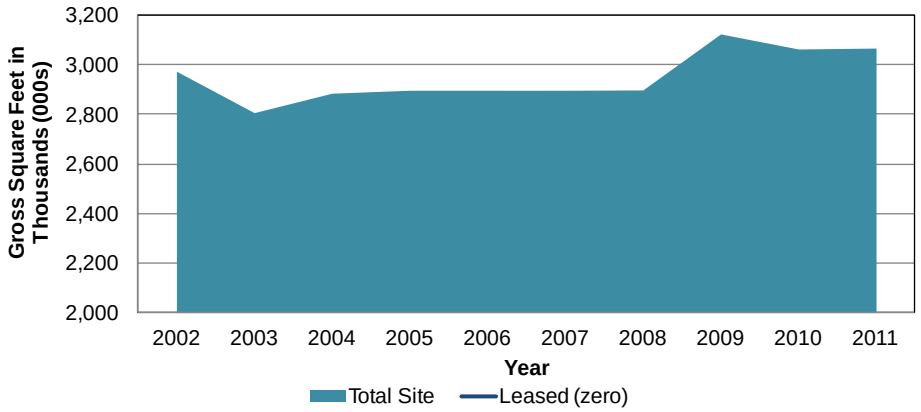
Table C-34. Data and Metrics for NRL

Assessment	Data and Metrics	Management Systems	Models
Inspections performed by NRL inspectors and contractors; Contractors have been used since 2005/2006; NAVFAC performed one time Facilities Condition Assessment Program in 2009 of all Navy facilities	Facility age; Mission Dependency Index (MDI); building condition; equipment efficiency; NRL uses maintenance backlog, customer feedback, service call data, and inspection reports	Laboratory-level: Maintenance and service databases Agency/Subagency-level: Facilities Readiness Evaluation System (FRES)	Laboratory-level: *None identified*. Agency-level: Facility Sustainment Model

Table C-35. Laboratory and Facilities and Infrastructure (F&I) Data for NRL, FY 2011

Metric	Value
Facilities	
Total Site Square Footage	3.1M GSF
Buildings	3.1M GSF
Trailers	*Not provided*
Leased Square Footage	0 GSF
Excess Facilities Disposition	*Not provided*
Number of Total Buildings	88
Average Age of Buildings	57 years
Oldest building	138 years
Newest building	1 year

Source: Naval Research Laboratory.



Source: Naval Research Laboratory.

Note: Disposition gross square feet were not available.

Figure C-4. Total Gross Square Feet by Year for Naval Research Laboratory

Brookhaven National Laboratory (BNL)

Table C-36. Planning Guidance and Documentation for BNL

Long-Term (t > 10 years)	Mid-Term (5 years < t < 10 years)	Short-Term (t < 5 years)
DOE Strategic Plan; DOE Quadrennial Technology Review; DOE Real Property Asset Management Plan; DOE Strategic Sustainability Performance Plan; DOE-SC Infrastructure Modernization Initiative Program Management Plan	DOE-SC Laboratory Planning Guidance; Ten Year Site Plan (TYSP); Site Master Plan; Consolidated Unfunded Requirements List (CURL)	Three-Year Rolling Timeline (TYRT); Annual Laboratory Plan (ALP); Facilities & Operations Directorate Business Plan; S&T Directorate Business Plan

Table C-37. Planning Process and Prioritization Criteria for BNL

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
Multi-Agency Co-Funded Projects: • DOE Deputy Secretary makes the final approval of the project Institutional General Plant Projects (IGPP) and GPP (<$10M): • Office of Science (SC) defines core competencies for each SC laboratory • DOE-SC Brookhaven Site Office (BHSO) reviews the Laboratory Director-approved CURL and provides feedback to the BNL Assistant Laboratory for Facilities and Operations (ALD F&O) • DOE-SC receives a list of projects and the laboratory Annual Plan Science Laboratories Infrastructure (SLI) Projects ($10M-$100M): • DDFO and the Associate Director for Safety, Security and Infrastructure	Institutional General Plant Projects (IGPP) and GPP (<$10M): • Safety, health, security, and sustainability • Efficient to operate and maintain • Right sized • Mission readiness • Working environment • Elimination of excess facilities • Building condition • Financial costs and ROI • Energy costs • Institutional commitment • Guiding principles Science Laboratories Infrastructure (SLI) Projects (>$10M) Screening criteria:	All Projects: • Department Chairs, Directorate Chief Operating Officers, and facility managers provide the 3PBP Program Manager (PM) a list of current and updated projects from the Project Datasheets (PDS) database • Infrastructure Management (IM) Group tracks and inputs project request forms (PRFs) into the VFA, Inc. database • 3PBP PM provides PDSs to Prioritization Team Chairs • Infrastructure and Environmental Safety and Health Prioritization Teams score the PDSs and enter data into the VFA database • 3PBP PM sends scores to the Consolidation Team, which bins the PDSs and enters data into the VFA	All Projects: • Laboratory modernization • Recruitment/retention • Quality of workplace • Public outreach VFA Prioritization Gates: • Mission need • Timing • Definition • Funding • Consolidation Team: • Mission readiness • Time criticality

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
(DSSI) holds an annual meeting to solicit input from site offices and laboratory Chief Operating Officers on projects identified in the Annual Laboratory Plan • SC provides the laboratory with feedback • NNSA Headquarters may be invited to presentations for laboratories with extensive NNSA work • A closed-door Federal session with SC and laboratory managers is held to discuss the projects • DOE research program Associate Directors and DDSP provide input on how the project will impact their missions • DDFO compiles input • Director of Science makes the final approval of projects considering the annual schedule and funding targets	• Dedicated across site • Goal to modernize • Cannot use alternative financing • Beyond IGPP scope • Sufficiently mature • Prioritization criteria: • Mission relevance • No. of years maintenance deferred • Elimination of excess • Return on investment • Institutional commitment	database • 3PBP PM sends projects including their scores to Assistant Laboratory Directors (ALDs) and meets individually with ALDs to get feedback on PDSs and identify near-term (1-2 years), mid-term (3-5 years), and long-term (6+ years) needs • 3PBP PM drafts a Consolidated Unfunded Requirements List (CURL) of all PDSs based on scores and ALD discussions • 3PBP PM reviews the CURL with the Budget Officer to review funding targets for IGPP and Operating Funded Projects • 3PBP PM sends the draft CURL to the ALD F&O for review and updates the list with any feedback • ALD F&O presents the draft CURL to the Policy Council and revises the CURL based on recommendations • Laboratory Director approves the CURL • ALD F&O sends approved CURL to DOE-SC BHSO for review • Approved projects with a review of mission readiness are inserted into the TYSP and Annual Laboratory Plan • Urgent PDSs can be addressed at any time and approved by the ALD F&O to be considered by the Policy Council if the project should be accommodated in the current year	

Table C-38. Stakeholder Involvement and Communication for BNL

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
DOE Basic Energy Sciences (SC-BES)	Typically funds multi-purpose user facilities across the DOE laboratories in the range of $50M-$100M	Assistant Laboratory Directors: Facilities and Operations (ALD F&O), Environmental Safety, Health and Quality (ALD ES&H)	Reviews the IPT and ES&H PT recommendations and discusses projects with the 3PBP PM to draft the CURL
Office of Science (SC): Deputy Director for Field Operations (DDFO); Deputy Director for Science Programs	Issues annual SC program direction and guidance; Issues policies related to F&I Oversees facility and energy managers at site offices Integrates research program, sustainability, and operations activities	Project Planning, Programming, and Budgeting Process Project Manager (3PBP PM)	Manages the 3PBP process to identify, integrate, and prioritize projects considering a 3-year time horizon Provides a list of new Project Data Sheets (PDSs) to Prioritization Teams for evaluation Interfaces with key stakeholder groups and ensures input and feedback are provided
Office for Safety, Security, and Infrastructure (SSI)	Works with the DDFO to develop and implement SC F&I policies Manages the Science Laboratories Infrastructure (SLI) program Oversees the Mission Readiness process aligning infrastructure with mission needs	Infrastructure Prioritization Teams (IPT): DOE-SC BHSO; Facilities and Operations (F&O); scientific departments; safety and health Services	Reviews technical elements of submitted PDSs Meets to present PDSs and provide a numerical score to PDSs according to the VFA Prioritization System
Office of Acquisition and Project Management (OAPM)	Manages F&I data Provides analysis and technical assistance Prepares asset management plans	Environmental Safety and Health Prioritization Team (ES&H PT)	Reviews the environmental safety and health aspects of PDSs Provides a score according to the VFA Prioritization System
DOE-SC Brookhaven Site Office (BHSO)	Provides oversight of project selections Works with the laboratory Chief Operating Officer to present projects to the DDFO and DOE leadership for approval	Consolidation Team: DOE-SC BHSO; Associate Laboratory Directors (F&O, ES&H); senior laboratory mangers; Directorate Chief Operations Officers; Budget Officer; IPT Chair; 3PBP PM; ES&H Prioritization Team Chair	Develops a consolidated list of prioritized project needs based on PDSs Ensures projects are aligned with the laboratory's strategic needs Assigns a management priority (bin) to projects Reviews previously binned projects selected by the PM for review
		Policy Council	Interfaces with DOE Headquarters to validate mission needs and priorities

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
		Modernization Project Office Infrastructure Management (IM) Group	Collects and tracks PDSs and updates the VFA facility database with submitted revised PDSs Provides assistance with new projects requests
		Architectural and Engineering Firms/Contractors: Flad Architects; VFA, Inc.	Worked with BNL to set up databases such as the Prioritization System to score projects and space tracking Conducts facility assessments

Table C-39. Partnerships and Alternative Financing Mechanisms for BNL

Partnerships		Mechanisms		
Laboratory Partnerships Within Agency	Interagency Partnerships	Operating Leases	Energy Saving Performance Contracts	Other Partnerships
None identified	*None identified*	Considering NY State financing through the NY Economic Development Fund for building construction	*None identified*	Easement to BP Solar and the local utility for two 18.5 megawatt solar arrays* Optimized customer and lab funds to construct and centralize chillers

* Brookhaven National Laboratory (BNL). "Environmental Assessment for BP Solar Array Project Released," http://www.bnl.gov/bnlweb/pubaf/pr/PR_display.asp?prID=1056.

