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Executive Summary

Background

Federal partnerships revitalize Federal laboratory facilities, infrastructure, and large instrumentation by pooling resources across the government to fund a project of shared interest. In the process, such partnerships bring about scientific collaboration and enhance research capabilities. To provide guidance to Federal laboratories, departments, and agencies wishing to form Federal partnerships for these purposes, the Office of Science and Technology Policy (OSTP) asked the IDA Science and Technology Policy Institute (STPI) to identify motivations, barriers, and strategies related to creating and implementing Federal partnerships.

Approach

A team of STPI researchers explored a range of Federal facilities, infrastructure, and instrumentation (FI&I). Included in this investigation were entire buildings, such as research centers and laboratories, and related infrastructure projects, such as utility plants or emergency services, which provide critical support for laboratory buildings. The team also assessed partnerships for large instrumentation, where the facility is composed mainly of the instrument itself.

The STPI team held discussions with 44 representatives from laboratories and headquarters of 10 Federal agencies to learn about the formation, planning, and implementation of five partnership cases:

- Captain James A. Lovell Federal Health Care Center Merger in North Chicago
- Hollings Marine Laboratory in Fort Johnson, Charleston Harbor
- Life Sciences Beamlines at the National Synchrotron Light Source and National Synchrotron Light Source-II at Brookhaven National Laboratory
- National Interagency Confederation for Biological Research and National Interagency Biodefense Campus
- Physical Sciences Facility at Pacific Northwest National Laboratory

These five cases reflect a variety of partnership types across the Federal Government that encompass co-funding, co-location, and coordination of operations.

Findings

FI&I partnerships can be driven by a variety of factors, including congressional or Presidential mandates, agency and laboratory staff that identify opportunities to leverage resources, and local drivers such as proximity of underutilized facilities from multiple agencies. Benefits of Federal FI&I partnerships include the ability to strategically plan for resources, leverage agency budgets, optimize operations and maintenance, and stimulate research collaborations.

Barriers and Strategies

The barriers and strategies found from interviews and case studies are grouped into four categories.

Leadership, Guidance, and Certainty

There is a lack of guidance on how to form and implement FI&I partnerships throughout the Federal Government. The annual budget process and changes to agency leadership throughout a partnership's implementation can create uncertainties that threaten the progress of an FI&I project.

Certain agencies have issued guidance that supports strategic planning of the research infrastructure. Others have increased project visibility through regular communication, briefings, or establishing committees that serve as one voice for the partnership.

Coordination and Communication across Multiple Agencies

Inefficiencies in communicating across agencies can lead to mistrust and lack of cooperation in funding commitments and staffing. Coordination of reviews and approvals among multiple partner agencies increases the logistical burden and can lead to delays. Further, agencies find it difficult to identify partnership opportunities due to the lack of transparency and awareness of other agencies' FI&I planning and priorities.

Memoranda of understanding or other agreements reinforce an agency's commitment to the partnership. Agreements that work well are both rigorous and flexible and address various levels of obligations. They also specify a lead agency for implementing decisions and day-to-day operations. Partnerships also document lessons learned and seek out advice from expert review panels to create transparency and resolve issues in a timely manner.

Funding and Dedicated Resources

Federal partnerships require long-term funding streams to plan, construct, and operate the FI&I. Partnerships expand by integrating new members, which increases demands for shared resources, space, and equipment. A major funding challenge is the inability to pool funding from multiple agencies and use these funds for joint activities.

Cost-share agreements on the initial construction and long-term operation of shared resources make the roles and responsibilities of partners clear. Partnerships also centralize planning and develop principles for funding new infrastructure. Other approaches to innovative funding include adopting cooperative funding models that strategically allocate resources across partners and facilitate integration of operations through joint funding of awards.

Legislative and Regulatory Requirements

Partners have different construction thresholds and congressional approval requirements. Some partner agencies lack the necessary legislative authority to pool funding for common infrastructure and research activities. At times, changes to legislation are needed to form a partnership.

Changes in legislation have been accomplished by partnerships working closely with the Executive Office of the President, including the Office of Management and Budget (OMB), and congressional stakeholders. Agreements are also signed by the partners to document agree-upon funding arrangements for joint activities. Other partnerships work with Congress to secure future line-item funding commitments from each agency up front.

Policy Suggestions

Interviewees for the five case studies provided several suggestions that could facilitate the formation, planning, and implementation of Federal FI&I partnerships. The policy suggestions could be implemented at various levels as follows.

Executive or Legislative Action

- One way to address the long-term funding needs of partners is for agencies to work with Congress to establish an appropriation for the partnerships where funds could be pooled into a joint infrastructure and research activities fund.
- Partnerships could also work with Congress to receive committed funds for the partnership across multiple years in a single year up front.
- Executive orders or legislation that mandates partnerships could include language on exactly how the agencies should fund the partnership.
- Agencies could establish an appropriation specific to the partnership within each agency's budget to help maintain long-term funding commitments.
- An Executive order, Presidential Memorandum, or other Executive guidance could provide a framework for developing partnerships and help share the lessons learned from partnerships previously implemented.

Interagency Coordination

- Agencies could improve communication with the executive branch and increase coordination among different OMB examiners assigned to each agency.
- OSTP could also play a role by increasing visibility of FI&I partnerships, coordinating agency efforts to identify and develop joint projects, and encourage dialogue and feedback early in the planning stages of a partnership proposal.
- Agencies could facilitate the identification of interagency opportunities by sharing the results of the capital planning and prioritization process with potential partners.
- Agencies could encourage participation and feedback from agencies with similar capabilities and common research goals.

Agency and Laboratory-Level Policies or Guidance

- Agencies could develop a lessons-learned document that shows strategies in forming Federal FI&I partnerships and guides partnerships through the life cycle of the FI&I—from construction to maintenance to decommissioning.
- Agencies and facility staff could encourage partners to be flexible about how partnerships evolve, including the number and types of partners.
- Agencies could ensure that the staff for each facility develops formal strategic plans and organized governance structures with input from each partner and other FI&I users.
- Agencies could develop policies or guidance showcasing best practices or models for cost-sharing and joint-Federal funding mechanisms as well as describing how partnerships have resolved legislative or regulatory barriers.
- Agencies could explore mechanisms and policies to facilitate the digital exchange of information among agencies.

Though the lessons learned and strategies from past partnerships provide helpful guidance for future projects, certain challenges remain for agencies interested in forming multiagency FI&I partnerships. Implementation of the policy suggestions provided by the interviewees could further streamline and facilitate future Federal partnerships of the types examined.

Contents

A. Introduction

The Federal science and technology enterprise advances the state of science and technology to address the most important challenges facing the United States, including revitalizing its economy, protecting the global environment, improving the quality of the nation's health care systems, and preserving national security. The Federal laboratory system comprises thousands of buildings and other structures. Some of these are repurposed facilities that were not originally intended for laboratory use. Others are decades old structures that have not been refurbished or replaced by new buildings.

One mechanism for revitalizing the Federal laboratory facilities, infrastructure, and large instrumentation (FI&I) is a Federal partnership—that is, pooling interagency, interdepartment, or interlaboratory resources to fund a project of shared interest. These partnerships enhance research capabilities across agencies by making best use of public resources and investments, both by replacing aging infrastructure and exploiting underutilized buildings. At the same time, these partnerships bring about scientific collaboration across Federal laboratories, departments, and agencies.

The Office of Science and Technology Policy (OSTP) asked the IDA Science and Technology Policy Institute (STPI) to identify existing Federal partnerships for facilities, infrastructure, and large instrumentation and to conduct a handful of in-depth case studies involving interviews with Federal staff that supported the formation and implementation of the partnerships. The goal was to identify motivations for, barriers to, and strategies of partnerships to provide guidance or models for those wishing to form one. A secondary goal was to understand what broader policies could be implemented to facilitate existing or new partnerships.

B. Background

To maximize the strategies and lessons learned across many different types of Federal partnerships, the STPI team covered a broad scope of FI&I. These included entire buildings, such as research centers and laboratories; related infrastructure projects, such as utility plants or emergency services, that provide critical support for one or more laboratory buildings; and large instrumentation, such as wind tunnels and beamline development at synchrotrons, where the facility is mainly composed of the instrument itself. There are also multiple types of Federal partnerships, including co-funding, co-location, and coordination of operations. Table 1 describes the five kinds of Federal partnerships identified.

Table 1. Federal Facility, Infrastructure, and Large Instrumentation Partnership Types

Partnership Type	Description
Co-funding an entire facility	Includes the co-funding by more than one agency to fund construction or renovations of one facility.
Co-funding large instrumentation within a facility	Includes the co-funding by more than one agency to fund the development of large instruments within one facility.
Co-funding supportive infrastructure or utilities	Includes the co-funding by more than one agency to support infrastructure or utilities necessary for the construction or renovations of one or more agency's facilities.
Co-location	Includes the co-location of more than one agency's facilities in one centralized campus.
Cooperation and integration of management and operations	Includes the integration of management, operations, and services for more than one agency's facilities under one agency's chain of command.

C. Study Questions and Approach

The STPI team compiled an initial list of 14 Federal partnerships for FI&I. The team held discussions with 44 representatives across 10 Federal agencies and laboratories to learn about the formation, planning, and implementation of several of these partnerships. Appendix A lists the names and affiliations of the Federal and laboratory representatives interviewed and Appendix B provides the discussion guide. From among the variety of partnerships proposed during these discussions, the team chose five cases for further study. The team considered the following questions:

- What were the drivers in forming the partnership?
- What were challenges, including ongoing issues?
- What were the strategies used to overcome the challenges and lessons learned?
- What are policy suggestions to facilitate partnership development and implementation?

D. Overview of Case Studies

The five case studies reflect a variety of partnership and facility types across the Federal Government:

- *Captain James A. Lovell Federal Health Care Center in North Chicago*: A facility complex involving two agencies' facilities that cooperate and integrate their management and operations under one agency's chain of command.
- *Hollings Marine Laboratory in Fort Johnson, Charleston Harbor*: A facility where multiple agencies share a National Oceanic and Atmospheric

Administration facility, co-fund supportive infrastructure and services, and cooperate on the management and operations of the facility.

- *Life Sciences Beamlines at the National Synchrotron Light Source and National Synchrotron Light Source-II at Brookhaven National Laboratory*: Large instrumentation co-funded and installed by multiple agencies at a Department of Energy facility.
- *National Interagency Confederation for Biological Research and National Interagency Biodefense Campus*: A campus created by co-locating separate facilities from multiple agencies at a Department of Defense Army installation, and agencies co-fund supportive infrastructure and services.
- *Physical Sciences Facility at Pacific Northwest National Laboratory*: A facility co-funded by multiple agencies at a Department of Energy laboratory.

See Table 2 for details. The partnerships involved a range of agencies that faced a variety of challenges and pursued different strategies for overcoming them.

The overall findings from the case studies and interviews are explored in subsequent sections of this report. Detailed outcomes of the case studies are presented in Appendixes C through G. Appendix H lists additional Federal partnerships considered.

Table 2. Five Federal Partnerships for Facilities, Infrastructure and Large Instrumentation

Partnership	Type	Federal Partners	Location	Year Established
Captain James A. Lovell Federal Health Care Center (Lovell FHCC)	Cooperation and integration of management and operations	Department of Defense–Navy, Department of Veterans Affairs	Chicago, IL	2010*
Hollings Marine Laboratory (HML)	Co-funding of supportive infrastructure or services; Cooperation and integration of management and operations	National Institute of Standards and Technology; National Oceanic and Atmospheric Administration	Charleston, SC	2003
National Interagency Confederation for Biological Research (NICBR)/National Interagency Biodefense Campus (NIBC)	Co-location; co-funding of supportive infrastructure or services	Centers for Disease Control and Prevention; Department of Defense–Naval Medical Research Center, U.S. Army Medical Research and Materiel Command; Department of Homeland Security; Food and Drug Administration; National Institutes of Health–National Institute of Allergy and Infectious Diseases, National Cancer Institute; U.S. Department of Agriculture	Frederick, MD (Fort Detrick)	2002
Life Sciences Beamlines at the National Synchrotron Light Source (NSLS) and NSLS II	Co-funding of large instrumentation/user facility	Department of Energy, National Institutes of Health	Long Island, New York (Brookhaven National Laboratory)	1987 (NSLS) 2005 (NSLS-II)†
Physical Sciences Facility (PSF)	Co-funding of a single facility	Department of Energy Office of Science, National Nuclear Security Administration; Department of Homeland Security	Richland, WA (Pacific Northwest National Laboratory)	2004‡

* The partnership was not formalized with a memorandum of understanding until the completion of a new facility in 2010; however, the partnership began in 2002 when the DOD and the VA agreed to share their facilities in the North Chicago area.

† The NSLS-II project officially began with the approval of the mission need (Critical Decision-0) within the DOE's facility acquisition process; construction began in 2008.

‡ The PSF project officially began with the approval of the mission need (Critical Decision-0) within the DOE's facility acquisition process, construction began in 2007.