Table C-40. Data and Metrics for BNL

Assessment	Data and Metrics	Management Systems	Models
Facility condition and prioritization assessments; Readiness Evaluations - Beneficial Occupancy Readiness Evaluation, Operational Readiness Evaluation, and Exit Readiness Evaluation	Space utilization, asset quantity; building condition; Facility Condition Index (FCI); Asset Condition Index (ACI); Mission Readiness	Flad Architects Space database; Maximo; VFA facility prioritization system; FIMS	*None identified*

Table C-41. Laboratory and Facilities and Infrastructure (F&I) Data for BNL, FY 2011

Metric	Value	Metric	Value
Facilities		Condition and Utilization	
Total Site Square Footage	4.2M GSF	Condition Index	5.2%
Buildings	4.2M GSF	Mission Critical	5.8%
Trailers	20.0K GSF	Mission Dependent, Not Critical	3.5%
Leased Square Footage	9.9K GSF	Not Mission Dependent	0.0%
Excess Facilities Disposition	31.0K GSF	Utilization Index*	91.9%
Number of Total Buildings	357	Mission Critical	96.9%
Average Age of Buildings	38 years	Mission Dependent, Not Critical	85.9%
Oldest building	94 years	Not Mission Dependent	17.7%
Newest building	1 year		

Source: Department of Energy, Ten Year Plans for the Office of Science National Laboratories; DOE Office of Engineering and Construction Management.

* Asset Utilization Index is calculated from owned and operational gross square footage (GSF) and based on FY 2010 (the value is weighted based on gross building or trailer area).

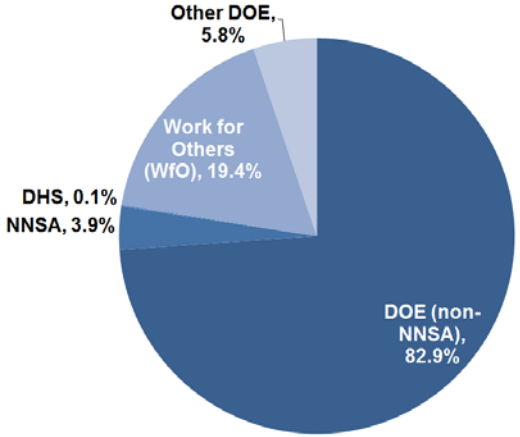


Figure C-5. Funding Sources
(Total Funding FY 2011: $652.4 million)

Los Alamos National Laboratory (LANL)

Table C-42. Planning Guidance and Documentation for LANL

Long-Term (t > 10 years)	Mid-Term (5 years < t < 10 years)	Short-Term (t < 5 years)
DOE Strategic Plan; DOE Quadrennial Technology Review; DOE Strategic Sustainability Performance Plan; NNSA Strategic Plan; DOD Nuclear Posture Review; NNSA Corporate Physical Infrastructure Business Plan; NNSA Stockpile Stewardship and Management Plan; 50-Year Infrastructure Plan; Twenty-Five Year Site Plan (TYSP)	NNSA Integrated Plan(under development); NNSA Communications Plan (under development); Environmental Stewardship Plan	NNSA Facilities and Infrastructure Recapitalization Program (FIRP) Execution Plan

Table C-43. Planning Process and Prioritization Criteria for LANL

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
Institutional General Plant Projects (IGPP) and GPP (<$10M): • Projects are reviewed by the Site Office (SO) and included in the TYSP • For IGPP, SO certifies that the project will not change the cost of doing business • For GPP, SO approval is not required • Projects are approved by DOE-NNSA Headquarters Readiness in Technical Base and Facilities (RTBF) Line Item (LI) Projects: • Laboratory, working with the SO, provides the site's prioritized projects with mission gap statements to the Construction Working Group (CWG)	Institutional General Plant Projects (IGPP) and GPP (<$10M): • Mission critical, dependent or not mission dependent Readiness in Technical Base and Facilities (RTBF) Line Item (LI) Projects: • Support operational and business goals (25%) • Support mission deliverables (45%) • Provide improvement of safety, environmental, security, and readiness (30%) • Urgency (no weight) FIRP Projects: • Health and Safety • Environmental and waste	All Projects: • Program leadership and subject matter experts from programs identify the capabilities for the laboratory and project needs • Program Infrastructure Offices prioritize Request for Project Authorization (RPAs) to be included in the TYSP and provide comments to the Los Alamos Site Office (LASO) for review	*None Identified*

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
• CWG provides comments to sites and updated mission gap statements are provided to the CWG • CWG scores all sites' projects: all CWG members score the operational and business goals criterion; only NNSA Headquarters scores the mission deliverables criterion; and Site Office managers score the improvement of safety criterion • CWG meets in Washington, D.C. over two days and deliberates scores and prioritizes projects • Previously ranked projects maintain their score unless the CWG rescores (a higher score moves the project up) FIRP Projects (now considered under LI process, under consideration to continue as the Capabilities Based Facilities and Infrastructure (CBFI) Program in FY13): • NNSA Headquarters selects recapitalization projects less than $10 million from TYSP • NNSA Headquarters notifies Congress of recapitalization projects Facility Disposition Program Projects: • Criteria are currently under development	management • Safeguards and security • Mission and investment—commitment to deferred maintenance reduction Facility Disposition Program Projects (pair-wise comparison): • Mission and ES&H Risk • Deferred maintenance reduction • Reinvestment Impact • Investment		

Table C-44. Stakeholder Involvement and Communication for LANL

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
NNSA Office of Infrastructure and Facilities Management and Program Director FIRP Recapitalization, Planning, Disposition	Provides guidance and oversight of FIRP Program Director acts as the FIRP point-of-contact for all eight NNSA sites and develops the Integrated Prioritized Project List (IPPL)	Laboratory Director	Determines the risk and mission relevance of proposed projects Serves as a champion for infrastructure initiatives
NNSA LANL Site Office (LASO)	Supports the on-site management and execution of FIRP-funded projects Reviews the FIRP-funded projects design, engineering, and schedule baseline Certifies IGPP projects	Subject matter experts	Provides input to the laboratory leadership on project needs
Construction Working Group (CWG): NNSA Headquarters; representatives from NNSA laboratories; subject matter experts from the site offices	Coordinates group meetings in order to identify F&I problems across the NNSA		
Office of Acquisition and Project Management (OAPM)	Manages F&I data Provides analysis and technical assistance Prepares asset management plans		

Table C-45. Partnerships and Alternative Financing Mechanisms for LANL

Partnerships		Mechanisms		
Laboratory Partnerships Within Agency	Interagency Partnerships	Operating Leases	Energy Saving Performance Contracts	Other Partnerships
Tri-lab (LANL, LLNL, and Sandia) High-Performance Computing (HPC) Consortium coordinates acquisitions across the NNSA complex	*None identified*	Failed to obtain funding as an operating lease for the Science Complex building	$19M contract with Noresco to provide energy efficient lighting*	*None identified*

* LANL, "Multi-million dollar energy efficiency project begins," http://www.lanl.gov/news/stories/noresco_begins.html.

Table C-46. Data and Metrics for LANL

Assessment	Data and Metrics	Management Systems	Models
Subcontracts assessments	Operating costs, Facility Condition Index (FCI), Asset Utilization Index (AUI), Deferred Maintenance, Recapitalization rate	Facilities Information Management System (FIMS); Active Facilities Data Collection System	Enterprise Modeling Consortium

Table C-47. Laboratory and Facilities and Infrastructure (F&I) Data for LANL, FY 2010

Metric	Value	Metric	Value
Facilities		Condition and Utilization*	
Total Site Square Footage	8.6M GSF	Condition Index	5.7%
Buildings	8.2M GSF	Mission Critical	2.2%
Trailers	378.0K GSF	Mission Dependent, Not Critical	9.5%
Leased Square Footage	452.0K GSF	Not Mission Dependent	9.8%
Excess Facilities Disposition	496.0K GSF	Utilization Index^	97.0%
Number of Total Buildings	1,169	Mission Critical	96.0%
Average Age of Buildings	34 years	Mission Dependent, Not Critical	97.0%
Oldest building	67 years	Not Mission Dependent	83.0%
Newest building	0 years		

Source: Los Alamos National Laboratory, Ten Year Site Plan FY 2012–2021; DOE Office of Engineering and Construction Management.

* Excludes Other Structure Facilities.

^ Asset Utilization Index is calculated from owned and operational gross square footage (GSF) and based on FY 2010.

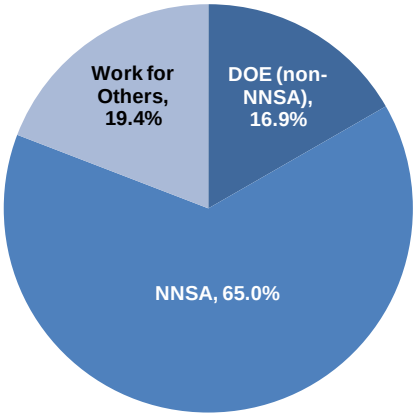
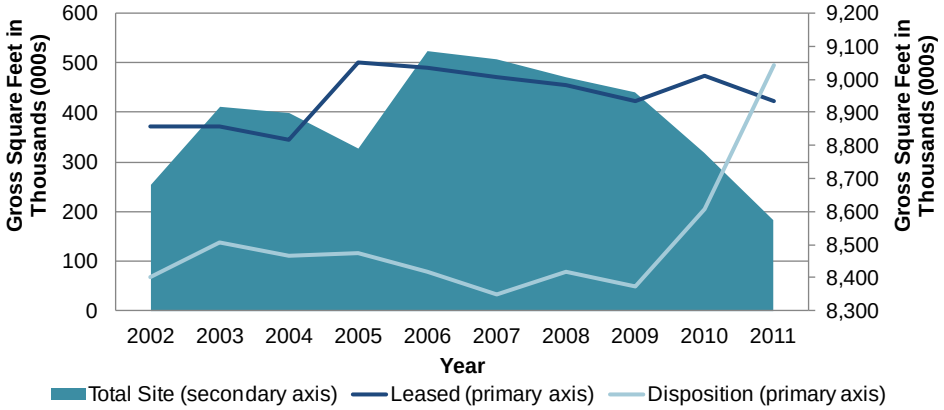
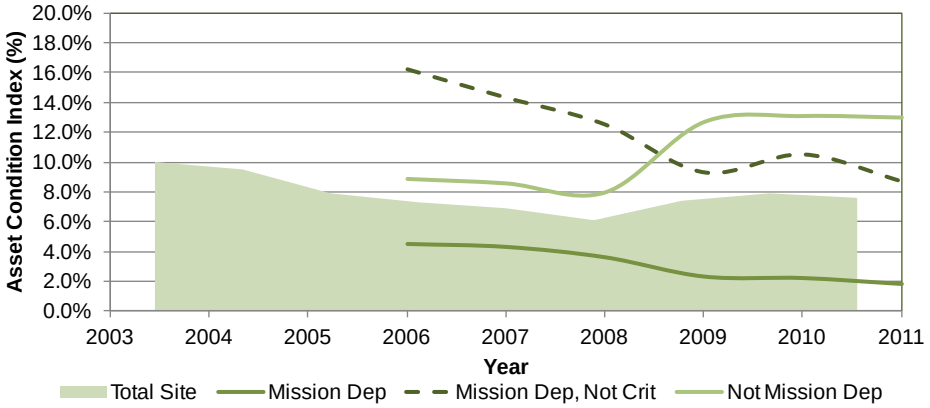


Figure C-6. Funding Sources (Total Funding FY 2010: $2.3 billion)



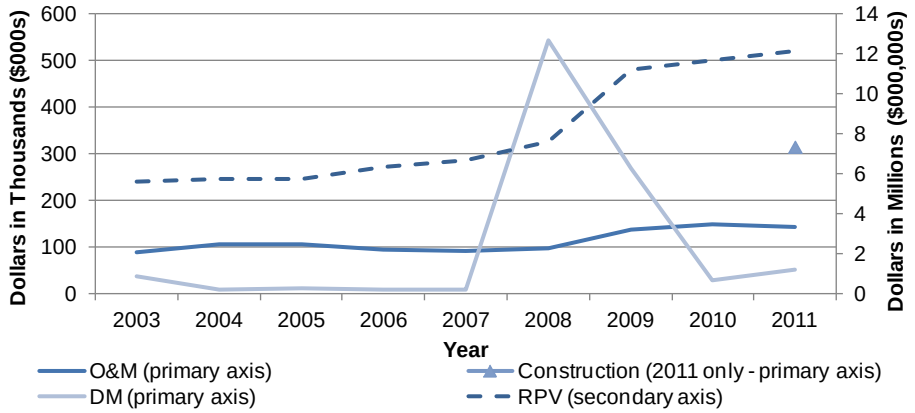
Source: Los Alamos National Laboratory, Ten Year Site Plan FY 2012–2021; DOE Office of Engineering and Construction Management.

Figure C-7. Total, Leased, and Disposition Gross Square Feet by Year for Los Alamos National Laboratory



Source: Los Alamos National Laboratory, Ten Year Site Plan FY 2012–2021; DOE Office of Engineering and Construction Management.

Figure C-8. Asset Condition Index (ACI) by Year for Los Alamos National Laboratory



Source: Los Alamos National Laboratory, Ten Year Site Plan FY 2012–2021; DOE Office of Engineering and Construction Management.

Note: This increase in DM from 2007 to 2008 was predominately for Non-Mission Dependent facilities and due to updated facility inspections (6%), corrected DM for shutdown facilities (26%), and revised utility DM from previous inspections (67%). Also the DM for Excess Facilities was reactivated until complete decommissioning and demolition.

Figure C-9. Facilities and Infrastructure (F&I) Funding for Operations and Maintenance (O&M), Deferred Maintenance (DM), Construction, and Replacement Plant Value (RPV) by Year for Los Alamos National Laboratory (Total Operating Cost FY 2010: $2.5 billion)

Sandia National Laboratories

Table C-48. Planning Guidance and Documentation for Sandia

Long-Term (t > 10 years)	Mid-Term (5 years < t < 10 years)	Short-Term (t < 5 years)
DOE Strategic Plan; DOE Quadrennial Technology Review; DOE Strategic Sustainability Performance Plan; NNSA Strategic Plan; DOD Nuclear Posture Review; NNSA Corporate Physical Infrastructure Business Plan; NNSA Stockpile Stewardship and Management Plan; Long-Range Development Framework and Plan; NM-Site Development Plan	Twenty-Five Year Site Plan (TYSP); NNSA Integrated Plan (under development); NNSA Communications Plan (under development); Strategic Plan; Subarea Plans; Five-Year Strategic Space Management Plan; Strategic O&M Plan; Site Sustainability Plan; Facilities Energy Management Plan	Facilities Capital Investment Plan; Strategic Management Units Strategic Plans; Project Execution Plan

Table C-49. Planning Process and Prioritization Criteria for Sandia

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
Institutional General Plant Projects (IGPP) and GPP (<$10M): • Projects are reviewed by the Sandia Site Office (SSO) and included in the TYSP • For IGPP, SSO certifies that the project will not change the cost of doing business • For GPP, SSO approval is not required • Projects are approved by NNSA Headquarters Readiness in Technical Base and Facilities (RTBF) Line Item (LI) Projects: • Laboratory, working with the SO, provides the site's prioritized projects	Institutional General Plant Projects (IGPP) and GPP (<$10M): • Mission critical, dependent or not mission dependent Readiness in Technical Base and Facilities (RTBF) Line Item (LI) Projects: • Support operational and business goals (25%) • Support mission deliverables (45%) • Provide improvement of safety, environmental, security, and readiness (30%) • Urgency (no weight) FIRP Projects: • Health and Safety	Institutional General Plant Projects (IGPP) and GPP (<$10M) and FIRP Projects: • Program management units (SMUs) and organizational lines identify F&I needs • SMU Space Coordinators work with Facilities Management and Operations Center to validate the Space Application Request (SAR) • Facilities Management and Operations Center assesses and prioritizes SARs • Projects are included in the TYSP and provided to NNSA Headquarters Readiness in Technical Base and	Space Application Requests (SARs): • Affordability (uses existing space first, then acquire) • Efficiency—use by other programs • Anticipated necessary facilities workforce • Life and safety • Financial costs and lifecycle • Urgency for mission • Building health • Fit for mission use—power capabilities, flexibility, compliance • Risk of not funding • State of health of program/operations

Agency/Subagency-Level		Laboratory-Level	
Process	Criteria	Process	Criteria
with mission gap statements to the Construction Working Group (CWG) • CWG provides comments to sites and updated mission gap statements are provided to the CWG • CWG scores all sites' projects: all CWG members score the operational and business goals criterion; only NNSA Headquarters scores the mission deliverables criterion; and Site Office managers score the improvement of safety criterion • CWG meets in Washington, D.C. over two days and deliberates scores and prioritizes projects • Previously ranked projects maintain their score unless the CWG rescores (a higher score moves the project up) FIRP Projects (now considered under LI process, under consideration to continue as the Capabilities Based Facilities and Infrastructure (CBFI) Program in FY13): • NNSA Headquarters selects recapitalization projects less than $10 million from TYSP • NNSA Headquarters notifies Congress of recapitalization projects Facility Disposition Program Projects: • Criteria are currently under development	• Environmental and waste management • Safeguards and security • Mission and investment – commitment to deferred maintenance reduction Facility Disposition Program Projects (pair-wise comparison): • Mission and environmental safety and health risk • Deferred maintenance reduction • Surveillance and maintenance reduction • Sustainability goals • Mission need	Facilities (RTBF) Line Item (LI) Program: • LI projects are identified by the laboratory • SSO reviews projects and F&I information and provides the list to the CWG for review	• Other funding sources