E. Motivations and Drivers for Federal Partnerships

Federal partnerships FI&I can be driven by congressional or Presidential mandates for interagency collaboration on cross-cutting issues. For example, Congress and the President directed the biodefense agencies to coordinate their research by taking advantage of the unique capabilities at Fort Detrick, which led to the creation of the National Interagency Confederation for Biological Research (NICBR) partnership across eight agencies. The Physical Sciences Facility (PSF) at Pacific Northwest National Laboratory was the result of legislative requirements for nuclear site clean-up and an agreement with the State of Washington.[1]

The partnerships can also be driven by agency leadership and laboratory staff aspiring to improve cooperation and leverage resources between one or more agencies. The genesis for the Hollings Marine Laboratory (HML) was a white paper written by colleagues at the National Oceanic and Atmospheric Administration (NOAA) and the South Carolina Department of Natural Resources that recommended including the College of Charleston and the Medical University of South Carolina. The National Institute for Standards and Technology (NIST) joined the partnership soon after, in part because of existing relationships with NOAA and NIST. The partnership was formally created when Congress appropriated funding for construction and later for operations.

Local drivers can lead to partnerships, often when complementary facilities and services are near each other. The Captain James A. Lovell Federal Health Care Center (Lovell FHCC) brought together an underutilized Navy clinic and a Department of Veterans Affairs (VA) medical center to reduce costs and realize efficiencies.

F. Benefits of Federal Partnerships

Federal FI&I partnerships provide benefits that reduce costs and improve the efficiency of building and operating Federal laboratories and research facilities. These benefits are achieved through co-funding, co-location, and cooperation across agencies.

Co-funding allows agencies to think strategically about their resources and leverage their combined budgets to construct or renovate a facility that otherwise would not be possible without the partnership. (Note that agencies should consider the uncertainties of such an approach, which include depending on annual appropriations and the need for each agency's commitments to be maintained over the life cycle of the project.)

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[1] Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). For further information on the Tri-Party Agreement, see http://webcache.googleusercontent.com/search?q=cache:http://www.hanford.gov/page.cfm/TriParty.

In cases where the facilities or land are underutilized before the partnership is formed, co-location improves the efficiency of the use of government holdings. Co-location also allows agencies to share infrastructure, which decreases costs. Resources built for one facility (e.g., security, information technology networks, utilities, and hazardous materials) can meet the needs of multiple co-located facilities. Facility staff members in co-located laboratories find it useful to share lessons learned in operating their facilities. Exchanging experiences with international and national laboratory testing and certification processes has proved particularly valuable for new bio-containment laboratories. Co-location permits the consolidation and streamlining of operations and maintenance of facilities. Finally, cooperation and integration of management and operations helps agencies streamline the functions and capabilities of their facilities. This can include integrating common services or research areas across partner agencies to help reduce costs and improve capabilities.

Partnerships can also enhance research and expand it to new areas by bringing together complementary expertise, capabilities, equipment, and infrastructure. Memorandum of understanding (MOU) agreements for research between partner agencies, which often exist in Federal FI&I partnerships, can further drive scientific collaborations. For example, in the NICBR/National Interagency Biodefense Campus (NIBC), agencies established bilateral MOUs with partners in particular research areas. The proximity of the facilities allows researchers to easily share unique capabilities and equipment across several laboratories on the campus. Recognizing the value in these cross-agency collaborations, the partner agencies have established procedures to facilitate reciprocity in researcher training.

Partnerships can also bring together different skills to augment an agency's existing capabilities for the benefit of multiple agencies' missions. For example, the National Synchrotron Light Source (NSLS) and NSLS-II benefit from Department of Energy (DOE) expertise in constructing and managing large user facilities and the National Institute of Health's (NIH) scientific expertise in developing instrumentation for the facility. NIH's input into the development of the beamlines at the facility allows the research community to build innovative equipment that better meets the scientific users' needs. This has contributed to the potential for new scientific discoveries that fulfill the missions of multiple agencies—two Nobel Prizes in Chemistry have been awarded to researchers for work conducted at the NSLS over the past decade.

G. Partnership Challenges, Strategies, and Lessons Learned

Federal partnerships for FI&I are generally more complex to coordinate than single-agency projects. Challenges abound at all stages of the partnership, from the formation of the partnership to construction, maintenance, operation, and upgrades of the finished facility. The case studies and interviews revealed a number of barriers, strategies and lessons learned that fell into four themes: (1) leadership, guidance, and certainty;

(2) coordination across multiple agencies; (3) long-term funding and resource allocation; and (4) legislative and regulatory requirements/review and approval processes.

1. Leadership, Guidance, and Certainty

a. Challenges

Leadership support is critical to partnership success, and it must be maintained through the many years necessary to plan and construct the FI&I. Lack of backing from the agency, Congress, or the Office of Management and Budget (OMB) can delay or even stop projects. Uncertainties may arise from the annual budgetary approval process and changes to executive office personnel from year to year. In particular, interviewees felt it was difficult to ensure approval from the multiple OMB examiners required for any one funding decision when multiple agencies were involved.

There is also a lack of guidance from agencies or elsewhere explaining how to form and implement a partnership. For example, the lack of agency guidelines for strategic beamline developments across synchrotron facilities may have initially affected how efficiently the research was coordinated across partner users at the NSLS. A lack of strategic planning can lead to redundancies in instrumentation and research. Interviewees also said that they had difficulty locating examples of successful Federal FI&I partnerships to emulate.

b. Strategies and Lessons Learned

Partners have increased their projects' visibility and strengthened their commitments through regular communication and briefings with agency leadership, Congress, and OMB staff. This communication can be formal through meetings or progress reports designated by an interagency MOU, or informal through ad hoc visits with program managers, with researchers, or at the facility site. Commitment at the local level can overcome these challenges, but generally strong senior leadership and support at the agency director or secretary level is needed for Federal partnerships to succeed. Partnerships must also ensure that they provide a common message from across their agencies to the public and other external stakeholders.

At the NICBR/NIBC, for example, the partners have established a committee focused on public relations to express a single strategic message to stakeholders (i.e., their agencies, regulatory agencies, the State and local governments, and local communities). Leadership at other agencies has also played a role in facilitating partnerships by creating guidance for establishing strategic plans to develop a facility or campus. Partner agencies have also visited similar facilities as a team to learn how other partnerships operate.

2. Coordination across Multiple Agencies

a. Challenges

With FI&I partnerships, it is typically more burdensome to coordinate staff, policies, budgets, and approvals across multiple agencies than for a single agency. FI&I partnerships must often wait for extended periods of time to implement new agreements or execute upgrades due to the lengthy review and approval times at each of the headquarters. This often leads to implementation delays due to regulations, approvals, and bureaucracy, all of which vary by agency. For example, the lengthy and complicated process to resolve conflicting policies and procedures across agencies and departments at the Lovell FHCC negatively affected planning by increasing uncertainty and delays. Effectively addressing these issues requires partners to develop a good understanding of policies, processes, and needs across the different agencies.

In addition, the FI&I investment planning and prioritization frameworks in place at many agencies does not encourage interagency collaborations. Agencies lack awareness of other agencies' investment and budgeting discussions due to a lack of transparency. Cross-agency coordination of facilities typically occurs ad hoc. Potential agency partners often participate after the planning and design of a facility has begun, leaving little room for discussions to identify opportunities for partnerships.

Inefficiencies also occur in communicating across agencies, which leads to mistrust and lack of cooperation in funding commitments and staffing. Without trust and commitment, project proposals from multiple agencies can become uncoordinated, and the facility can develop in less than optimal ways, which hampers research and operations. Restrictions on the digital exchange of information between facilities or researchers from different agencies can also limit the effectiveness of collaborations. This is especially true for laboratories that conduct research with classified information, where security and a lack of interoperability in information systems prevents researchers from posting information to shared accounts.

b. Strategies and Lessons Learned

In establishing partnerships, there must be trust among the partners, reinforced by an agreement, which can be an MOU, a Joint Project Agreement, or similar agreement. The agreement must be both rigorous and flexible. For example, formal agreements with partner users helped Brookhaven National Laboratory balance the needs of its agency to serve as a steward and yet were flexible enough to allow other partners to operatre beamlines in the NSLS facility. The participation by relevant stakeholders (scientists, laboratory directors, and other facility users) in setting up the agreement ensures that all parties will abide by the terms.

Another strategy to guide coordination is to use multiple plans and agreements to address various levels of the partner agency's commitments. For instance, the partner agencies at the NICBR/NIBC have several agreements in place. At the highest level, all partner agencies have an agreement to coordinate research through the NICBR. The NICBR strategic plan outlines the governance structure and details the mission, vision, roles, and responsibilities of partners. More detailed agreements are used to implement various elements of the partnership. For instance, agencies that constructed new facilities on the campus engaged in an MOU with the Army, which is responsible for developments at the installation. Each partner agency has a bilateral interservice agreement with the other agencies. Additional agreements and procedures, such as those outlining the process for cost sharing, are established by subcommittees and working groups.

In general, governance agreements that work well specify a lead agency for implementing decisions and day-to-day operations. Project management teams and sub-teams handle longer run planning and serve in an advisory role to the lead agency. At the NICBR/NIBC, the governance structure includes a partnership office and full-time staff focused on coordinating activities across partner agencies. Other strategies are to allow each agency to use its own planning process, rather than forcing it to conform to a single agency's decision-making process and culture.

To execute the partnership, partnership leaders also select project managers who have worked on cross-agency projects or can work within the spaces between each partner agency's mission. A clear understanding of missions across the partner agencies is a critical factor in building trust and establishing agreement among partners. The DOE and NIH program managers had already built a strong working relationship during their collaborations on the NSLS. They were able to capitalize on these relationships when developing the new life science program at the NSLS-II. In addition, the program managers have gained critical institutional memory by coordinating the research and development of beamlines at both the NSLS and NSLS-II.

Partnerships also document lessons learned from their successes and failures throughout the project. This helps make execution of the project transparent to all stakeholders and allows for the timely resolution of similar issues that may occur. At HML, partner agencies invite an expert review panel to assess the partnership and make recommendations for changes. Input from external experts provides a fresh perspective and helps identify issues and strategies to facilitate the partnership.

3. Long-Term Funding and Resource Allocation

a. Challenges

The long-term funding streams necessary to plan, construct, and operate FI&I make partnerships difficult to initiate and maintain. Future funding is often uncertain, and partners may experience difficulties obtaining their planned funding commitments due to unforeseen constraints in their agency's budgets. As partnerships grow over time, the demand for the shared resources, space, and equipment increases and partners often lack a means to fund their needs. For example, HML has been subject to financial constraints because NOAA appropriations have remained flat, but partnership needs have increased over time.

Annual budgetary approvals contribute to difficulties all agencies face in justifying and executing budgets for a project over multiple years. Sustaining agency commitments becomes even more difficult when an agency's leadership or other key personnel, such as budget examiners, leave the agency and are replaced by staff with different views on the agency's or partnership's commitments.

Another major funding challenge for FI&I partners is the inability to pool funding from multiple agencies and use these funds for joint activities for the partnership. Instead of pro-rating the contribution of each partner based on an agreed upon formula, each agency's contributions must be targeted to a specific activity, equipment purchase, or facility upgrade. For example, one agency pays for a specific service contract, another agrees to purchase a new piece of equipment, and yet another agrees to upgrade the IT infrastructure. This makes funding the partnership more complicated.

b. Strategies and Lessons Learned

Cost-share agreements on the initial construction and long-term operation of shared resources clarify the roles and responsibilities of partners. Joint funding has been used to promote integration of capabilities or common infrastructure needs, with some individual partners taking a larger role in financial support when another partner's funding is delayed. For example, the individual agency commitments for the PSF were discussed at an interagency planning workshop. In developing the cost shares, the partners considered how much of the existing facilities they were using for core capabilities and the square footage that the research capability would require in the new PSF.

The NICBR/NIBC partnership uses centralized planning for funding common infrastructure. Each agency funds projects separately, and there is no co-funding of installations or facilities. There is, however, centralized planning for additional new infrastructure and research. The NICBR partners agreed upon a set of business principles and methods for allocating cost sharing for changing requirements that arose on the campus. This has provided clear guidelines and mutual understanding of each agency's funding commitments in the partnership.

An additional successful strategy for funding and resource allocation involves integrating the research or services across the partner agencies' FI&I. For example, a partnership may increase the role of facilities and infrastructure staff in guiding and allocating resources and establish early collaborations through joint funding of awards.

4. Legislative and Regulatory Requirements/Review and Approval Processes

a. Challenges

Legislative and regulatory requirements can limit the ability of partners to fully integrate capabilities of the partnership into their FI&I. For example, certain Federal agencies have different major and minor construction thresholds and processes for when congressional approval of projects is necessary. At the Lovell FHCC, these restrictions placed limitations on the projects that could be funded by the DOD and the VA to support the integration of their facilities. Additionally, even though the Lovell FHCC had significant support from agency leadership, Congress, and the military and veterans communities, full legislative authority to integrate property, personnel, and funding streams was not received until the National Defense Authorization Act for FY 2010 (Public Law 111-84 2009). This was only 1 year before the scheduled full integration of the facility.

The NICBR/NIBC partnership lacks the necessary legislative authority to pool funding for common infrastructure and research activities. Although Congress authorized the construction of the new laboratories of the NIBC, no provisions were made to support the common infrastructure and services. At times, changes to legislation are needed to transfer resources among partners; a time-intensive and complex process.

b. Strategies and Lessons Learned

Partnerships have achieved legislative changes by working closely with the Executive Office of the President, including the OMB, and congressional stakeholders. Throughout the entire planning process for the Lovell FHCC, task groups and agency leadership faced uncertainty over whether they would have the authority to transfer Navy property to VA control, the status of Navy civilian employees, and whether the facility would receive a single operations budget through a joint Treasury fund. Additional planning and agreement drafts were necessary to plan for contingencies in case the project did not receive the necessary legislative changes. The partners signed an executive sharing agreement in case the joint Treasury fund was not approved or appropriations did not pass before the launch of the integrated facility complex in 2010. This planning proved essential to allow operations of the Lovell FHCC for 9 months in FY 2011 when the DOD’s appropriation and the associated creation of the Treasury fund were delayed.