Table C-50. Stakeholder Involvement and Communication for Sandia

Agency/Subagency-Level		Laboratory-Level	
Stakeholder	Roles	Stakeholder	Roles
NNSA Office of Infrastructure and Facilities Management and Program Director FIRP Recapitalization, Planning, Disposition	Provides guidance and oversight of FIRP Program Director acts as the FIRP point-of-contact for all eight NNSA sites and develops the Integrated Prioritized Project List (IPPL)	Management Units (SMUs) and organizational lines	Identify F&I needs and work with Facilities Management and Operations Center to validate needs prior to submitting a Space Application Request (SAR)
NNSA Sandia Site Office (SSO)	Supports the on-site management and execution of FIRP-funded projects Reviews the FIRP-funded projects design, engineering, and schedule baseline Certifies IGPP projects	Facilities Management and Operations Center	Performs condition assessments and prioritizes the SARs
Construction Working Group: NNSA Headquarters; representatives from NNSA laboratories; subject matter experts from the site offices	Coordinate group meetings in order to identify F&I problems across the	Architectural and Engineering Firms/Contractors: ARC Planning	Work with Facilities Management and Operations Center in order to perform economic analyses of alternative space planning options and better communicate cost savings, including sustainability and environmental dimensions of proposed projects

Table C-51. Partnerships and Alternative Financing Mechanisms for Sandia

Partnerships		Mechanisms		
Laboratory Partnerships Within Agency	Interagency Partnerships	Operating Leases	Energy Saving Performance Contracts	Other Partnerships
• HPC Consortium • DOE Basic Energy Sciences (BES) owns buildings • Funded a second site at LANL for the Center for Nanotechnology Research	• DHS owns buildings • DOD weapons facility was rejected by MILCON but funded piecemeal by expense budget • Considering partnership with intelligence community to co-finance a new facility • Considered GSA financing • Developed an agreement with the Post Office for lease of land	Considering for administrative buildings at the Livermore Valley Open Campus (LVOC)	*None identified*	Pursuing alternative financing with the State of New Mexico's Finance Authority

Table C-52. Data and Metrics for Sandia

Assessment	Data and Metrics	Management Systems	Models
Contract independent facility assessments; Condition Assessment Survey every 5 years	Facility Condition index (FCI), Mission Dependency Index (MDI)	Facilities Information Management System (FIMS), Tririga, MAXIMA	Laboratory-level: Stockpile Optimization Resource Constrained Enterprise Agency-level: Enterprise Modeling Consortium

Table C-53. Laboratory and Facilities and Infrastructure (F&I) Data for Sandia, FY 2011

Metric	Value	Metric	Value
Facilities		Condition and Utilization	
Total Site Square Footage	7.3M GSF	Condition Index	7.3%
Buildings	6.9M GSF	Mission Critical	3.0%
Trailers	366.8K GSF	Mission Dependent, Not Critical	7.5%
Leased Square Footage	396.5K GSF	Not Mission Dependent	14.1%
Excess Facilities Disposition	16.8K GSF	Utilization Index*	*Not provided*
Number of Total Buildings	1,094	Mission Critical	97.0%
Average Age of Buildings	36 years	Mission Dependent, Not Critical	92.5%
Oldest building	79 years	Not Mission Dependent	85.9%
Newest building	0 years		

Source: Sandia National Laboratories, Ten Year Site Plan FY 2012–2021; DOE Office of Engineering and Construction Management.

* Asset Utilization Index is calculated from owned and operational gross square footage (GSF) and based on FY 2010.

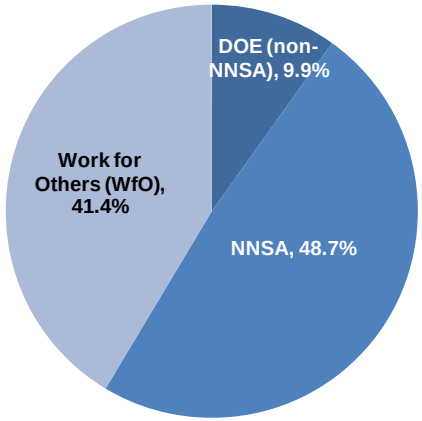
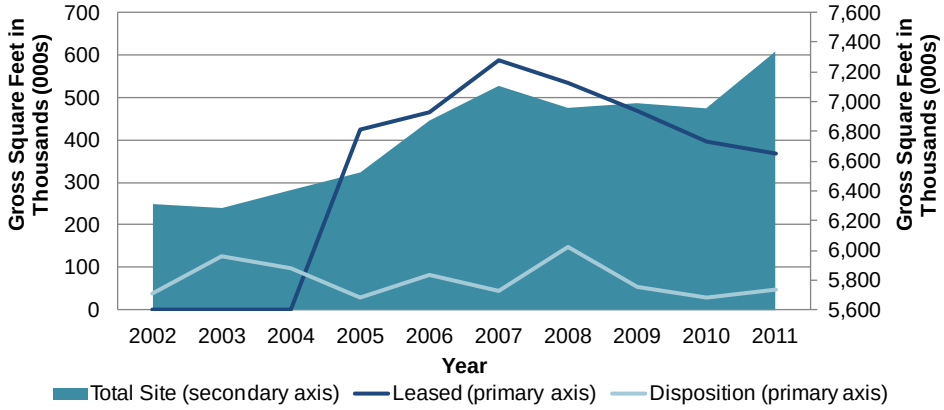
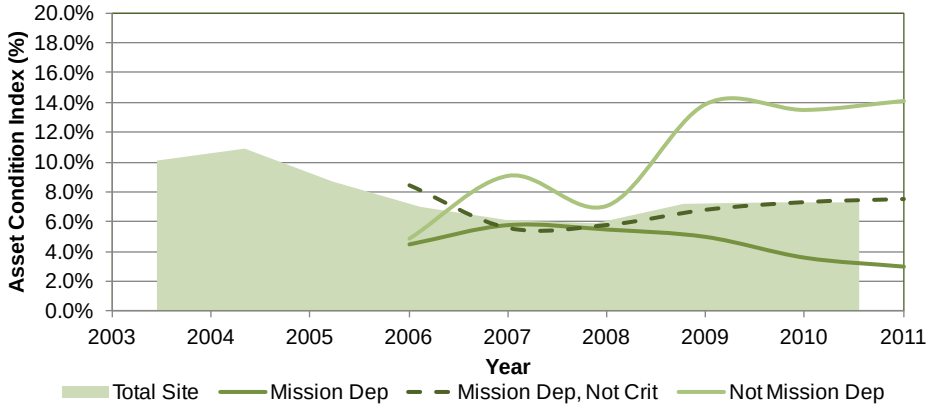


Figure C-10. Funding Sources
(Total Funding FY 2011: $2.4 billion)



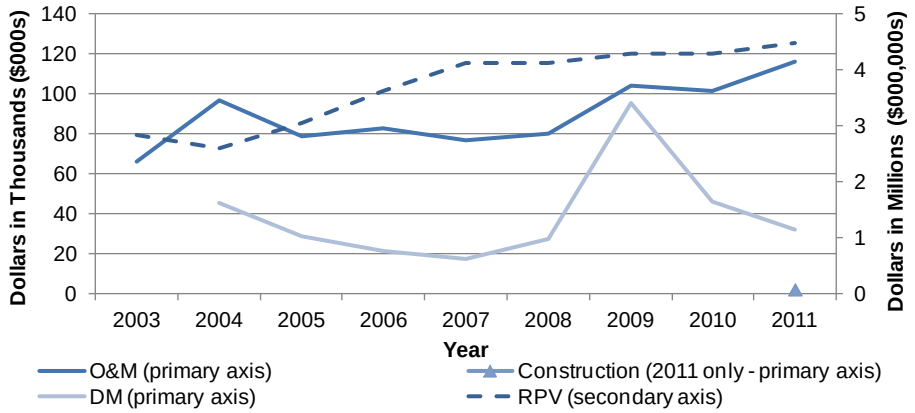
Source: Sandia National Laboratories, Ten Year Site Plan FY 2012–2021; DOE Office of Engineering and Construction Management.

Figure C-11. Total, Leased, and Disposition Gross Square Feet by Year for Sandia National Laboratories



Source: Sandia National Laboratories, Ten Year Site Plan FY 2012–2021; DOE Office of Engineering and Construction Management.

Figure C-12. Asset Condition Index (ACI) by Year for Sandia National Laboratories



Source: Sandia National Laboratories, Ten Year Site Plan FY 2012–2021; DOE Office of Engineering and Construction Management.

Figure C-13. Facilities and Infrastructure (F&I) Funding for Operations and Maintenance (O&M), Deferred Maintenance (DM), Construction, and Replacement Plant Value (RPV) by Year for Sandia National Laboratories (Total Operating Cost FY 2011: $1.6 billion)

Appendix D.
Private Sector Master Planning Frameworks and Models

STPI researchers contacted staff from the five architectural and engineering firms listed in Table D-1 by email or phone to discuss the firms' facilities master planning and prioritization frameworks and use of metrics and tools in facility assessments. Each of the five firms has experience working with one or multiple Federal laboratories across the DOD and DOE, as well as with colleges and universities, corporations, and organizations in the health care sector. In some cases, they have worked with other Federal agencies, such as the Department of Veteran Affairs (Payette Associates) or the Department of Agriculture (RTKL Associates and Whitestone Research Corporation).