When legislation cannot be changed, partners can establish sharing agreements to fund joint activities. Partners recognize the importance of funding the joint activity for the benefit of their laboratories and informally agree to share in funding commitments each year so that one agency will not bear the sole burden of supporting an activity. In another strategy, the partners of the PSF worked with Congress to secure the future line-item funding commitments from the Department of Homeland Security earlier than planned to decrease funding uncertainties.

H. Policy Suggestions

Interviewees for the five case studies provided several suggestions that could facilitate the formation, planning, and implementation of Federal FI&I partnerships. Each of the policy suggestions presented here were compiled from one or more comments from the agency and laboratory staff interviewed. Some of the policy suggestions constitute wider application of a strategy discussed previously. The policy suggestions could be implemented through executive or legislative action, interagency coordination, or agency and laboratory policies.

1. Executive or Legislative Action

Executive or legislative action could help address funding barriers and streamline the approval process of partnerships. Every FI&I partnership has faced funding concerns even after clearly identifying agency commitments in formal interagency agreements. One way to address the long-term funding needs of partners is for agencies to work with Congress to establish an appropriation for the partnership to pool funding for joint infrastructure and research activities. A legislative proposal for such a joint fund has been successful in at least one partnership, although the process is lengthy. Another mechanism employed by one partnership included working with partner agencies and Congress to receive committed funds for the partnership across multiple years in a single year up front.

Executive orders and legislation also drive the creation of partnerships. Including language in these documents on how the agencies should fund Federal partnerships could be helpful when initiating partnerships and establishing agreements. For example, in cases where partners have struggled to fund the costs of FI&I as a partnership evolves and expands, having an appropriation specific to the partnership within each agency’s budget could help maintain long-term commitments. An Executive order, Presidential memorandum, or other Executive guidance could also provide a framework for developing partnerships and help share the lessons learned from existing partnerships.

2. Interagency Coordination

Agencies could focus on improving interagency coordination and identifying opportunities for new FI&I partnerships. For instance, partner agencies could find ways to improve communication with the executive branch. For example, improved coordination among the different OMB examiners for partner agencies could help resolve some difficulties experienced when a project depends on multiple agency budgets and could help minimize delays. OSTP could also play a role in coordinating agencies to identify and develop new FI&I partnerships. Not only does increasing the visibility of the partnership at the executive level create positive pressures for the partnership to succeed, it also encourages dialogue and feedback early in the planning stages of a partnership proposal.

Identifying interagency opportunities for FI&I partnerships could be facilitated by sharing the results of the agency's capital planning and prioritization process with potential partners. Current interagency discussion of the capital planning process is marginal and ad hoc. To help improve communication and understanding of needs across agencies, agency leadership could increase transparency and obtain more feedback from other agencies with similar capabilities and common research goals.

3. Agency and Laboratory Policies or Guidance

Agency and laboratory policies or guidance could also be established to efficiently implement FI&I partnerships. Agencies could develop a lessons-learned document that shows strategies in forming Federal facility partnerships and guides each partnership through the life cycle of the facility—from construction to maintenance to decommissioning. Once a partnership is established, agencies and facility staff could encourage partners to be flexible about how the partnership evolves. For instance, expanding the number and types of partners, including non-Federal or private organizations, could provide additional resources to leverage.

Implementing FI&I partnerships is more complex than a single-agency project. To do so, agencies should ensure that the staff for each facility develops formal strategic plans and organized governance structures with input from all partners and other FI&I users. This could optimize the facility's design and operations and make certain that the facility supports research needs and the missions of all agencies involved.

Agencies could also help address the funding issues faced by partnerships by developing policies or guidance showcasing best practices or models for cost-sharing and joint-Federal funding mechanisms. The guidance could also provide examples of how partnerships have resolved legislative or regulatory barriers by developing agreements and procedures.

Current information security procedures and information systems can hinder the timely exchange of data for optimal facility operations and research collaborations. Agencies could explore mechanisms and policies to facilitate the interoperability of information systems and digital exchange of information among agencies.

I. Conclusion

Appendixes C through G present details of the five case studies of Federal partnerships for facilities, infrastructure, and large instrumentation that have faced implementation and operational challenges and have developed strategies to overcome these challenges. Each of the case studies follows the same basic framework:

- Summary table of findings from the interviews and relevant literature.
- Background of the partnership, motivations, a description of the FI&I, goals and objectives, funding process, management and organization, and unique aspects.
- Barriers, including challenges faced when forming or implementing the project.
- Lessons learned and strategies for the formation, planning, implementation, and maintenance and operation of the partnership or FI&I.
- Benefits, including research and non-research-based outcomes.
- Policy suggestions, including executive or legislative proposals, interagency coordination, and agency- or laboratory-level policies or guidance to facilitate FI&I partnerships. These policy suggestions are often successful strategies from the partnership that could be applied more broadly across the Federal Government. They also address policy gaps and unmet needs that have created difficulties for the partnership.

Despite evidence of forward progress, challenges remain, both for current and new FI&I partnerships. Implementing the policy suggestions outlined through executive or legislative action, interagency coordination, and agency and laboratory policy and guidance could help further streamline and facilitate Federal FI&I partnerships.

Appendix A.
Interviewees

The study team had discussions with 44 representatives from laboratories and headquarters of 10 Federal agencies.

Table A-1. Interviewees and their Affiliations

Agency	Office/Laboratory	Name
Centers for Disease Control and Prevention	National Center for Emerging and Zoonotic Infectious Diseases	Stephen Morse Sheila Barber
Department of Agriculture	Agricultural Research Service	Doug Luster
Department of Defense	Air Force Research Laboratory	Charles Ward
	Army	Jim Gilman
	Army Garrison	Don Archibald
	Army Health Facility Planning Agency	Michael Brennan
	Army Medical Research and Materiel Command	James Tuten
	Navy Medical Research Center	Trupti Brahmbhatt
	Office of the Assistant Secretary of Defense for Health Affairs TRICARE Management Activity	Clay Boenecke
	Science and Technology Associates (contractor)	Dolores Schaffer
Department of Energy	Brookhaven National Laboratory	Patrick Looney
	Energy Efficiency and Renewable Energy	Kelly Visconti
	Office of Science	Gordon Fox Marc Jones Patricia Dehmer William Harrod Barbara Helland Peter Lee Mike Procario Ronald Hirsch
	Pacific Northwest National Laboratory (and former contractors)	Angus Bampton Marty Conger Greg Herman Jeff Pittman Mary Spada

Agency	Office/Laboratory	Name
Department of Energy (continued)	Stanford Synchrotron Radiation Lightsource	Chi-Chang Kao
Department of Homeland Security	Science and Technology Directorate, Office of National Laboratories	Jamie Johnson Sharla Rausch Lewis Brown
Food and Drug Administration	Office of the Chief Scientist	Estella Jones
National Institutes of Health	National Cancer Institute	Craig Reynolds
	National Institute of Allergy and Infectious Diseases	Cliff Lane Mary Wright
	National Institute of General Medical Sciences	Amy Swain Ward Smith
National Institute of Standards and Technology	Material Measurement Laboratory	Paul Becker
	Metallurgy Division	James Warren
	Office of Facilities and Property Management	Steve Salber
National Oceanic and Atmospheric Association	National Ocean Service	Jeff King Geoff Scott Kirsten Larsen
National Science Foundation	Office of Large Facilities	Mark Coles Kristin Ludwig

Appendix B.
Discussion Guide

If a project was successfully instigated:

Description of Project

1. Who are the parties involved?
2. What is the facilities and infrastructure (F&I) project?
    a. Function of building(s)?
    b. Total cost?
    c. Cost-breakdown among the parties?
    d. Location?
    e. Square footage?
    f. Completion date?
3. Currently, the project is in what stage? Is it ahead of schedule/behind schedule?
4. Is there anything unique or interesting about your F&I project?

Formation of Partnership

1. How was the partnership instigated?
    a. E.g. one agency approached another, presidential directive
2. Whose approval was required?
3. How was the partnership formalized?
    a. E.g. MOU
4. Was the partnership created solely for F&I or did it serve another purpose also?
5. Was any individual or office instrumental to forming the partnership?
6. What barriers existed during initial formation of the partnership?
7. Did you develop any strategies to overcome these barriers?

F&I Project Planning

1. Who were the decision makers on design, funding, etc.?
2. How did you decide how much funding each agency would provide?
3. Were any concessions made in exchange for funding?
4. Which agency planning process did you use? One, both or all?
5. When and how was OMB involved? Other agencies?
6. What barriers existed during project planning?
7. Did you develop any strategies to overcome these barriers?

F&I Project Implementation

1. Who was responsible for overseeing construction?
2. What barriers existed during project implementation?
3. Did you develop any strategies to overcome these barriers?

F&I Maintenance and Operations

1. Who is responsible for maintenance and operations of the F&I?
2. Do the other parties still have opportunities to provide input?

Overall

1. In your opinion, what are the benefits of an interagency, interdepartmental, inter-laboratory F&I project over a single entity project?
    a. Would the project have been possible without interagency funding?
    b. Were the benefits of the interagency partnership worth the extra planning necessary?
2. If you could do anything differently, what would it be?
3. Anything you did that was particularly helpful in facilitating the project?
4. Do you have any policy suggestions for improving the process?

Conclusion

1. Are there any other interagency, interdepartmental, inter-laboratory partnership F&I projects in your agency, department, lab that you are aware of?
2. Do you have any recommendations of people we should speak with?
3. Any final thoughts?

If a project was not successfully instigated:

1. In your opinion, what are the benefits of an interagency, interdepartmental, inter-laboratory F&I project over a single entity project?
2. What F&I project(s) were you interested in undertaking? With which agency, department, lab?
3. At what point did the project dissolve? (e.g. formation of partnership, planning, implementation)
4. What were the primary barriers that prevented the project?
5. Do you have any policy suggestions for removing these barriers?
6. If you could do anything differently, what would it be?
7. Are there any other interagency, interdepartmental, inter-laboratory partnership F&I projects in your agency, department, lab that you are aware of?
8. Do you have any recommendations of people we should speak with?
9. Any final thoughts?

Appendix C.
Captain James A. Lovell Federal Health Care Center Merger in North Chicago

Table C-1. Summary of Findings on Captain James A. Lovell Federal Health Care Center

Parties Involved	Department of Defense (DOD), U.S. Navy Department of Veterans Affairs (VA)
Motivations	Proximity of complementary facilities and services Underutilized facilities due to the industry-wide shift to outpatient care Strong opposition from veterans, community, and Congressman to close inpatient facilities Priorities to seamlessly transition wounded service members from active duty to veterans status Realize efficiencies and reduce costs of health care based on previous experience in similar DOD/VA cooperative arrangements
Barriers	Lengthy and complicated process to resolve conflicting policies and procedures across agencies and departments Organizational and technical limitations to achieving a fully-integrated facility Statutory limitations in cross-transferring civilian employees, funds, and property Uncertainty throughout planning
Lessons Learned and Strategies	**Project Formation** Working inclusively with executive and congressional stakeholders **Project Planning** Establishing interagency task groups and clear guidelines to develop implementation plans Creating an interagency funding mechanism Establishing agreements to address legislative and funding uncertainties **Project Implementation** Adopting a single chain of command Establishing early collaborations through Joint Incentive Fund awards
Benefits	Efficiencies through cost savings in construction, staff, and operations
Policy Suggestions	Agencies could improve identification of opportunities through cross-agency awareness of the facility-planning processes

Background

The Captain James A. Lovell Federal Health Care Center (Lovell FHCC) integrates complementary health care facilities operated by the U.S. Navy and the Department of Veterans Affairs (VA) under one management and mission. Previously, the facilities that now make up the Lovell FHCC, which were located just 1.5 miles from each other, were underutilized and out of date. In 1995, the Department of Defense (DOD) Base Closure and Realignment Commission recommended consolidating Navy recruiting and training at the North Chicago health clinic, driving the need for a facility with new and expanded capabilities. The Navy planned for the construction of a new facility to begin in 2007. Around this time in 1999, a VA task force recommended closing all inpatient care services at the North Chicago VA medical center to address the industry-wide shift to outpatient services. This led to strong opposition from veterans, the surrounding community, and members of Congress.

The Illinois congressional delegation urged the DOD and VA to combine their services. The delegation proposed the Lovell FHCC as a solution to reduce the costs of health care and accommodate the DOD and VA's missions to seamlessly transition wounded service members from active duty to veteran's status. Through the Lovell FHCC, the VA provides inpatient services for the Navy and utilizes outpatient services at the Navy's medical center. Successful partnerships for shared services between the DOD and VA have previously occurred in New Mexico, Hawaii, and Alaska, among other locations (NRC 2012).

Description

Located in North Chicago, Illinois, the Lovell FHCC was established as a 5-year demonstration project to showcase the opportunity for a fully integrated, jointly operated Federal health care center. The facility became fully operational in 2010. The partnership involves sharing facilities at the North Chicago VA Medical Center and the Naval Health Clinic Great Lakes, including health care services, funding, and employees. The VA Medical Center was built in 1926 and later renovated in 1992 and 1996. It serves approximately 78,000 military veterans in the surrounding area. The Naval Health Clinic was built in 1960 and serves the Naval Station Great Lakes, which houses a recruit training command and training support center. Nearly 35,000 recruits and 16,000 training students arrive at the naval station each year. The Naval Health Clinic also provides services for about 67,000 military retirees and family members in the area (NRC 2012).

Initially, in 2002, the DOD/VA Health Executive Council, which oversees areas of collaboration between the DOD and VA, recommended that the Navy build an outpatient facility adjacent to the VA medical center to provide complementary services. The agencies agreed that they would operate the facilities alongside one another. This model was shown to be successful at other co-located DOD and VA facilities. Starting in 2003, the Naval Health Clinic began closing some of its inpatient services and sending patients to the VA Medical Center. In 2005, the DOD/VA Health Executive Council made a decision to move beyond this model and fully integrate the VA Medical Center and Navy Health Clinic under one management command and budget. This required consolidation of duplicative services across the facilities with the goal of achieving a fully integrated facility by 2010. Based on this decision, DOD approved the Navy's construction of a 201,000-square-foot ambulatory care center connected to the VA Medical Center, with expanded parking facilities and 45,000-square-feet of new outpatient clinics.

Goals and Objectives

The DOD and VA leadership envisioned the Lovell FHCC as a state-of-the-art, integrated facility that would provide seamless health care to DOD and VA beneficiaries from northern Illinois to southern Wisconsin. The facility would allow the agencies to expand medical services beyond those currently provided at the separate facilities. The single command structure and single budget are intended to improve coordination across the facilities to better respond to patients' needs. The single operations budget reduces burdens in trying to determine the costs associated with services for each of the agencies.

The directors of the DOD and VA facilities maintained a united vision to consolidate activities into one set of organizational units and systems, such as for finance, personnel, facilities management, and electronic health records. Other goals included integrated operations, administrative services, new software, and cost savings from integrating these services.

Funding Process

In 2002, the DOD/VA Health Executive Council signed an executive decision memorandum, which outlined the major activities that would take place to implement the Lovell FHCC, such as the Navy closure of its hospital and transition of its inpatient services into the VA Medical Center, and outpatient services into a newly constructed Navy ambulatory care center. The new ambulatory care center cost $135 million. The VA committed $13 million to renovate the VA Medical Center through FY 2004 construction funds and accommodate the Naval Health Clinic's surgical and emergency-room services. There is normally a $4 million limit for VA renovation projects, but VA worked with Congress to receive authority to allocate a larger amount.

Management and Organization

The Lovell FHCC is managed by a Senior Executive Service director from the VA and a deputy director and chief of operations from the Navy. The Lovell FHCC director is accountable to the VA. Several advisory boards and councils support the Lovell FHCC leadership and include senior representatives from across the DOD, Navy, and VA. Resolutions to any issues are handled first by each agency's chain of command, then elevated, if necessary, to the Joint Health Care Facility Operations Steering Group, the DOD/VA Health Executive Council, and finally to the Joint Executive Council.[1]

To help implement the partnership, the DOD/VA Health Executive Council formed seven national task groups to develop plans: leadership, finance and budgeting, human resources, information technology, clinical, administration, and communication.[2] The seven task groups, each co-chaired by VA and DOD staff, included subject-matter experts such as local, regional, and central office representatives from each agency. There were more than 100 members across the task groups.

Unique Aspects

The DOD and VA partnership is unique in several ways:

- *Unprecedented management of cross-agency medical services by a single agency*: The Lovell FHCC presents the first instance where a facility partnership between the DOD and VA is managed as a single organization under one chain of command.
- *Effective coordination and cooperation among agencies, Congress, and the executive branch in implementing legislative proposals*: Through extensive planning and communication, the DOD and VA were able to propose and Congress passed a proposal to create a joint funding mechanism for facility operations.

Barriers

Lengthy and Complicated Process to Resolve Conflicting Policies and Procedures across Agencies and Departments

The task groups were the main mechanism for resolving conflicting policies and procedures across the DOD, Navy, and VA. The process began in 2005 and continued for 5 years until the integrated facility was announced as fully operational. Throughout that time, the task groups identified several problems that required legislative revisions to resolve. They created an interagency funding mechanism and revised agency authorities, which required continuous communication and collaboration with Congress, the Office of Management and Budget (OMB), and the executive branch.

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[1] The Joint Executive Council includes membership from the DOD and VA at the under-secretary and assistant secretary levels, see TRICARE Management Activity, "DOD/VA Program Coordination - JEC Membership," http://www.tricare.mil/DVPCO/joint-exe.cfm.

[2] See "DOD/VA Health Executive Council," http://vadodrs.amedd.army.mil/hec.html. The communications task force was established in 2007.

Organizational and Technical Limitations to Achieving a Fully Integrated Facility

Although the vision for the Lovell FHCC was to reduce duplication in functional and health care services at the VA Medical Center and the Navy Health Clinic, it did not make sense to integrate certain areas, such as pediatric clinics, because the VA had no pediatric beneficiaries. The Lovell FHCC staff recognized that some services were unique to the DOD or VA, and these also were not integrated.

The lack of technical interoperability in the electronic health record systems between the agencies also imposed limitations on integration. The Lovell FHCC staff has developed work-arounds to manually enter clinical information into each of the systems, but this takes significantly more time than having a joint system.

Statutory Limitations in Cross-Transferring Civilian Employees, Funds, and Property

Three areas where legislative changes were required to implement the Lovell FHCC were transferring Navy civilians to the VA, creating a joint fund to support operations and maintenance, and designating the facility as a military treatment facility. Although the partners were optimistic that Congress, based on its encouragement for the project, would revise the necessary statutes, much of these changes took several years to implement and included a significant amount of negotiations in the executive branch and between the House and the Senate.

Uncertainty throughout Planning

The Lovell FHCC had substantial support from agency leadership, the DOD/VA Health Executive Council, Congress, and from the military and veterans communities. Even so, full legislative authority to integrate property, personnel, and funding streams was not received until the National Defense Authorization Act for FY 2010 (Public Law 111-84 2009). This was only 1 year before the scheduled full integration of the facility. Throughout the entire planning process beginning in 2005, the task groups and agency leadership faced uncertainty related to (1) whether they would hold the authority to transfer the Navy property to the VA to operate and maintain; (2) the status of Navy civilian employees; and (3) whether the facility would receive a single operations budget. Additional planning and agreement drafts were necessary to plan for contingencies in case the project did not receive the necessary legislative changes.

Lessons Learned and Strategies

Project Formation

Working Inclusively with Executive and Congressional Stakeholders

Since its beginning, the Lovell FHCC was driven by a strongly invested congressional delegation that championed the idea to the DOD/VA Health Executive Council. Because of the large scope of the project and the necessary legislative changes, agency leadership communicated regularly with executive level staff, including the OMB, and Congress. Strong external pressures from Congress, as well as internal pressures from the DOD/VA Health Executive Council and the Joint Executive Council were important drivers for partners to successfully integrate the facilities.

Project Planning

Establishing Interagency Task Groups and Clear Guidelines to Develop Implementation Plans

The DOD/VA Health Executive Council developed clear guidelines for the task groups, including:

- Identify all conflicting policies, directives, regulations, and laws related to their task group's subject area that would need to be revised or removed to achieve integration of operations at both facilities.
- Develop a schedule, including milestones and activities, for implementing the project.
- Provide recommendations on how to overcome any identified barriers.

The task groups met monthly or quarterly, except for the leadership task group, which met more often to coordinate all aspects of the project. If there were any problems, members would hold group meetings to address those topics. The task groups enabled staff to resolve issues at the lowest levels possible and helped highlight areas that needed higher levels of approval.

Creating an Interagency Funding Mechanism

The DOD and VA were restricted from directly transferring funds to the Lovell FHCC because doing so would make the facility an independent Federal agency, and this was not the intent. Agency leadership thought that an interagency funding mechanism for the Lovell FHCC could be expanded from an already established funding mechanism for joint venture projects, the Joint Incentive Fund. The Joint Incentive Fund for the DOD and VA was established as a Treasury fund by the National Defense Authorization Act for FY 2003. It required DOD and VA to implement joint projects to increase sharing of health resources, but Congress and executive leaders resisted expanding the Joint Incentive Fund beyond its intent to provide "seed money for creative sharing initiatives."

After negotiations with agencies, Congress, and the executive branch, Congress established a separate Treasury fund, the Joint Medical Facility Demonstration Fund. Both the DOD and VA can contribute to this fund. In order to retain control of how much and when the funds are spent, the DOD must spend its contributions within 1 year and the VA within 2 years. Although this authorization provides less flexibility than the Joint Incentive Fund, where the DOD and VA can use funds until exhausted ("no year" money), the Demonstration Fund allowed sufficient elasticity for the VA to fund the facility while DOD appropriations were delayed by a continuing resolution in Congress.

Establishing Agreements to Address Legislative and Funding Uncertainties

The DOD and VA established an executive sharing agreement that would provide funding for operations of the Lovell FHCC in case the joint Treasury fund was not appropriated by the time the facility formally opened in October 2010. When DOD's appropriations for FY 2011 were delayed and the joint Treasury fund could not be fully established with funding from both agencies, the Lovell FHCC was able to begin operations as scheduled and continue operating for 9 months under this agreement.

Project Implementation

Adopting a Single Chain of Command

Initially, the proposed governance structure involved both the DOD and VA counterparts acting as co-directors of the new facilities. DOD leadership urged that the organizational structure be streamlined in a single chain of command to enhance coordination and the quality of patient care. The partners agreed that since the VA was operating most of the facilities in the joint venture, the Lovell FHCC's director should be from the VA.

Establishing Early Collaborations through Joint Incentive Fund Awards

The Joint Incentive Fund was used to implement joint projects to increase sharing of health resources at the DOD and VA facilities. Several awards were provided to the North Chicago facilities, which helped to transition and consolidate several medical services and equipment across the facilities (Table C-2).

Table C-2. Early Joint Incentive Fund Awards to North Chicago, FY 2004–2006

Fiscal Year	Funding	Description
2004	$850,000	Women's health clinic
2005	$470,000	Mammography services
2005	$685,000	Hematology-Oncology program
2005	$3,426,000	Joint magnetic resonance imaging
2005	$248,000	Clinical fiber optics
2006	$403,000	Hospitalist
2006	$638,000	Digital radiography

Benefits

The full integration of management and services of the DOD and VA facilities into the Lovell FHCC complex has not yet been achieved. A lack of interoperable data systems has delayed the integration of primary clinical services. Nonetheless, the partnership has resulted in efficiencies. Cost savings are realized by avoiding construction costs, reducing staff, and integrating operations.

Policy Suggestions

One suggestion mentioned by an interviewee could facilitate future Federal facility partnerships:

- *Agencies could improve identification of opportunities through cross-agency awareness of facility planning processes*. The Lovell FHCC project was facilitated by ideas emanating from Congress to integrate the Navy's and VA's North Chicago facilities. Partnership opportunities are difficult to identify and could be facilitated through cross-agency awareness of each agency's facility planning processes. This could lead to better communication between agencies and their leadership.

Appendix D.
Hollings Marine Laboratory in Fort Johnson, Charleston Harbor

Table D-1. Summary of Findings on Hollings Marine Laboratory

Parties Involved	National Oceanic and Atmospheric Administration (NOAA) National Institute of Standards and Technology (NIST) Non-Federal Partners: Coastal Center for Environmental Health and Biomolecular Research (CCEHBR), South Carolina Department of Natural Resources (SCDNR), Medical University of South Carolina, College of Charleston
Motivations	Provide the science to sustain, protect, and restore coastal ecosystems emphasizing linkages between environmental condition and human health, using an interdisciplinary approach
Barriers	NOAA appropriations have remained flat and non-Federal partners do not contribute funding for equipment and facilities upgrades Approval processes for interagency non-environmental work is slow Limitations to the integration of partners due to lack of interoperable systems Accommodating increasing demand for Hollings Marine Laboratory research and laboratory space is challenging Executive Board meets twice a year, rather than quarterly Inability to communicate current and potential future benefits of the partnership
Lessons Learned and Strategies	**Project Formation** Establishing a governance structure that involves all partners in decision-making and allows the lead agency to effectively implement the partnership Establishing a rule to use the most stringent procedures of each agency **Project Planning and Implementation** Establishing a Joint Project Agreement and governance structure with leadership rotations and flexibility to evolve **Maintenance and Operation** Leveraging funding from Federal, state, and private partners
Benefits	Bringing together interdisciplinary researchers to work on complex problems in unique laboratory space Efficiencies of scale in operating one site for multiple parties
Policy Suggestions	Agencies could share best practices for streamlining approval processes and transfer of funds across agencies Agencies could increase opportunities for outreach and improving communication of the value of facility partnerships and research collaborations Agencies could allow for flexibility to amend agreements to facilitate non-Federal partners contributions to maintenance and operations funding

Background

The Hollings Marine Laboratory (HML) is a Federal, state, and academic partnership with the mission "to provide science and technology for evaluating and understanding linkages between coastal development, the condition of marine ecosystems, and human health" (Sandifer et al. 2005). The National Oceanic and Atmospheric Administration/National Ocean Service's National Centers for Coastal Ocean Science (NCCOS) is the lead agency (referred to as NOAA in this case study), and the partners include the National Institute of Standards and Technology (NIST); South Carolina Department of Natural Resources (SCDNR); and two local universities, College of Charleston and Medical University of Charleston.