Table D-1. Five Architectural and Engineering Firms STPI Contacted

Firm Name	Federal Laboratory Experience	Focus Area(s)
Flad Architects	Army Medical Research and Materiel Command/ Army Medical Research Institute of Infectious Diseases (DOD-Army) Brookhaven National Laboratory (DOE-SC) Pacific Northwest National Laboratory (DOE-SC)	Facility Master Planning Prioritization Facility Assessment
Payette Associates	Massachusetts Institute of Technology–Lincoln Laboratory (DOD-Air Force)	Facility Master Planning Prioritization Facility Assessment
RTKL Associates	Johns Hopkins University–Applied Physics Laboratory (DOD-Navy)	Facility Master and Site Planning Facility Assessment
VFA, Inc.	Brookhaven National Laboratory (DOE-SC) Lawrence Berkeley National Laboratory (DOE-SC)	Facility Master Planning Prioritization
Whitestone Research Corp.	Brookhaven National Laboratory (DOE-SC) Los Alamos National Laboratory (DOE-SC) Lawrence Livermore National Laboratory (NNSA)	Facility Assessment Cost Modeling

This appendix provides a selection of the firms' frameworks and models for facility master planning, prioritization strategy and criteria, facility assessments using data and benchmarking, and cost modeling.

Facility Master Planning Frameworks

The master planning frameworks used across the firms can vary, although they all generally include: developing and understanding the laboratory's goals, collecting information on the characteristics and condition of the facilities, establishing prioritization criteria, benchmarking, and providing costs and alternatives.

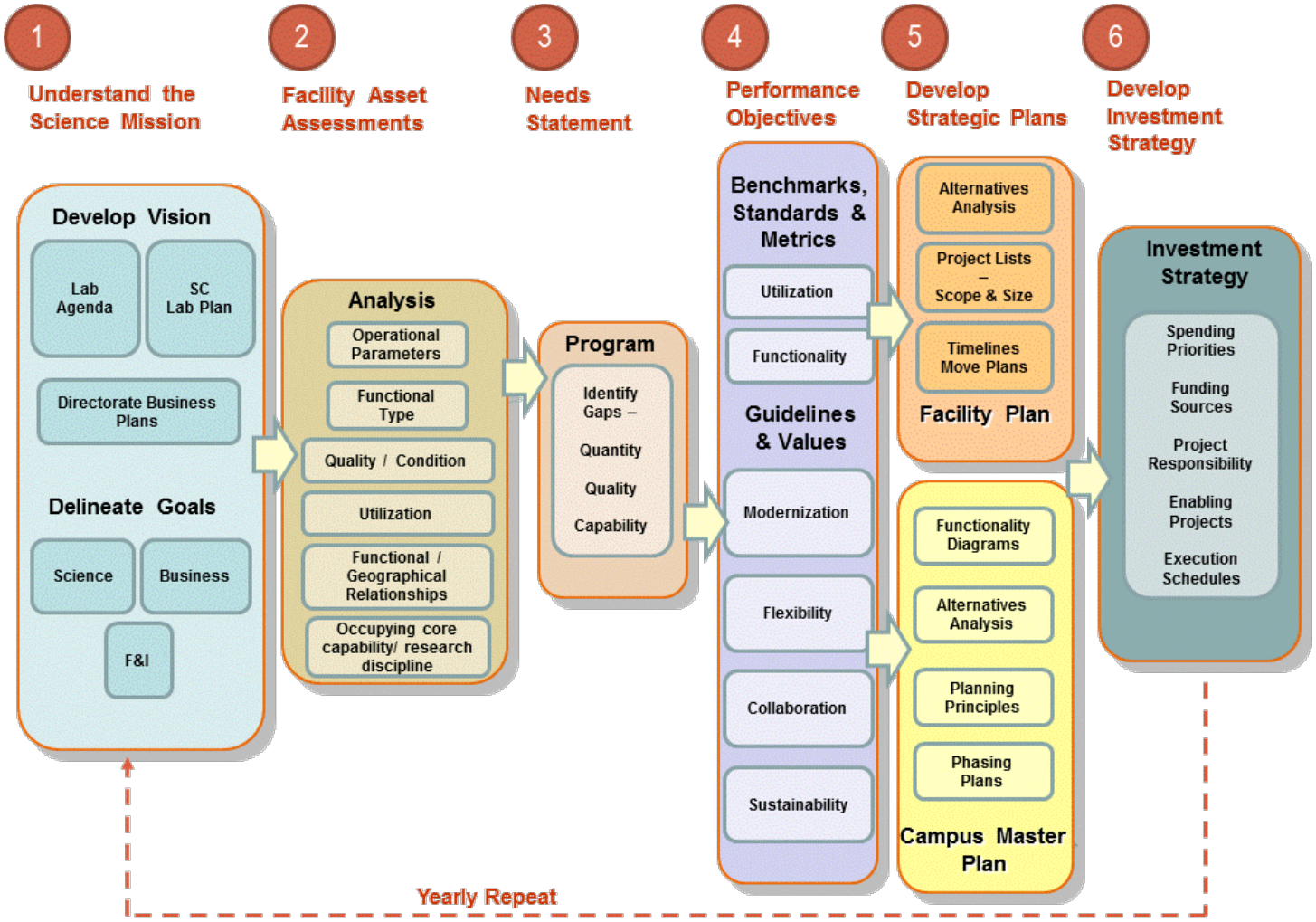
Flad Architects

Flad Architects follows the six-step framework depicted in Figure D-1 when developing a master plan. The first step in this framework is to understand the laboratory's mission, vision, and goals, which was also stressed as an important dimension by other architectural and engineering firms involved in master planning. Flad Architects looks to the laboratory and agency plans in order to gain further insight into the laboratory's program, budget, and culture. They also hold workshops with laboratory, scientific, and facilities leadership. The facilities data and information resulting from the subsequent steps in the framework provide information for laboratory leadership to prioritize projects into work plans. When coupled with budget information, the prioritized lists can be translated into facility site and campus plans and an overall facility investments strategy.

RTKL Associates

For over 12 years, RTKL Associates has guided the development of three facility master plans at Johns Hopkins University-Applied Physics Laboratory (JHU-APL). The master plans have focused on three areas: security, site planning, and alternatives to new construction and renovations. As JHU-APL plans for new infrastructure and large renovations, RTKL Associates has been placing a much larger emphasis on the economic costs of alternative scenarios. RTKL Associates noted the following lessons learned from their work with JHU-APL:

- Communication with the laboratory leadership: RTKL Associates tailors their assessments and recommendations to the needs of their clients. They build trust and a culture of understanding with the laboratory staff, which ultimately improves investment decisions.
- Priorities of laboratories may be different than those for industry and academia: Initially, RTKL Associates recommended design alternatives based on industry standards and that would increase space efficiency (e.g., shared office space). However, this conflicted with JHU-APL's culture to maintain a competitive scientific workforce. Trust and open communication lines becomes important to share recommendations that are aligned with the laboratory's priorities.



Source: Reproduced with permission from Flad Architects/Battelle.

Figure D-1. Flad Architects Facility Master Planning Process

Prioritization Strategy and Criteria

Flad Architects

Flad Architects uses six performance objective measures: utilization, functionality, modernization, flexibility, collaboration, and sustainability. The measures are largely guidelines when developing a prioritization scheme and remain flexible based on the laboratory's needs.

- Facility utilization and functionality aim to quantify the space requirements and ensure the space is aligned with industry metrics and design standards.
- Modernization refers to the quality of the facility to deliver mission-ready laboratory space and is marked by the reduced average age of facilities and updated equipment and technology.
- Flexibility describes the ability of the facility floor layout to support modular, multi-purpose laboratories such that they can enable efficient change in space usage.
- Collaboration represents the co-location of staff within their technical teams and using shared spaces to facilitate interdisciplinary collaborations
- Sustainability focuses on energy and water efficiency to support a healthy work environment and lower operating costs.

Flad Architects works with the laboratory staff to apply weights across these measures. The facility projects are rated on a five-point scale from low to high value, and ranked based their overall score considering the assigned weights to each measure.

VFA, Inc.

VFA, Inc. outlines five inputs to developing a prioritization scheme:

1. The criteria across which needs will be ranked
2. The relative priorities of the value within each criterion
3. The funding sources that may be applied, and any associated constraints
4. The funding timeline (e.g., annual or every 5 years)
5. Assumptions, such as inflation rates

VFA, Inc. works with the laboratory leadership early in the master planning process to specify the dimensions to evaluate facility projects. This ensures that the assessments to be conducted will provide the necessary data and information to evaluate the projects.

VFA, Inc.'s VFA.facility software package uses a pairwise comparison method to simplify the decisions that are made across a variety of criteria. VFA.facility users can input criteria and rank each criterion relative to all others. The results are a series of one-to-one comparisons and an overall ranking strategy for each criterion. Projects are objectively given a composite score and ranked according to the prioritization strategy.

Facility Assessments Using Data and Benchmarking

Flad Architects

Three steps in Flad Architects' master planning framework are conducting facility assessments, defining future facility needs, and benchmarking. Flad Architects supplements information from facility walk-throughs with existing laboratory databases in order to provide a current understanding of the quality, condition, and use of the facility as well as track patterns over time. They conduct user and operations staff interviews and compare data with industry benchmarks in order to describe the laboratory's facility needs.

Payette Associates

Payette Associates evaluates a variety of factors in their building surveys, including space use, mechanical, electrical, plumbing/fire protection (MEP/FP), life safety and code compliance, and building envelope and structure. Building surveys can focus on facility and campus-wide infrastructure or be conducted for each room in a facility.