The idea for the HML originated in a 1987 white paper written by the director of the NOAA Charleston laboratory and one of the division directors of SCDNR. The white paper described the concept of a "new cooperative science facility designed to address effects of natural and anthropogenic stress in coastal and marine environments. The white paper spurred action to bring together potential partners and to develop formal agreements. Over the course of 6 years, the mission was broadened to include the evaluation of effects of changes in the marine environment on human health. In January 1994, NOAA received an appropriation for the partners to undertake a detailed facility requirements study, and in 1995, NIST joined the partnership. Each partner contributed to the planning. The laboratory was originally called the "Marine Environmental Health Research Laboratory," but in 2000, it was renamed the "Hollings Marine Laboratory" in honor of South Carolina's Senator Ernest F. Hollings. In 2001, the laboratory began operations. It is now referred to as the Hollings Marine Laboratory.[1]

Description

The HML is located at Fort Johnson, an 89-acre site on the Charleston Harbor (Table D-2). HML has 103,000 square feet of laboratory space designed to encourage and support interdisciplinary research from molecules to ecosystems by sharing expertise, equipment, space, and other resources (HML 2012):

- Analytical instrumentation necessary to identify and quantify pollutants, toxicants, and pathogens
- Level 2+ biosafety laboratories for dealing with viruses and other disease-causing organisms

1 To avoid confusion, we use Hollings Marine Laboratory (or HML) throughout the report for both time frames (before and after 2000).

- Seawater systems and aquaculture facilities to produce quantities of selected marine species for research
- A nuclear magnetic resonance facility for identification of marine toxins and potential pharmaceutical agents
- An ecological field-collection launching and sample-preparation area
- A cryogenic specimen bank for preservation of a variety of marine-related biological samples, including protected species
- A genomic laboratory devoted to marine species

Table D-2 describes each of these spaces in more detail.

Table D-2. Buildings, Capabilities, and Functions at the Physical Sciences Facility at Hollings Marine Laboratory

Laboratory Space	Capabilities and Functions
Analytical and Environmental Chemistry Laboratory	Cutting-edge chemical measurement laboratories for environmental analyses, which include elemental or molecular mass, molecular structure, and quantity of substances Mass spectrometry
Nuclear Magnetic Resonance	High field facilities and laboratories to support structural biology, metabolomics investigations, and biotoxin/natural products determinations 800 MHz magnets 700 MHz magnets Auxiliary equipment such as magic angle and flow probe
Aquatic Production Laboratory	Ten independent seawater culture systems, each with a self-contained filtration package totaling more than 100 cubic meters of culture volume, together with a support lab and food preparation area. Access to Waddell Mariculture Center
Ecological Field Processing Laboratory	Facilities for launching field-collection activities, sample processing, and equipment storage for ecological assessments and a platform for testing new tools and techniques 18-foot boat R/V TideCreek with 82-inch beam Twelve continuous measure water quality data loggers with chlorophyll and oxidation/reduction potential probes
Genomic- Cellular-Molecular Biology	Biosafety Level 2 facilities dedicated to the support of recombinant DNA library construction and the cloning and propagation of libraries Robotic spotter and arrayer Robotic microarrayer Real-time PCR (polymerase chain reaction)
Microscopy	Scanning electron microscope Confocal microscope with multi-line argon, green helium neon, and red helium neon lasers Light microscopes

Laboratory Space	Capabilities and Functions
Marine Environmental Specimen Bank	Cryogenic facilities for long term-archival of well-documented and well-preserved specimens for both retrospective and comparative environmental health analysis Clean rooms
Reference Material Production Facility	Equipment for developing and producing reference materials used in chemical analyses of marine samples
Challenge Laboratories	Suite of laboratories adaptable to environmental conditions that include light, temperature, salinity, and oxygen for animal health and toxicology research
Level 2+ Biosafety laboratories	Four level 2+ laboratories to bring in unknowns and separate projects that require a heightened level of safety and isolation

Source: "Facilities at the Hollings Marine Laboratory," http://www.nist.gov/mml/hml/hml_facilities.cfm, last updated March 13, 2013.

Goals and Objectives

The HML facility and expertise is set up to evaluate marine environmental quality and relate it to human health, specifically "to identify and understand the factors and mechanisms affecting marine environmental quality, including linking the condition of the marine environment to human and marine organism health" (HML Undated).

NIST's partnership in the HML is the result of the 1993 closing of the Navy Base and Shipyard in Charleston and congressional appropriations that followed as part of the recovery. NIST was tasked with establishing a presence at a NOAA facility in Charleston. After exploring several options, NIST entered into an agreement with NOAA in 1995 to locate NIST staff at a NOAA laboratory at Fort Johnson. The agreement defined NIST's mission at HML:

- Improve the quality of marine chemical environmental measurements through development and application of analytical methods and through quality assurance activities.
- Provide environmental specimen banking infrastructure.
- Conduct collaborative interdisciplinary research.

Funding Process

Congress appropriated $50 million to NOAA over the 1994–2005 time period to support the design and construction of HML. Beginning in FY 2000, Congress appropriated annual operating funds to NOAA. The SCDNR provided the land for the facility under a 50-year no-cost lease to the Federal Government. Each of the partners provided expertise for the design, planning, implementation and operations of HML as well as faculty and scientific staff time to conduct the science.

NIST provided $726,000 to NOAA for renovation of existing laboratory space at Coastal Center for Environmental Health and Biomolecular Research (CCEHBR), plus

$200,000 for freezers and other equipment necessary for establishing the specimen bank.[2] NIST also provided $4,775,000 for construction of the Specimen Bank—Reference Material Production Facility, cleanrooms, and analytical laboratory space within the HML (see Table D-3).

Table D-3. Partners and Cost Share for the Planning and Construction of the Hollings Marine Laboratory (thousands $), 1994–2005

Partners	Total Cost Share
Design and Construction	**$55,701**
NOAA	$50,000
NIST	$5,701
South Carolina Department of Natural Resources	0
College of Charleston	0
Medical University of Charleston	0

Source: Sandifer et al. (2005).

Since the construction of HML, NOAA's base funding for the laboratory has remained flat, at slightly over $3 million per year. NOAA has relied on alternative sources to fund research. Since FY 2010, NIST has contributed from $867,000 to $1.2 million per year. Part of this funding is the overhead that NIST employees would incur if they worked at a NIST laboratory. Instead, these funds are transferred to NOAA to pay for the overhead costs at HML. NIST funding has provided additional resources for building new capacity (the recent H-wing) and purchasing equipment.[3] Another example of transfer of funds from NIST to NOAA is for payment of a service contractor to assist in operations of the Specimen Bank. In 2010, NIST deployed staff to study the Deepwater Horizon oil spill, which it is still working on. As a result, NIST does not have enough manpower to maintain the Specimen Bank, so it provided funds to HML to pay a service contractor to assist with this work.

HML has moved from a model of solely relying on base funding to one of reimbursable funding from other Federal entities. In FY 2012, about one-third (37%) of HML's total funding was leveraged (or reimbursable) funds for HML to conduct specific

[2] This CCEHBR space was occupied by NIST personnel while HML was being planned and constructed; the freezers and other equipment were later moved to the HML.

[3] NIST funding at HML: FY 2010, $867,000; FY 2011, $1.2 million; FY 2012, $1 million; and FY 2013, $900,000. NIST is putting in a new analytical instrument, so it transferred money to HML so that the building engineer could take care of the building upgrades and installation.

projects for other Federal programs.[4] The remaining funds are base funds appropriated by Congress to NOAA.

HML researchers from NIST, SCDNR, College of Charleston, and Medical University of South Carolina have also obtained additional funds through grants and awards. In FY 2012, these totaled about $3.8 million, and they were used to undertake collaborative research at HML.

Another mechanism that HML is pursuing is to work with companies to advance HML-developed technologies to the market. HML has recently put in place a Cooperative Research and Development Agreement (CRADA) with Biosortia Pharmaceuticals (Parks 2012). NOAA plans to provide training to HML staff about technology-transfer mechanisms to encourage researchers to work with the private sector.

Management and Organization

The HML model is based on strategic partnerships necessary to accomplish its mission (Sandifer et al. 2005). The laboratory is governed by a formal Joint Project Agreement, signed in December 2000 by the leadership for each of the five partners, which superseded the 1994 Memorandum of Agreement. The Executive Board is made up of the Director of the NCCOS (the HML is part of NCCOS), the Director of NIST, the Director of the SCDNR, the President of the College of Charleston, and the President of the Medical University of South Carolina, or their designees. The Chair rotates annually among the partners. According to the Joint Project Agreement, the Executive Board is expected to meet quarterly to address policy issues and review activities at HML; however, it tends to meet less frequently, usually twice per year.

The Science Board is composed of a leading scientist representative from each partner. The Science Board is responsible for ensuring that the science is consistent with HML's mission, that is, ensuring that it is collaborative, and of high quality. The Science Board also allocates space and other resources. The Chair of the Science Board originally rotated among the partners, but is now the HML laboratory director. The Science Board has created a Research Committee to oversee the science-related planning, since the Science Board spends more time on administrative issues.

Previously there was a requirement that the chair of the Executive and Science Boards not be from the same organization at the same time, but now that the Science Board Chair is permanently the laboratory directory, this requirement no longer holds. The Science Board Chair reports to the Executive Board and also serves as a non-voting,

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4 Department of Energy, Savannah River National Laboratory; Army Corps of Engineers; NIST; and other NOAA agencies (Office of Response and Restoration; Coastal Reef Program; Oceans and Human Health Institute; National Marine Fisheries Service; and Aquaculture Program).

ex officio member of the Executive Board. The HML laboratory director manages the day-to-day operations at HML, is employed by NOAA, and responds to the directions of the Executive Board and advice from the Science Board.

In FY 2012, HML invited an expert panel of scientists from four external organizations to identify high-priority research areas in which HML has competitive advantages and recommend business practice improvements that will enhance HML's long-term sustainability. The expert panel had two main recommendations. First, HML should emphasize science in its mission. Second, the Science Board should formally acknowledge its evolution from providing direction to the HML laboratory director to serving in an advisory role to the laboratory director—a subtle but important change that allows the HML director more latitude in the day-to-day operations, as well as in implementing facility and equipment upgrades.

Unique Aspects

HML is a unique partnership that brings together a diverse set of partners to undertake research at the intersection of coastal development, marine ecosystems, and human health. HML has succeeded by establishing a governance structure, procedures, and operating principles that all can abide by. The facility has several unique research laboratories, including a nuclear magnetic resonance facility for identifying marine toxins and potential pharmaceutical agents; a cryogenic specimen bank for preserving a variety of marine-related biological samples, including protected species; and a genomic laboratory devoted to marine species. One measure of their success is the increased demand (and resulting funds) for research conducted at HML.

As one example, the HML is the only marine lab in the world that has a formal cryogenic specimen bank and a facility designed for production of reference materials for chemical analysis. NIST said that its experience and history in producing Standard Reference Materials (SRMs) that chemists use for verifying results for marine and freshwater samples stems from its past work establishing quality-assurance and quality-control programs for NOAA's monitoring programs. These SRMs are distributed worldwide to chemists. Also, the majority of samples in NIST's specimen bank are from various NOAA research and monitoring programs.

Barriers

NOAA Appropriations Have Remained Flat and Non-Federal Partners Do Not Contribute Funding for Equipment and Facilities Upgrades

NOAA's funding to support HML has not increased since FY 2003 in nominal terms, which means its real purchasing power has declined. The budget has remained steady at just over $3 million each year. As a result, the quality of much of the equipment and facilities has declined during the past 10 years, and has not kept pace with technology advancements. In addition, operational and infrastructural costs have increased each year. To remedy this, the Executive Board will discuss a proposal to amend the Joint Project Agreement,[5] so that all partners contribute to the operations and maintenance costs each year. If the Executive Board approves, the next challenge will be obtaining approval from NOAA, a potentially lengthy process. Once that is acquired, the partnership will need to develop and implement new agreements to share costs.

Approval Processes for Interagency Non-Environmental Work Is Slow

NOAA has streamlined setting up reimbursable work relationships for environmental-related work from other Federal agencies, such as the Army Corps of Engineers. The process now takes about 3 months. On several occasions, however, DOD has asked HML to conduct research and was willing to MIPR[6] funds to HML quickly. But the review approval process at NOAA took too long for DOD, so these relationships did not materialize. Planning for new agreements, equipment, and facility upgrades must start at least 1 year in advance (or longer) to accommodate the review and approval processes.

Limitations to the Integration of Partners Due to Lack of Interoperable Systems

The HML information technology system is a NOAA system. This presents large challenges for NIST employees wanting to access their e-mail and files because they must go through multiple firewalls. This can often cause delays in work and communications.

Accommodating Increasing Demand for HML Research and Laboratory Space Is Challenging

There are increasing numbers of requests to use shared Biosafety Level 3 (BSL-3) laboratories because they are contained and have specialized air handling and clean rooms.[7] Over the last few years, HML could not accommodate all requests. Providing space may give HML leverage when negotiating with partners to pay for some share of maintenance and operations costs.

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[5] The Joint Project Agreement allows the partners to contribute to operations and maintenance; however partner organizations have not yet done so.

[6] MIPR is a Military Interdepartmental Purchase Request, a logistics process of the United States military that allows the rapid transfer of money.

[7] BSL-3 laboratories use unidirectional airflow and high-efficiency particle air (HEPA) filtration to control aerosols and remove infectious organisms from the air within the laboratory (containment).

Executive Board Meets Twice a Year, Rather Than Quarterly

The Joint Project Agreement specifies that the Executive Board meet quarterly; however, they tend to meet twice a year, so there are long stretches of time between updates and decision-making.

Inability to Communicate Current and Potential Future Benefits of the Partnership

Several examples and at least one pilot project demonstrate the need for a coordinated environmental coastal surveillance program that integrates information and data from various agencies and networks, takes measurements in the field for analysis, and converts them into a near-real-time reporting network. This integrated surveillance program would catch signals in the environment and act as a sensor for pathogens and risks. HML's pilot project was successful, but it has not been able to obtain state or Federal funding to develop the system.

Lessons Learned and Strategies

Partnership Formation

Establishing a Governance Structure That Involves All Partners in Decision-making and Allows the Lead Agency to Effectively Implement the Partnership

The Federal legislation designated NOAA as the lead agency because HML is a marine laboratory. NOAA has been inclusive in setting up and executing its governance structure, which includes an Executive Board and Science Board. HML's goal was to create a laboratory with interdisciplinary capabilities to undertake research focused on the coastal ecosystem and environmental health issues. The capabilities for the laboratory required the expertise of all the partners, which no one lab could bring to the table alone.

Establishing a Rule to Use the Most Stringent Procedures of Each Agency

The HML project began as a partnership with state and Federal partners and quickly expanded to include one additional Federal agency and two state universities. In addition, the state agency provided a long-term, no-cost lease for the land. The partners agreed that the best approach would be to adopt the most stringent components of the procedures of each partner's organization. They also agreed that the best way to design HML was to visit other marine laboratories and then come together to do the planning.

Project Planning and Implementation

Establishing a Joint Project Agreement and Governance Structure with Leadership Rotations and Flexibility to Evolve

According to interviewees, the governance structure and executive plan works well for HML. The Executive and Science Boards each have leadership representatives and the chairs of each group rotate among the partners each year. This has resulted in consensus in operations and planning.

A recent success in planning and implementing a new construction project is the renovation of the 17,000 square feet H-Wing facility. The H-Wing laboratories are designed for cellular- and molecular-level research for two endowed chairs that are joining HML. There are two large conference rooms, breakout work areas, a smart (technology-enhanced) education room, and an information technology and bioinformatics center (HML 2012, 7)

Maintenance and Operation

Leveraging Funding from Federal, State, and Private Partners

The original plan relied on NOAA funding (and some funding from NIST), along with in-kind personnel contributions from the state and university partners. This worked well initially but has not been sufficient to sustain HML over time because the NOAA budget for HML has not increased since it began operations in 2001. The biggest challenge has been the difficulty in finding funds for equipment and facility upgrades. The Executive Board will review a proposal so that all partners will contribute to operations and maintenance.

Benefits and Outcomes

Research-Based

By bringing together microbiologists, biologists, clinical toxicologists, and other scientists in the marine and environmental disciplines, plus engineers, the traditional stovepipes are eliminated. The scientists and engineers share equipment, resources, and intellectual capital (they can walk down the hall to share or discuss new findings). Another benefit is having a wide array of skills available for each project:

> the scale, diversity and connectivity of issues suggest that no single organization possesses the breadth of scientific expertise needed to address these problems completely…Researchers from our partner institutions work together combining expertise to conduct research they could not otherwise accomplish (HML 2012, 4).

HML can more effectively conduct environmental health research by bringing together scientists from many different backgrounds to solve complex problems. Their unique laboratories, such as the cryogenic specimen bank for preservation of a variety of marine-related biological samples and a genomic laboratory devoted to marine species, aids such research.

Non-Research-Based

There are efficiencies of scale in operating one site for multiple parties.

Policy Suggestions

Interviewees had several suggestions to facilitate similar partnerships:

- *Agencies could share best practices for streamlining approval processes and transfer of funds across agencies.* Possible practices could include giving all agencies the ability to send and receive funds quickly, such as done through the DOD MIPR process (GSA 2012).
- *Agencies could increase opportunities for outreach and improve communication of the value of facility partnerships and research collaborations.* Outreach efforts could increase awareness of the importance of coastal health and marine health and their relationship to human health and homeland security. Increasing opportunities to tell this story could lead to greater awareness of opportunities for partnerships with other agencies and access to funding at the state and national levels.
- *Agencies could allow for flexibility to amend agreements to facilitate non-Federal partner contributions to maintenance and operations funding.* To improve the flexibility and ability to maintain and upgrade equipment and facilities, the agreement could be structured so that each public and private partner can contribute funds to the laboratory. Relying solely on Federal funds can be difficult, especially when budgets are flat or declining. Part of the challenge will be to get support from NOAA general counsel and budget office. Then the partnership will need to implement new policies and processes to facilitate cost-sharing.

Appendix E.
Life Sciences Beamlines at the National Synchrotron Light Source and National Synchrotron Light Source II at Brookhaven National Laboratory

Table E-1. Summary of Findings on Life Sciences Beamlines

Parties Involved	Department of Energy Office of Science (DOE-SC) National Institutes of Health (NIH) Other users: National Science Foundation (NSF), other Federal, private companies, and foundations
Motivations	Scientific needs and the application of synchrotron technologies in biomedical research Large NIH user community affected by the phasing out of operations at National Synchrotron Light Source
Barriers	Lack of agency guidelines for strategic beamline development Long-term planning and funding profiles necessary for coordination of research and beamline development Lengthy beamlines proposal review and approval processes performed by each agency Struggle balancing facility involvement and flexibility when managing users
Lessons Learned and Strategies	**Project Formation** Championing and support from agency leadership Managing the facility through a cooperative stewardship model Working effectively at the boundaries of agencies' missions **Project Planning** Understanding user and cross-agency needs through bottom-up scientific workshops, working groups, and advisory panels Incorporating partner feedback on strategic planning and design Developing a scientific facilities plan **Project Implementation** Adopting an innovative funding model for beamline development Coordinating each agency's reviews of beamline proposals Formalizing commitments through a memorandum of understanding and statement of work **Maintenance and Operation** Continuing coordinated operations across agencies
Benefits	Meeting research needs and opportunities for scientific discoveries Achieve economies of scale and efficiencies in research and operations
Policy Suggestions	Agencies could develop a lessons-learned framework on partnerships for beamline developments Agencies could encourage all synchrotron facilities to develop a formalized facility strategic plan alongside participation from users Agencies could adopt a single-standard user facility model in future facility partnerships

Background

The National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory (BNL) has been in operation for almost three decades. Although the NSLS continues to serve its large user community successfully, other synchrotrons now offer superior capabilities. To take advantage of the latest developments in light source technology, the Department of Energy Office of Science (DOE-SC) is constructing the NSLS-II, a next-generation synchrotron scheduled to begin operating in 2015. In 2013 and 2014, BNL will phase out operations at the NSLS and transition certain research capabilities to the NSLS-II. The large biological and life science user community at the NSLS will be affected by the transition to the NSLS-II. To ensure that these users' needs are met, the National Institutes of Health (NIH) has worked closely with the DOE-SC's Offices of Basic Energy Sciences (BES) and Biological and Environmental Research (BER) to design a research program that includes construction of beamlines for the life sciences user community at the new facility.

Description

National Synchrotron Light Source

The NSLS at BNL in Upton, New York, is a national user research facility commissioned in 1982 and operated by the DOE-SC. The DOE-SC BES funded the construction of the NSLS. The DOE-SC BER program, NIH, and other partner organizations support biological user access as well as scientific research in biological systems at the facility.

The NSLS serves a large and diverse scientific user community of about 2,500 unique users per year from approximately 400 academic, industrial, and government institutions (BNL 2009). Currently, about 40 percent of the users conduct life science research and about one-third of these users are funded through NIH, mainly from the National Institute of General Medical Sciences (NIGMS) (BNL 2008). The role of NIH as a funding source for life science and medical research at NSLS began through research grants and the shared use of existing beamlines. In the early 1990s, the demand for access to synchrotrons from the biology community was rapidly increasing, and by the late 1990s, it was the fastest growing field among synchrotron users (NRC 1999). NIH, jointly with DOE-SC BER, funded the construction and operation of beamlines for NIH-supported researchers at the NSLS. This provided increased access to these beamlines for NIH-supported researchers.

The facility consists of two electron storage rings, an X-ray and a vacuum-ultraviolet ring, which can accommodate 60 beamlines or 25 experimental stations.[1] There are two types of beamlines at the NSLS:

- Facility beamlines are operated by the NSLS staff and must reserve a minimum of 50 percent of their beamtime for general users. There are currently 26 facility beamlines.
- Participating Research Team (PRT) beamlines are operated by users and reserve 25 percent of their beamtime for general users. There are currently 32 PRT beamlines.[2]

To bring the NSLS online in a timely manner, the Department of Energy (DOE) requested that external scientists develop instrumentation and form PRTs to (1) recruit individuals that could design and construct the necessary instrumentation and (2) raise funds to build and operate the instrumentation. In return for this investment in the facility, each PRT was granted 75 percent beamtime and exclusive access to its beamline (NRC 1999). NIH supports operations at one facility beamline, shared jointly with the DOE-SC BER, and nine PRT beamlines for biological research at NSLS.[3]

National Synchrotron Light Source-II

The NSLS has been operational for 28 years. Upgrades to the facility have occurred throughout this time, leading to improvements in brightness and new research capabilities. Today, however, the facility faces certain limitations in its performance. The biology community, in particular, voiced several concerns necessitating upgrades and access to the NSLS (BioSync 2002, 10):[4]

> Much of the growth in beamline number, quality and capability in recent years has occurred…in the mid-west and the Bay area. While these developments are welcomed by all because of their positive impact on the nation's scientific capabilities, they pose a significant logistical problem for investigators based on the east coast, who increasingly find themselves

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[1] See "BES User Facilities," http://science.energy.gov/user-facilities/basic-energy-sciences.

[2] For a full list of beamlines by type see http://beamlines.ps.bnl.gov/default.aspx?t=facility and http://beamlines.ps.bnl.gov/default.aspx?t=prt.

[3] The facility beamline is the X6A beamline. See http://beamlines.ps.bnl.gov/beamline.aspx?blid=X6A. The PRT stations include five operated by the Macromolecular Crystallography Research Resource (PXRR) (X12B, X12C, X25, X26C and X29) (see http://www.px.nsls.bnl.gov/) and four by the Case Western Research University Center for Synchrotron Biosciences funded by the NIH National Institute of Biomedical Imaging and Bioengineering (X3A, X3B, X28C, X29; see http://csb.case.edu/about.html#), one of which is also under PXRR.

[4] BioSync is a grassroots organization that promotes the use of synchrotrons in structural biology research; see: http://biosync.sbkb.org.

having to travel long distances to collect data hands-on at state-of-the-art beamlines.

The DOE began planning for the replacement of the NSLS in 2005 by formally establishing the mission need for NSLS-II driven by several goals: to build the brightest synchrotron in the world, offer leading-edge research capabilities, and better meet users' needs in the Northeast and elsewhere. The NSLS-II will provide10,000 times the X-ray brightness and 10 times the flux relative to the NSLS. The NSLS-II is an approximately 600,000 gross square foot facility near the NSLS and BNL's Center for Functional Nanomaterials. These facilities will form a research cluster in materials science, condensed matter, biology, and chemistry on the campus. It is expected that the NSLS-II will serve about 3,500 users per year. The NSLS-II will build upon research areas at the NSLS and bring new opportunities for scientific discoveries (see Table E-2). NIH has already provided about $40 million to support three beamlines at the NSLS-II, for which detailed plans have been developed and orders for major equipment will soon be issued.

Table E-2. Biology Research at the National Synchrotron Light Source and National Synchrotron Light Source-II

The National Synchrotron Light Source (NSLS) and NSLS-II provide ultrahigh flux and high-brightness electromagnetic radiation that can be drawn off at beam ports placed along the ring. The radiation energies range from X-ray to ultraviolet and infrared light. For biologists, the radiation can be used to conduct experiments in crystallography, imaging, and small angle scattering and diffraction, among other areas.

- *Macromolecular crystallography*—One major area of research is in crystallography, which uses X-rays to improve visualization of biological molecule and protein structures. Macromolecular crystallography using micro-beams allows researchers to improve data collection and reduce signal-to-noise of the data by reducing the size of the beam to that of the crystal. The NSLS-II can support micron- and submicron X-ray beams, which reduces radiation damage to samples.
- *Imaging*—Another area of research is using X-rays to image tissue and cells and visualize biological processes, such as protein folding. The NSLS-II can enhance imaging capabilities due to its significantly brighter X-ray beams.
- *Small angle scattering and diffraction*—This tool is increasingly used by structural biologists to complement high-resolution structural studies. The NSLS-II can support beamlines that enables time-resolved studies at the level of microseconds and milliseconds, which is currently beyond the state of the art.

Source: National Institutes of Health (2009).

Goals and Objectives

The goals of the partnership between the DOE-SC and NIH are to anticipate and accommodate the life sciences and biology user communities' needs, develop a vision for life science research and beamline development at the NSLS-II, and support scientific discovery and advance each agency's mission.

Funding Process

Facility

DOE-SC budgeted and managed funding for the construction of the NSLS and NSLS-II. Other agencies were not asked to contribute funds to the core facility due to DOE's role as a steward of major national user facilities. The projects followed the DOE's program and project management process for the acquisition of capital assets.[5] Funding for the NSLS-II was allocated through an annual line item in the DOE-SC's budget. The funding profile extends from FY 2005 to FY 2015, and the construction project is expected to be completed in FY 2015. The Office of Management and Budget (OMB) approved the inclusion of the NSLS-II in the President's Budget Requests. Congress passed the appropriations for the NSLS-II, including $150 million from the American Recovery and Reinvestment Act in 2009, which helped BNL accelerate construction (BNL 2012). The OMB did not have a significant role in providing input during the DOE's program and project management process, other than through the annual budget process.