Payette Associates benchmarks facilities according to three categories:

- *State-of-the-art facilities:* These facilities are used to establish benchmarks for goal-setting and highlight industry standards. Information is typically collected through site visits and conveyed through graphical plans and photographs.
- *Buildings of similar use, size, and location to those being evaluated:* These facilities represent the best overall comparison with the laboratory in terms of space distribution or other facility dimensions.
- *Existing spaces within the institution:* These facilities are used to provide a comparison of specific space types within the facility and are useful in establishing criteria for space utilization based on the specific functional space use.

RTKL Associates

RTKL Associates worked with JHU-APL staff in their most recent master plan to conduct the facility assessments, rather than using solely RTKL Associates' staff. Cost savings were a motivating factor for JHU-APL's decision to use their staff in the

assessments. RTKL Associates noted that the laboratory's staff provided a large amount of corporate knowledge of their facilities.

Cost Modeling

Whitestone Research Corporation

Whitestone Research Corporation has worked with Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL) to integrate their models with the NNSA's Enterprise Modeling Consortium activities. Whitestone Research Corporation's infrastructure life-cycle cost forecasting tool (MARS) was integrated with NEMUS, a weapons demand model developed by LLNL. The new NEMUS-MARS Integration (NMI) life-cycle cost modeling system is used throughout the NNSA to forecasts the costs and personnel demand of alternative weapons scenarios. Data is collected across eight NNSA sites. NMI provides NNSA leadership with annual cost estimates for acquisition, deferred maintenance, operations and maintenance, recapitalization and revitalization, and disposition for individual facilities, complete laboratories, or the entire NNSA enterprise (Whitestone Research Corporation 2011).

Appendix E.
Selected Applicable Legislation and Regulations

Table E-1 shows selected legislation related to F&I across the Federal Government as well as Executive orders and agency-level directives and orders throughout the DOD and the military departments, the DOE, and the DHS:

- 8 statutory requirements
- 6 Executive orders or guidance provided by the Executive Office of the President
- 17 agency-level directives and orders (8 DOD, 6 DOE, and 3 DHS)
- 10 military department-level service directives or requirements (4 Air Force, 3 Army, and 3 Navy)

Table E-1. F&I-Related Legislation and Regulations

Statutory Requirements	
Energy Policy Act of 2005 (2005)	Establishes a number of energy management standards and goals to be adopted across the entire Federal facility fleet. Agency implementation to meet Energy Policy Act of 2005 requirements is supported by the DOE Federal Energy Management Program. Facilities related requirements include: • Building Metering and Reporting (Sec 103) • Energy-efficient Product Procurement (Sec 104) • Provides the authority for agencies to utilize Energy Savings Performance Contracts (Sec 105) • Establishes building performance standards (Sec 109)
Energy Independence and Security Act of 2007 (2007)	Establishes new Federal energy management goals or amends goals from Energy Policy Act of 2005. These goals apply to all Federal facilities and include: • Energy-reduction goals for Federal buildings as required under EO 13423 (Sec 431) • Federal facility managers must complete energy and water evaluations to benchmark building resource performance, and implement commissioning for upgrades to validate planned improved performance (Sec 432) • Establishes performance standards for new buildings and major renovations benchmarked against similar scale building types described in the Commercial Buildings or Residential Energy Consumption Survey (Sec 323, 433), and increases the life-cycle cost calculation horizon to 40 years (Sec 441) • Provide significant authority for agencies to utilize Energy Savings Performance Contracting to implement energy and water savings upgrades (Sec 511-518) • Strengthens Energy Policy Act of 2005 energy-efficient product procurement requirements (Sec 522-526)
Title 10 USC § 2667 DOD Land Use Planning Authority/Non-Excess Lease Authority	Provides the authority for the Secretary of Defense to use Enhanced Use Leases (EULs) in order to generate revenue from underutilized property. DOD may lease the property or land to public or private entities for varying durations and must receive no less than the fair market rental rate for the property.

Title 10 USC § 2805 (d) Armed Forces, Unspecified Minor Construction, Laboratory Revitalization	Provides the authority for the Secretary of Defense to use funds from operations and maintenance appropriations to fund unspecified minor military construction projects costing no more than $2 million and from appropriations available for military construction not otherwise authorized by law or from funds authorized to be made available under Section 219 (a) of the National Defense Authorization Act (Public Law 110-417) to fund projects costing no more than $4 million.
Title 42 USC § 7256 DOE Leasing of Excess Property Authority	Authorizes the Secretary of Energy to lease excess real property that is closed DOE property or real property that will be unused. The lease duration may be up to 10 years unless DOE finds that the lease will be in the public interest or in the interest of national security where the lease may be extended an additional 10 years. In-kind services such as protection and maintenance of the property may be considered as a component of the payment for the lease.
Defense Base Closure Realignment Act of 1990 (2005 amendments) (P. L. 101-510)	Authorizes the establishment of an independent commission (the Defense Base Closure and Realignment Commission, referred to as BRAC) and the process that will result in the timely closure and realignment of military installations in the United States.
Duncan Hunter National Defense Authorization Act for Fiscal Year 2009 § 219, Mechanisms to Provide Funds for Defense Laboratories for Research and Development of Technologies for Military Missions (2008) (P. L. 110-417)	Authorizes appropriations for the Department of Defense, military construction, and defense activities of the Department of Energy. Particularly, § 219 provides the authority for the director of a defense laboratory to use discretionary funds up to 3% of the laboratory's budget to carry out unspecified minor military construction projects. The statute states that funds can be used for (1) innovative basic and applied research; (2) development programs that support the transition of technologies to operational use; and (3) workforce development activities that improve the capacity to recruit and retain personnel.
National Defense Authorization Act for Fiscal Year 2012 § 2802, Modification of authority to carry out unspecified minor military construction projects (2011) (P. L. 112-81)	Authorizes appropriations for the Department of Defense, military construction, and defense activities of the Department of Energy. Particularly, § 2802 modifies the authority to carry out unspecified minor military construction projects by extending the Laboratory Revitalization Authority from September 30, 2012 to September 30, 2016.

Executive Orders (EOs), Presidential Memoranda, and Office of Management and Budget (OMB) Issuances	
EO No. 13327 Federal Real Property Asset Management (2004)	Establishes a real property asset management policy for executive branch departments and Federal agencies. Requirements include: • Establishes an Agency Senior Real Property Officer that is responsible for developing and implementing an agency asset management planning process. • Establishes Establishment of the Federal Real Property Council within the Office of Management and Budget.
EO No. 13423 Strengthening Federal Environmental, Energy, and Transportation Management (2007)	Establishes more aggressive energy goals than were established by Energy Policy Act of 2005. Components of the Order relating to facilities management are: • Agencies must reduce energy intensity by 3% with a goal of 30% reduction in FY 2015 compared to a FY 2003 baseline. • Requirements to increase procurement of renewable energy • Requirements to reduce water intensity of facilities by 2% per year through FY 2015 (gallons/sq. ft. basis) • Requires new construction and major renovations to comply with Federal guidelines for designing and operating sustainable buildings
EO No. 13514 Federal Leadership in Environmental, Energy, and Economic Performance (2009)	Establishes overall Federal energy, water, buildings, and waste performance standards accompanied with updated accounting and reporting requirements. Requirements related to facilities management include: • Agencies are required to establish and report greenhouse gas reduction goals, which include measures that reduce building energy intensity and implementing planning reduces transportation by agency staff. • Establishes requirements for sustainable buildings and communities which include net-zero energy buildings by 2030, ensuring 15% of existing buildings above 5,000 sq. ft. meet sustainable building guidelines, and review process that optimizes performance of portfolio property. • Requirements to increase water efficiency and promoting water reuse strategies. • Waste reduction requirements to divert 50% of non-hazardous solid waste by FY 2013.

Presidential Memorandum Implementation of Energy Savings Projects and Performance-Based Contracting for energy savings (2011)	Outlines requirements to reduce operating costs and increase energy efficiency in Federal buildings. Requirements related to facilities management are: • Agencies must implement energy conservation measures in Federal buildings with a payback period of less than 10 years. • The Federal Government will fund a minimum of $2 billion in performance-based contracts within 24 months of the memorandum. • Agencies must prioritize new projects based on return on investment. Agencies must complete required energy and water evaluations required by EISA 2007 and ensure data are regularly updated in DOE's Compliance Tracking System.
Presidential Memorandum Disposing of Unneeded Federal Real Estate (2010)	Establishes actions that were planned to eliminate excess properties and make better use of remaining real property assets. Actions outlined in the memorandum related to facilities management are: • Accelerating cycle times for identifying excess assets and disposing of surplus assets • Eliminating lease arrangements that are not cost-effective • Pursuing consolidation within and across agencies in common asset types (e.g., data centers, laboratories) • Increasing occupancy rates • Identify offsetting reductions in inventory when new space is acquired.
OMB Circular A-11 Part 7, Section 300, Planning, Budgeting Acquisition, and Management of Capital Assets (2011)	Establishes OMB policy for planning, budgeting, acquisition, management, and reporting of Federal capital assets and describes information that must be submitted to OMB. The document specifies what information must be submitted with capital programming budget requests include justification on the establishment of performance measures, financial management standards, validation of cost-benefit analysis, and the establishment of oversight mechanisms.