Since the 1980s, the size and scope of synchrotrons have increased significantly. The NSLS was budgeted as a $24 million (about $70 million in 2013 dollars) project through the Energy Research & Development Administration (now the DOE), and the NSLS-II is a $912 million project. The NSLS-II obtained additional financing from New York State to construct an adjacent facility, the Joint Photon Sciences Institute, in which operations are funded by the DOE, NIH, and Department of Defense, among others (NRC 1999).

Beamline Development

Funding Models

The funding models for beamline development at the NSLS and the NSLS-II differ slightly. Management of the NSLS follows the cooperative stewardship model, in which the DOE assumed responsibility for the design, construction, operation, and maintenance of the core facility, and partners fund experimental stations and other instrumentation (NRC 1999). Generally, beamlines funded through sources other than the facility are financed and operated by the PRTs, although some are operated jointly with other programs. The Federal cooperative stewardship model at NSLS stabilized operations funding and produced innovative beamline designs. However, it also led to a less than

[5] See DOE Order 413.3B (DOE 2010), which canceled the previous DOE Order 413.3A (DOE 2006b) on November 29, 2010.

optimal placement of beamlines, low reinvestment rates for beamlines, and research silos since each PRT operated independently.

The NSLS-II is using a different construct called the General User–Partner User model, where the role of facility staff in beamline development and operations is enhanced. Like NSLS, there are facility and user beamlines; however, the process and requirements for partner users differ. There is greater emphasis on proposals to access beamlines and the maximum access time of partner users has been significantly decreased to 40 percent. In addition, the duration of the partner user proposals is limited to 2 to 3 years. Partner users can still contribute to the facility by installing an experimental station, providing staff or equipment, and designing or constructing beamlines (BNL 2009, 2006a).

Funding Mechanisms

Beamlines are funded by a range of sources, including government agencies, industry, and the facility. The funding mechanisms that NIH has used are also diverse.

- At the NSLS, NIH provided funding for beamlines through research grants and contracts. Previously, NIH awarded research grants for research at experimental stations and for the construction and operations of the beamlines. Contracts provided a more controlled method of constructing beamlines.
- At the NSLS-II, the partnership for beamline development between the DOE and NIH was formalized through interagency memorandum of understanding (MOU) agreements. NIH approved two MOUs for beamline construction, $12 million in FY 2010 (funding from the American Recovery and Reinvestment Act) and $33 million in FY 2011. This funding will support the construction of three beamlines for biomedical research.
- Operation of the NIH-funded beamlines and potential additional biological beamlines will be funded separately by peer-reviewed research grants awarded by NIH and the DOE BER program. These awards are not subject to approval at the agency’s director-level or OMB since they are funded by the NIH-NIGMS budget.

Proposal Review Process

The NSLS-II has issued two calls for beamline proposals. The development of beamlines at the NSLS-II undergoes a sophisticated review process across both partner agencies. Prospective users submit proposals for beamlines that are reviewed by BNL facility staff and NIH. BNL’s Light Sources Directorate conducts a peer review of the proposal with input from scientific advisory committees (BNL 2011).

At NIH, the beamline review process includes establishing a standing committee of advisors. The advisors help with technical issues in the planning stages of beamline construction and to ensure that the beamline specifications are consistent with the needs of NIH and its user community. As the project progresses, outside advisors who serve on both NIH and DOE advisory committees and represent the NIH community during beamline planning and construction are selected.

In addition, representatives from several NIH institutes and the DOE BER program participate in monthly project meetings by NSLS-II teams responsible for the NIH beamlines. These meetings allow NIH program managers to observe periodic outside reviews of progress at NSLS-II and generally remain in close communication with the NSLS-II project team at BNL to provide oversight of the beamline projects. In addition, the MOUs in place require quarterly and annual progress reports to NIH by the NSLS-II project team at BNL.

Management and Organization

Brookhaven Science Associates is contracted to manage and operate BNL and its facilities, including the NSLS and NSLS-II. The DOE BES program serves as the steward of the NSLS and NSLS-II.

Several teams and committees advise the facility staff and are responsible for executing the NSLS-II construction project (BNL 2009):

- An integrated project team composed of staff from the BES, Brookhaven Science Associates, BNL, and the Brookhaven Site Office[6] was established to assist in implementing the NSLS-II.
- A project advisory committee advises the project management team on the scientific mission, strategic planning, construction, and user access among other areas. The committee includes individuals with expertise managing synchrotrons and related research at national laboratories.
- Beamline advisory teams represent particular user communities and play a significant contributing role in advising facility staff during beamline design, construction, and commissioning.

Although NIH-funded researchers are involved in the operations of the beamlines, NIH is not formally involved in facility management. The NIH community is represented by participants in advisory committees, however.

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[6] The Brookhaven Site Office is staffed with DOE personnel responsible for overseeing the management and operations contract for the laboratory.

Unique Aspects

The NSLS and NSLS-II partnerships for beamlines demonstrate several unique aspects:

- *State-of-the-art facility*: The NSLS-II will include capabilities that are rare or nonexistent at other facilities throughout the world. As a state-of-the-art facility, the project has garnered and maintained agency-level and public attention.
- *Co-funding of instrumentation rather than the core facility*: Consistent with the cooperative stewardship model, the DOE maintains its role as the sole steward of the facilities and establishes partnerships to develop instrumentation. Beamline construction is largely driven bottom-up by the user community. The NSLS and NSLS-II have leveraged resources for beamline construction from Federal agencies, industry, and other private organizations.
- *NIH's coordination role and hands-off management in beamline development*: NIH is a funding partner in the construction of the beamlines supporting the biomedical scientific user community, while most of the operations and management of the beamlines are conducted by the DOE and the user teams. NIH's strong relationship with the DOE BES and BER programs ensures that their user community's needs are considered in facility planning.
- *Transitioning and anticipating needs of an existing user community*: Planning for the NSLS-II life science research program involved a lengthy communication process spanning about 4 years. Much of the communication entailed determining the needs of the user community. One interviewee noted that having an organized user community from the NSLS helped minimize the complexity of planning and obtaining feedback when preparing for life science beamlines at the NSLS-II.

Barriers

Lack of Agency Guidelines for Strategic Beamline Development

The DOE has no overarching guidelines for the development of life science programs or beamlines at its synchrotron facilities. Traditionally, synchrotron facilities have been managed, funded, and otherwise supported in a variety of ways. Interviewees recognized that a standardized guide may be challenging to create due the uniqueness of each facility. However, these facilities bring together a complex array of stakeholders, and there has been growing concern about efficiencies in beamtime allocation and operations.

The NSLS initially operated with no facility strategic plan for beamline developments. The PRTs mostly worked independently of the facility staff and other

PRTs. More recently, facilities recognize that efficiencies could be achieved through greater coordination of research and beamlines. Facilities began developing strategies for beamline development, and most synchrotrons, including the NSLS and NSLS-II, have developed a strategic plan (BNL 2009).

Long-Term Planning and Funding Profiles Necessary for Coordination of Research and Beamline Development

Coordination of the life sciences research program and beamlines specifications with the DOE, NIH, and the user community occurred over several years. This is a lengthy process even with a well-established user community.

Beamlines take several years to develop, depending on the scope and facility. When planning the funding profiles for life science research beamlines, NIH initially planned to allocate its investments at the NSLS-II over several years. Instead, NIH was appropriated its total budget request in 1 year. This placed constraints on the mechanisms NIH could use to build the beamlines. The funding was ultimately distributed to BNL through an MOU that would allow BNL to obligate the funding over multiple years through NSLS-II's construction phase.

In addition, beamline costs have evolved over the past 20 years. As one interviewee noted, now the increasingly large scope and sophistication of the beamline technologies have raised the costs of developing beamlines tenfold or more. This has placed greater pressure on the partner agency to include beamline funding budgets.

Lengthy Beamlines Proposal Review and Approval Processes Performed by Each Agency

Several years ago, NIH expanded its review process to cover pre-proposal applications, including beamline proposals. This lengthened the review cycle to 2 years, so that funding awarded in mid-2014 required submission of a pre-proposal by late 2012.

Because each agency uses its own review process, the review process is more complex than a single agency review. Prospective researchers must coordinate between agencies when drafting the technical and scientific aspects of their proposals. The NSLS-II's new user-access policy proposes a more centralized peer-review process for beamline developments within DOE (BNL 2011). In addition to NIH's review process, beamline proposals now undergo both technical feasibility and scientific reviews through BNL's Photon Sciences Directorate and a science advisory committee.

Struggle Balancing Facility Involvement and Flexibility When Managing Users

One interviewee mentioned that there can be a struggle between top-level oversight of maintenance and operations and the bottom-up, science-driven nature of user facilities and research teams. The new General User–Partner User funding model at the NSLS-II has shifted greater authority to the facility in guiding the instrumentation and research, including the placement of beamlines. The outcome of this model has yet to be realized; however, facility staff members are well aware that this may affect the sense of community ownership, user participation, or development of innovative beamline designs.

Lessons Learned and Strategies

Partnership Formation

Championing and Support from Agency Leadership

NIH's leadership recognized the growth of the life science community at the NSLS and the need to ensure the user community's input in the DOE's planning and design phases of the NSLS-II. Life science research at the synchrotrons is heavily supported by NIH at the Director level, signaling its priority across NIH, even though the majority of participation comes from 2 of its 27 institutes and centers. The high costs to develop the NSLS-II, as well as its research potential, have also elevated the visibility of the project across each of the partner agencies.

Managing the Facility through a Cooperative Stewardship Model

Facility staff and NIH agreed that the partnership functions well by having a single primary steward of the facilities. NIH finds that it can leverage the expertise of the DOE and BNL in constructing and managing synchrotrons and user facilities. In turn, NIH brings the scientific expertise in life science research and funding to further develop the beamlines and other instrumentation needed by its researchers.

As the main steward, the DOE strives to provide stable funding for the operation of the facility, which sometimes requires forming partnerships. Note that seeking support for the development and operation from partners is riskier than single-agency funding because the number of partners and the level of support vary over time. Nonetheless, the partnerships are mutually beneficial and have historically helped the DOE meet its mission to provide cutting-edge capabilities.

Working Effectively at the Boundaries of Agencies' Missions

Partners work closely to understand each agency's missions and how their work at the synchrotron aligns with the missions of the other agency. This collaboration is at the root of successful communication between the DOE and NIH. Partners communicate by a variety of formal and informal means. The MOUs include formal communication of beamline developments with NIH through quarterly and monthly reports. Informal communication occurs throughout the project's planning and review processes.

Project Planning

Understanding User and Cross-Agency Needs through Bottom-up Scientific Workshops, Working Groups, and Advisory Panels

Realizing the importance of life science research at the NSLS, the DOE involved NIH early in the planning for the NSLS-II. Since 2007, BNL has hosted workshops with participation from many users of the NSLS, including NIH-funded researchers. The life sciences became a prominent research priority in strategic planning for the NSLS-II beginning in 2008 after some of these initial user workshops. Since then, NIH has co-sponsored life science workshops and established working groups and advisory panels to evaluate what research capabilities are necessary at the NSLS-II and make recommendations on management models for beamlines.

The DOE co-sponsored some of these workshops, which functions to bring the community together and to inform the agencies and BNL staff of users' ideas and needs. Staff from the BER program also attended these workshops, which helped them identify collaborative research areas between NIH and BER researchers.

Incorporating Partner Feedback on Strategic Planning and Design

The DOE makes sure to inform NIH program managers of developments in new management practices for the NSLS-II. This is done informally because the DOE has no obligation to inform prospective users of progress during the development of its strategic plans and management. According to interviewees, NIH has a strong working relationship with the DOE BER and BES programs. NIH and the life science community have been successful when making suggestions for revisions to management of the NSLS-II. In one case, NIH and the user community recommended that the NSLS-II place the life science- and environmental-science-related beamlines close to each other. This led to the "biology village" which has facilitated increased interactions between the user communities.

Developing a Science Facilities Plan

For the NSLS-II, BNL has been documenting its plans for the life science community in a scientific facilities plan. The plan incorporates feedback from the relevant user communities to improve scientific productivity in areas of greatest scientific impact.

Project Implementation

Adopting an Innovative Funding Model for Beamline Development

The NSLS-II adopted a new funding model for beamline development to strengthen the facility's role, particularly in operations, and increase proposal-based access to beamlines. Facility staff see this model as an opportunity to optimize the use of beamlines.

Coordinating Each Agency's Reviews of Beamline Proposals

The DOE, BNL, and NIH engage with prospective users and support the development of their proposals. The strong informal relationship between the partners offers advantages when discussing beamline proposals since staff are able to reach each other at a moment's notice and are kept abreast of any new ideas from researchers. Because it can take a long time (up to 2 years or more) for partner beamlines to undergo each agency's review process, coordination between agencies helps facility staff plan for experimental floor space and anticipate workload.

Formalizing Commitments through a Memorandum of Understanding and Statement of Work

NIH has pursued two interagency MOUs to build beamlines at the NSLS-II. The MOUs specify the design, construction, and installation of the beamlines, timeline, and the obligations from NIH to the DOE for each year of the project.