Department of Defense Instructions (DODI)	
DODI 3200.11 Major Range and Test Facility Base (MRTFB) (2007)	Reassigns responsibilities relating to the MRTFB to USD(AT&L). The policy instruction establishes procedures for updating and modifying the MRTFB and the planning, programming, and financial planning requirements to make those changes.
DODI 3200.18 Management and Operation of the Major Range and Test Facility Base (2010)	Establishes DOD policy on how Major Ranges and Test Facility Bases (MRTFB) are identified, used, added, modified, and responsibilities for managing and reporting on the MRTFB. Procedures are described for closing or mothballing a MRTFB as well as reinstating a previously inactive base.
DODI 4165.06 Real Property (2008)	Describes the policy and responsibilities to the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) for the acquisition, management, and disposal of real property within DOD. The policy also holds the Secretaries of Military Departments responsible for maintaining an accurate inventory for real property and developing a comprehensive master plan that covers each installation under its jurisdiction.
DODI 4165.14 Real Property Inventory and Forecasting (2006)	Describes the responsibilities of DOD leadership to inventory, track, program, and report on DOD real property assets. The policy establishes the DUSD(Installations & Environment) as the primary policymaker for real property asset decision making. Responsibilities of Secretaries of Military Departments are established in the Instruction. Management topics covered are general property management, acquisition, environmental conservation, financial management regulations, and guidance for compliance with pertinent Executive orders.
DODI 4165.70 Real Property Management, Acquisition, Disposal (2005)	Establishes and re-delegates responsibilities for overall real property management to DUSD(I&E). This instruction provides guidance on master and comprehensive planning procedures, plan review processes, procedures for approvals of leaseholds, conservation of natural and cultural resources, mineral rights and exploration, and processes for change of use of space.
DODI 4165.71 Real Property Acquisition (2005)	Establishes DOD policy for acquiring real property for Departmental use. DUSD(I&E) is the primary office responsible for establishing guidance and approvals for real property acquisition. The instruction details the approval process for land acquisition larger than 1,000 acres or within 100 miles of Washington, DC which require special approvals, financial accounting standards, siting new real property, policy for withdrawing public land for Departmental acquisition, and procedures for establishing encroachment partnering agreements.

DODI 4165.72 Real Property Disposal (2007)	Establishes DOD policy for disposal of real property assets. The DUSD(I&E) is the primary office responsible for establishing guidance and procedures for property disposal. Disposal procedures are described, including DOD policy on addressing environmental impacts, CERCLA, remediation, specific requirements for non-Federal transfers, lands with munitions, disposal of excess family housing units, and retention of access rights.
DODI 4170.11 Installation Energy Management (2009)	Updates previous DOD energy installation policy and aligns DOD policy with EISA and EO 13423. The policy requires that the Department establish energy conservation goals, annual programmatic guidance to achieve the goals, criteria for the Energy Conservation Investment Program, and reporting standards for energy and water conservation programs. The instruction provides guidance on project development analytical requirements, including life cycle cost analysis, energy and water audits, sustainable building design, and the use of alternative financing mechanisms.

Air Force Policy Directives (AFPD)	
AFPD 10-24 Air Force Critical Infrastructure Program (1999)	Implements the Air Force component of DOD Directive 3020.40 and renames the Air Force Critical Infrastructure Program to the Air Force Critical Asset Risk Management (CARM) Program. Under the directive, any infrastructure facility, equipment or service is considered an infrastructure asset. For facilities, the directive requires that risk management procedures are followed in facility construction, installation recapitalization, and installation-level outsourcing and privatization efforts (sec 2.5).
AFPD 32-10 Installations and Facilities (2010)	Describes the roles and responsibilities of Air Force officers and installation commanders for managing, operating and maintaining installations and facilities. The directive requires that the department employs an Activity Management Plan which serves to assist facility managers to prioritize resources to operate and maintain facilities that are critical to mission support. Major Command and installation commanders are responsible for developing asset management plans, identifying infrastructure lifecycle requirements, operating facilities to optimize level of service at lowest life cycle costs, and develop and execute real property construction, sustainment, restoration, and modernization programs.
AFPD 63-7 Industrial Facilities (1993)	Establishes that Headquarters Air Force Materiel Command (AFMC) is responsible for acquisition, management and disposal of industrial production facilities. The policy directs that The U.S. Air Force manages its industrial facilities such that contractor reliance on government-owned industrial production facilities is discouraged. Compliance is measured through assessing air force plant divestiture, leases negotiated, and installation restoration program of Government-Owned, Contractor-Operated plants.
AFPD 90-17 Energy Management (2011)	Establishes an energy management framework for all activities within the Air Force. Facilities are considered within the scope of the reporting and tracking components of these requirements. The directive places the Deputy Chief of Staff of Air Force Logistics, Installations and Mission Support to establish and manage information systems that report and track facility energy and water consumption data.

Army Regulations (AR)	
AR 210-20 Real Property Master Planning for Army Installations (2005)	Establishes Army procedures and policy for master planning for all Army installations and off-post sites. The master planning process outlined by the regulation requires a phased data collection, objectives and mission analysis, a process to consider environmental, sustainable design, historic preservation and natural resource impacts, and detailed sets of phased approvals necessary before project siting and land use change authorizations are granted.
AR 405-70 Utilization of Real Property (2006)	Specifies that the ASA (Installations & Environment) is the primary oversight office for the use of Army real property. The ASA (I&E) is responsible for establishing policies, program objectives and conducting performance appraisal. The regulation specifies space planning procedures, utilization survey requirements, instructions on when leasing and rental of non-governmental owned property is permitted, and financial management requirements for O&M of Army facilities.
AR 420-1 Army Facilities Management (2008)	Provides a comprehensive regulation that covers all activities relating to planning, constructing, operating, and disposing of Army facilities. The regulation is split into 6 major sections that cover facility management: Management of Public Works Activities: outlines general public works policy, customer relations, utilization of personnel, and project management guidelines. Facilities Operation and Maintenance: covers activities for real property maintenance, hazardous materials, roofing systems, and transportation infrastructure and dams. Master Planning: policies covering installation planning and design standards. Real Estate: policies covering real property acquisition and disposal, mineral and natural resources management, and granting use of real property. Utility and Energy Management: covers programs and policies such as the Army Energy and Water Management Program, Army owned and operated utility services. Special Policies: these policies include fire and emergency services and policies on private organization use of Army installations.

Office of the Chief of Naval Operations (OPNAV) and Secretary of the Navy (SECNAV) Instructions	
OPNAV Instruction 3900.25C Major Range and Test Facility Base (MRFTB) (2006)	Establishes Navy policy on the information that commanders must provide and required coordination to comply with the associated DOD policy, DOD Directive 3200.11.
OPNAV Instruction 11011.10F Utilization of Navy Real Property (1989)	Provides guidance on required surveys, reporting, and responsibilities for cataloging utilization of Navy real property. Surveys and periodic reviews of real property follow General Services Administration standards and procedures. Each Navy executive agency reports on classes of property utilization levels to support the generation of an Annual Real Property Utilization Review.
SECNAV Instruction 11011.47B Acquisition, Management, and Disposal of Real Property and Real Property Interests by the Department of the Navy (2009)	Establishes policy and assigns responsibility for changes in Navy real property interests. The policy states that the Department may only acquire real property if there is no other Government property available to meet mission requirements. The policy establishes when the Department will request legislative approval for MILCON acquisitions, when an acquisition is considered a minor land acquisition, the withdrawal of public lands for the Department's use, and procedures for territories outside the US or areas under the sovereignty of foreign governments.

Department of Energy (DOE) Orders and Guides	
DOE Order 413.3B Program and Project Management for the Acquisition of Capital Assets (2010)	Establishes DOE and NNSA policy on the process required when acquiring capital assets. The requirements described in the Order apply to all DOE elements with capital projects having a total project cost exceeding $50M, with limited exceptions. The order lays out in detail the approval process for critical decisions, performance management, and rules and guidelines for project exceptions (e.g., environmental management projects, design-build projects, long-lead procurement, use of alternative financing).
DOE Order 420.2C Safety of Accelerator Facilities (2011)	Details the requirements and responsibilities for ensuring safety at DOE and NNSA accelerator facilities. Documentation requirements, responsibilities for headquarters and field officers and contractor requirements are described in the order.
DOE Order 430.1B Real Property and Asset Management (2003)	Establishes corporate property management guidelines for DOE owned sites and facilities. The order incorporates life-cycle asset management which requires the consideration of asset planning, programming, budgeting, and evaluation related to the DOE mission in capital planning. The order covers guidelines for planning, real estate management, acquisitions, disposition, value engineering, establishment and tracking of performance measures, and delegates responsibilities for complying with these requirements.
DOE Guide 430.1-4 Decommissioning Implementation Guide (1999)	Provides implementation guidance for decommissioning of DOE facilities, and provides a detailed framework for guiding agency actions, decision-making, and operations. The Guide provides necessary implementation framework to comply with the previous Order 430.1A which has been superseded by the current Order 430.1B, Real Property and Asset Management.
DOE Order 436.1 Departmental Sustainability (2011)	Defines requirements and responsibilities for managing sustainability in DOE facilities. Activities outlines in the Order include developing an annual Strategic Sustainability Performance Plan (SSPP), preparing a Site Sustainability Plans (SSP), and supporting alternative financing for energy saving projects.
DOE Order 5639.8A Security of Foreign Intelligence Information and Sensitive Compartmented Information Facilities (1993)	Establishes responsibilities for DOE officers and field managers for ensuring the integrity of Sensitive Compartmented Information Facilities (SCIFs). The Order includes instructions on necessary approvals for construction of new SCIFs, and architectural and engineering design review process for new SCIFs.

Department of Homeland Security (DHS) Directives	
DHS 102-01 Acquisition Management Directive (2010)	Outlines the policy and structure for acquisition management within the DHS, including the acquisition life cycle framework, review process and role of the review board. Directive 102-01 provides management procedures and responsibilities for the four phases of the capital acquisition process: • Need: identifying the need addressed by the acquisition • Analyze/Select: analyzing the alternatives to satisfy the needs and selecting the best option • Obtain: developing, testing, and evaluating the selected option and determining whether to approve production • Produce/Deploy/Support: produce and deploy the selected option and support it throughout the operational life-cycle
DHS 1330 Planning, Programming, Budgeting and Execution (2005)	Establishes the policy, procedures, and responsibilities for the Planning, Programming, Budgeting, and Execution (PPBE) process. The PPBE process is used to develop the Future Years Homeland Security Program (FYHSP) Plan and the Resource Allocation Plan, which outlines investment plans, justifications, and performance goals over the next 10 years.
DHS 1405 Charter of DHS Joint Requirements Council (2003)	Establishes the Joint Requirements Council (JRC), including membership, responsibilities, and procedures. The JRC is a senior-level requirements review board that identifies cross-cutting opportunities across the DHS for non-IT investments, reviews Departmental capital investment plans, and recommends new programs or changes to existing capital programs to the Investment Review Board.

Appendix F.
Workshop Participants

Table F-1 lists the 50 participants in the workshop held in Alexandria, Virginia, on February 22, 2012.

Table F-1. Participants in the National Security Science and Technology Facilities and Infrastructure Workshop

Participant	Affiliation
Michael Aimone	Battelle, National Security Global Business
Lanny Bates	Brookhaven National Laboratory
Carl Boquist	Department of Defense, Army Research Development and Engineering Command
Thomas Bower	Army Research Laboratory
Tim Burck	Department of Homeland Security, Office of National Laboratories
Timothy Coffey	National Defense University
Patricia Coury	Department of Defense, Office of the Deputy Under Secretary of Defense (Installations and Environment)
Phillip Coyle	White House Office of Science and Technology Policy (formerly)
Jay Dettmer	Johns Hopkins University Applied Physics Laboratory
Patricia Falcone	White House Office of Science and Technology Policy
Mark Falkey	Department of Defense, Office of the Assistant Secretary of the Army (Acquisition, Logistics and Technology)
John Fischer	Department of Defense, Office of the Assistant Secretary of Defense for Research and Engineering
Gordon Fox	Department of Energy, Office of Science
Dale Galyen	Naval Surface Warfare Center, Dahlgren Division
Scott Glaser	General Services Administration
Ivan Graff	Department of Energy, Office of Management
Paul Hansen	Flad Architects
Jim Helt	National Biodefense Analysis and Countermeasures Center
Donald Holmes	MIT Lincoln Laboratory
Keith Hull	Naval Research Laboratory
Jamie Johnson	Department of Homeland Security Office of National Laboratories
Tony Kakiel	Army Medical Research and Materiel Command
Shawn Kidwell	Army Research Laboratory
Tony Kushnir	Simmons & Kushnir LLP
Peter Lufkin	Whitestone Research
Don McConnell	The Tarrington Group

Participant	Affiliation
Daniel Morin	Air Force Research Laboratory
Roger Natsuhara	Department of Defense, Assistant Secretary of the Navy (Energy, Installations, and Environment)
Adam Nave	Department of Defense, Office of the Deputy Assistant Secretary of the Navy (Research, Development, Test, and Evaluation)
Jeanette Norte	Sandia National Laboratories, site office
Amy O'Donnell	Naval Surface Warfare Center, Indian Head Division
Jagadeesh Pamulapati	Department of Defense, Office of the Assistant Secretary of the Army, Acquisition, Logistics, and Technology
Lon Pribble	Department of Defense, Army Corps of Engineers, Engineer Research and Development Center [Retired]
Robert Proie	Johns Hopkins University Applied Physics Laboratory
Arthur Ratzel	Sandia National Laboratories
Arun Seraphin	White House Office of Science and Technology Policy
Jeff Singleton	Department of Defense, Office of the Assistant Secretary of the Army (Acquisition, Logistics and Technology)
Reed Skaggs	Army Research Laboratory
Jeff Smith	Oak Ridge National Laboratory
Mary Spada	Digitale, Inc.
William Stamper	National Aeronautics and Space Administration (Retired)
Lynda Stanley	National Academy of Sciences, Federal Facilities Council
Victoria Stoneking	Air Force Research Laboratory
John Szymanski	White House Office of Science and Technology Policy
Tri Tran	Lawrence Livermore National Laboratory
Jeff Underwood	National Nuclear Security Administration, Office of Construction Management
Janet Williams	National Nuclear Security Administration
George Williams	MSI Universal
Jerry Zekert	Department of Defense, Army Corps of Engineers

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Abbreviations

ACI	Asset Condition Index
AFCESA	Air Force Civil Engineer Support Agency
AFMC	Air Force Materiel Command
AFRL	Air Force Research Laboratory
AFRPA	Air Force Real Property Agency
AMC	Army Materiel Command
AMRIID	Army Medical Research Institute for Infectious Diseases
AMRMC	Army Medical Research and Materiel Command
ARL	Army Research Laboratory
AUI	Asset Utilization Index
BFI	Building Functionality Index
BNL	Brookhaven National Laboratory
BPI	Building Performance Index
BRAC	Defense Base Closure and Realignment Commission
CI	Condition Index
CUP	central utility plant
DHS	Department of Homeland Security
DM	Deferred Maintenance
DOD	Department of Defense
DODI	Department of Defense Instruction
DOE	Department of Energy
DOE-SC	Department of Energy Office of Science
EFCOG	Energy Facility Contractors Group
EO	Executive order
ERDC	Engineer Research and Development Center
ESCO	Energy Service Company
EUL	Enhanced Use Lease
F&I	facilities and infrastructure
FASAB	Federal Accounting Standards Advisory Board
FASB	Financial Accounting Standards Board
FCI	Facility Condition Index
FEI	Facility Experience Index
FFRDC	Federally Funded Research and Development Center
FIMS	Facilities Information Management System

FIRP	Facilities and Infrastructure Recapitalization Program
FRPC	Federal Real Property Council
FYDP	Future Years Defense Program
GAO	Government Accountability Office
GOGO	Government-Owned, Government-Operated
GPP	General Plant Project
GSA	General Services Administration
GSF	gross square feet
HQ	Headquarters
IGPP	Institutional General Plant Project
IMCOM	Installation Management Command
JHU-APL	Johns Hopkins University Applied Physics Laboratory
KBSCI	Knowledge-Based Condition Survey Inspection
LANL	Los Alamos National Laboratory
LBNL	Lawrence Berkeley National Laboratory
LEED	Leadership in Energy and Environmental Design
LLNL	Lawrence Livermore National Laboratory
LRDP	Laboratory Revitalization Demonstration Program
MDb	mission inter-dependency between
MDI	Mission Dependency Index
MDw	mission intra-dependency within
MEDCOM	Medical Command
MILCON	Military Construction
MIT	Massachusetts Institute of Technology
MIT-LL	Massachusetts Institute of Technology Lincoln Laboratory
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Command
NBACC	National Biodefense Analysis and Countermeasures Center
NIBC	National Interagency Biodefense Campus
NLCCG	Naval Laboratory and Centers Coordinating Group
NNSA	National Nuclear Security Administration
NRC	National Research Council
NRL	Naval Research Laboratory
O&M	Operations and Maintenance
OAPM	Office of Acquisition and Project Management
OECM	Office of Engineering and Construction Management
OMB	Office of Management and Budget
ONL	Office of National Laboratories
ONR	Office of Naval Research
ORNL	Oak Ridge National Laboratory

OSD	Office of the Secretary of Defense
PNNL	Pacific Northwest National Laboratory
PPBE	Planning, Programming, Budgeting, and Execution
R&D	Research and Development
RAMP	Roof Asset Management Program
RDECOM	Research, Development and Engineering Command
RDT&E	Research, Development, Test and Evaluation
RPV	Replacement Plant Value
PRB	Program Review Board
S&T	science and technology
SRNL	Savannah River National Laboratory
STPI	Science and Technology Policy Institute
UARC	University Affiliated Research Center
USACE	United States Army Corps of Engineers
WebRPLANS	Web Real Property Planning and Analysis System
WFO	Work for Others

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14. ABSTRACT

This report explores planning, prioritization, and assessment of facilities and infrastructure (F&I) at a set of Federal laboratories from the Department of Defense, Department of Energy, and Department of Homeland Security that conduct national security research and development. As the average age of Federal laboratory buildings increases, topping 34 and 57 years at Sandia National Laboratories and the Naval Research Laboratory, respectively, there is concern over the future health and sufficiency of the U.S. national security research enterprise. The study team reviewed relevant government documents; had discussions with F&I staff from laboratories, Federal agencies, and architecture and engineering firms; and convened a workshop with national security and F&I experts. This report identifies a number of barriers, such as the difficulty in capturing the impact of facilities and infrastructure on mission, and strategies, such as engaging in benchmarking or other data sharing activities.

15. SUBJECT TERMS

Alternative Financing Mechanisms, Department of Defense, Department of Energy, Department of Homeland Security, Facilities, Federal laboratories, Infrastructure, National Security

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