Interviewees indicated the MOUs provide sufficient flexibility for NIH to be involved throughout the development of the beamlines. The MOUs include reporting requirements and identify staff responsible for communication between NIH, DOE, and the facility. The MOUs also specify that communication be coordinated through NIH advisory committees to guide the project through any technical or scientific issues. The MOU dictates that the DOE will meet the agreed-on objectives and that NIH will be involved if the objectives are at risk or will not be met, at which point the project scope could be renegotiated. An accompanying Statement of Work further specifies the project details and deliverables.

Maintenance and Operations

Continuing Coordinated Operations across Agencies

The NIH and the DOE BER program have common missions and fund researchers in complementary scientific areas. Co-funding of beamlines at NSLS, where this science overlaps, allows both agencies to leverage funding by sharing expenses. It is envisioned that this complementarity will continue at NSLS-II, and it is fully anticipated that NIH and the DOE BER program will continue to partner in co-funding of certain beamlines.

Benefits and Outcomes

Research-Based

The development of beamlines funded by NIH and specific to the needs of the life science community could not have been accomplished without leveraging the core facility funding provided through the DOE. NIH and the DOE BER program staff communicate regularly with the life science user community and ensure that DOE and BNL staff members are informed of their needs. According to interviewees, the research needs of the community have been well met.

Life science research at the NSLS has led to two Nobel prizes in chemistry, in 2003 and 2009.[7] This signals the strong opportunities for future discoveries in the life sciences at the NSLS-II.

Non-Research-Based

The DOE plays an important role as steward of the NSLS and NSLS-II. This model provides a continuity of funding and service to the user community. BNL facility staff members achieve economies of scale and efficiencies in operations. For example, researchers benefit from an optimized design and placement of beamlines, standardized training, and cross-beam use. The steward also plays a vital role in guiding the transition to the NSLS-II while minimizing disruptions.

Policy Suggestions

Interviews with DOE and NIH staff highlighted several factors that have led to the success of the partnerships at the NSLS and NSLS-II that could help guide the implementation of future Federal partnerships for facilities and infrastructure:

- *Agencies could develop a lessons-learned framework on partnerships for beamline developments.* One interviewee thought facility staff could benefit by agencies developing a generalized “lessons learned” framework for how light sources become fully instrumented from their initial suite of beamlines and the DOE’s major item of equipment acquisition process, through partner beamline development, to maturity and upgrades of obsolete instrumentation and eventual decommissioning. Such a historical framework could help decision-makers and

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[7] Nobelprize.org, http://www.nobelprize.org/nobel_prizes/chemistry/laureates/2003, http://www.nobelprize.org/nobel_prizes/chemistry/laureates/2009.

partner agencies understand how the facilities stay at the forefront of science while serving large, diverse scientific user communities.

- *Agencies could encourage all synchrotron facilities to develop a formalized strategic plan alongside participation from users.* Meeting the needs of their scientific communities is the primary consideration of both NIH and the DOE. Communication and feedback throughout the development of beamlines at both the NSLS and NSLS-II have been critical in meeting the scientific communities' needs. This feedback has been incorporated into the design of the NSLS-II. Participation from users in developing policies and strategic plans helps create buy-in and establish transparency of the facility's scientific and development goals. Guidance from agencies could include a formalized framework for development of policies and strategic plans.
- *Agencies could adopt a single-steward user facility model in future facility partnerships*. Interviewees agreed that having the DOE as the main steward at the NSLS and NSLS-II optimizes operations and has significant benefits to the research community. Such a model helps stabilize funding and minimize risk if one or more partners decrease funding at any time. Where appropriate, facilities that depend on bottom-up, science-driven research to develop a user facility could follow the single-steward model if the user community is organized and supported by partner agencies.

Appendix F.
National Interagency Confederation for Biological Research and the National Interagency Biodefense Campus

Table F-1. Summary of Findings on National Interagency Confederation for Biological Research and National Interagency Biodefense Campus

Parties Involved	2002: National Cancer Institute (NCI) National Institute of Allergy and Infectious Diseases (NIAID) U.S. Army Medical Research and Materiel Command (USAMRMC) 2003: U.S. Department of Agriculture (USDA) U.S. Department of Homeland Security (DHS) 2005: Centers for Disease Control and Prevention (CDC) 2010: Naval Medical Research Center (NMRC) 2012: Food and Drug Administration (FDA)
Motivations*	Events of 9/11 and Anthrax attacks led to interest in coordinating biodefense Sharing research and infrastructure costs to support multiple agencies' research missions Requirements to relocate capabilities due to a mandate from the Defense Base Realignment and Closure Commission of 2005
Barriers	Interface of multiple agency processes Defining participation and representation for partners without laboratory facilities at Fort Detrick Lack of assigned staff dedicated to partnership functions Limitations on how each agency is authorized to execute its budget Lack of provisions for funding common infrastructure and activities
Lessons Learned and Strategies	**Partnership Formation** Organized governance structure Learning and participating before joining the partnership **Project Planning** Centralized planning for common infrastructure **Project Implementation** Strong commitment in subcommittees and working groups from all partners Regular communication and cooperation Rotation of responsibility and appropriate distribution of financial support **Maintenance and Operation** Dedicated partnership office and staff
Benefits	Interagency collaboration to strategically coordinate multiple agencies' research missions Enhanced laboratory safety and security; optimized operations, occupational exposure procedures, and workforce; increased awareness of and unified public affairs; and shared certification practices

Policy Suggestions	Congress could establish a separate NICBR appropriation or authority for a common fund
	Agencies and partnerships could develop clear policies on responsibilities for shared infrastructure
	OMB and agencies could establish mechanisms for better coordination with multiple OMB examiners when implementing co-funded partnership projects
	Agencies could explore mechanisms and policy to facilitate the secure, digital exchange of scientific and operational information between different Federal agencies

* Motivations for creating and joining the partnership vary over time and across agencies.

Background

After the events of 9/11 and the subsequent anthrax attacks, Congress and the President directed individual Federal agencies to coordinate their programs and capital investments to leverage their unique capabilities for biodefense. At that time, the DOD operated two biodefense programs: one was operated by the U.S. Army Medical Research Institute for Infectious Diseases (USAMRIID), a subordinate command of the U.S. Army Medical Research and Materiel Command (USAMRMC) located at Fort Detrick, and the other by the Naval Medical Research Center (NMRC) located at Forest Glen Annex. In May 2002, a working group was formed among the medical research and advanced biotechnology organizations at Fort Detrick to explore and coordinate areas of common interest. The collaborative efforts of these organizations resulted in the establishment of the Interagency Biomedical Research Confederation at Fort Detrick, later renamed the National Interagency Confederation for Biological Research (NICBR). At the time of its initiation, the NICBR was regarded as a "loose confederation of research organizations that are willing to discuss areas of common interest…and work in collaboration to coordinate and synchronize scientific interaction in areas of mutual interest" (Ball 2004). This confederation's work was done by creating an environment where Federal agencies encourage the most efficient management practices, foster scientific interchange, and maximize productivity through collaboration rather than a structured agency program or directive.

The charter agencies of NICBR included the National Cancer Institute (NCI), the National Institute of Allergy and Infectious Diseases (NIAID), and the U.S. Army Medical Command. In July of 2003, the Agricultural Research Service (ARS) of the U.S. Department of Agriculture (USDA) and the Office of Research and Development, Science and Technology Directorate, U.S. Department of Homeland Security (DHS) joined the NICBR. The Centers for Disease Control and Prevention (CDC) joined the NICBR in 2005. The NMRC joined in 2010, and the Food and Drug Administration (FDA) joined in 2012.

In a parallel response to the bioterrorism threat made evident by the events of 2001, Congress directed several individual agencies to develop and coordinate their research programs and capital investments in biodefense research and to co-locate research facilities at Fort Detrick, Maryland. NIAID and DHS each developed biodefense programs and constructed new laboratories on what would become the National Interagency Biodefense Campus (NIBC) at Fort Detrick. NIAID already had a long-standing relationship with the Army/USAMRMC in infectious disease research and treatment. In addition, the National Cancer Institute–Frederick had been located at Fort Detrick since 1972. Though NCI's cancer research mission is different than the rest of its NICBR partners, it joined the partnership to facilitate sharing of common research, advanced technology, and infrastructure costs. Congress also directed USDA to study the need for a shared Biosafety Level 3 (BSL-3) laboratory with the Army. The Navy joined the NIBC and NICBR after the Defense Base Closure and Realignment Commission of 2005 (referred to as BRAC 2005) mandated that the Navy move its biodefense functions from the Forest Glen Annex to Fort Detrick.

A brief chronology of the partnership follows:

- December 19, 2001: House Report 107-350 requested feasibility study of USAMRIID's mission and infrastructure requirements
- May 15, 2002: Senate Report 107-151 provided $5 million to plan the National Biodefense Analysis and Countermeasures Center (NBACC)
- May 30-31, 2002: NIH-USAMRMC Planning and Strategy Meeting held and working group formed
- June 25, 2002: House Report 107-532 provided $500,000 for a feasibility study of a shared USDA/Army BSL-3 research facility
- February 13, 2003: House Report 108-010 provided $105 million to build NIAID's Integrated Research Facility (IRF) at Fort Detrick
- April 22, 2003: NICBR Constitution signed by the U.S. Army Medical Command, NIAID, and NCI.
- December 8, 2003: Amendment to the NICBR Constitution adding USDA; Board of Directors approves DHS
- November 13, 2005: Amendment 2 to the NICBR Constitution, adding CDC
- May 13, 2010: Amendment 3 to the NICBR Constitution, adding Navy
- September 19, 2012: Amendment 4 to the NICBR Constitution, adding FDA as a non-voting member

Description

In addition to supporting other missions, Fort Detrick has two primary research campuses, the biotechnology campus and the NIBC. The biotechnology campus is owned by the Department of Health and Human Services (HHS) and houses NCI facilities that date from the 1970s. The NIBC is a combination of existing and new facilities that serves to host many NICBR partners that have facilities or operations related to biodefense research.

NIBC partners constructed several major new facilities, including NIAID's IRF, DHS's NBACC, the Navy's Naval Medical Research Center, and USAMRIID Stage I. Infrastructure was also upgraded through the Central Utility Plant and USAMRIID Steam Sterilization Plant. Few high-containment facilities were built in the United States during the two decades prior to the NIBC, and the new Fort Detrick facilities significantly expanded this national capability.

Funding for new facility construction occurred across several years. To support other NIBC partners' critical national missions during the construction period of these facilities, USAMRIID made high containment space available in their existing facilities. For example, USAMRIID temporarily provided space to NBACC's National Bioforensics Analysis Center and to NIAID-IRF senior researchers. Today, USDA and NIAID-IRF provide space in their facilities to USAMRIID researchers while USAMRIID Stage I is under construction. CDC currently does not have a facility at the NIBC. At the time CDC became a member, it did not have the funding to commit to constructing a facility and it was offered space in USAMRIID. Although, funding to move CDC researchers has not been allocated by the agency, a small number of CDC staff use space provided by USAMRIID.

In addition to the Navy's facility, Navy researchers use the BSL-3 and vivarium space in the existing USAMRIID building on a reimbursable basis. Army and Navy leadership decided not to build a separate BSL-3 laboratory because the construction of an additional high containment laboratory would have caused increased concern for the surrounding community and the time needed to complete an environmental impact statement would have meant missing the BRAC 2005 deadline.

Goals and Objectives

The NICBR Constitution lists the following common goals of the partners (Shea 2007):

- To establish an understanding and a process for coordinating and synchronizing areas of common interest among the Federal agencies involved in medical research and/or biotechnology at Fort Detrick.
- To promote Federal interagency coordination in facilities planning, technology sharing and sharing of expertise among the signatories.
- To minimize duplication of effort, technology, and facilities among the signatories.

- To improve the ability of the signatory agencies to produce science, technology, and quality products faster and better at minimum cost.

The confederation's ultimate goal is to promote the best scientific discoveries through collaboration, coordination, and synchronization of medical research /or biotechnology at Fort Detrick.

Funding Process

Each agency funded the construction of its own new laboratory facilities or replacement facilities. For example, USAMRIID Steam Sterilization Plant and USAMRIID Stage I were both funded through DOD Medical Military Construction (MILCON) appropriations. Congress appropriated funds for DHS to build NBACC over FY 2003–FY 2005 and for NIH to construct the NIAID-IRF in FY 2003 (Shea 2007).

Common Infrastructure

Many funding requirements for supportive infrastructure, such as security, roadways, fencing, and additional electricity/steam, etc., were not included with the construction of the laboratories. The new facilities exceeded the Army installation's capability to provide utilities, ensure safe and efficient access and egress, and meet environmental regulations for the NIBC. Therefore, further construction of supportive infrastructure was necessary in order to support the personnel and missions.

Common infrastructure for the NIBC includes

- Utilities, water, and steam;
- Wastewater hookup;
- Storm water management structures;
- Roadways, perimeter fencing, parking, campus greens; and
- Emergency communication and response.

Individual facilities' appropriations from Congress did not address shared infrastructure requirements or provide a funding mechanism for partners to use when the existing capability of Fort Detrick's infrastructure was exceeded. As a result, the NIBC partners sought alternative solutions such as funding a Central Utility Plant (CUP) through an Enhanced Use Lease (EUL). The CUP was built through a public-private partnership with costs for the mortgage, development, and operations of the facility shared among the users.

Each agency maintains its own facility though the U.S. Army Garrison Fort Detrick provides some common services on a reimbursable basis. This varies by agency and facility. Agreements between the agencies and the garrison offices were established to ensure that the services would be provided to the facility. In several cases, each agency provided part of the required infrastructure and the next building being constructed added to the requirement. For example, the NIAID-IRF and the NBACC each provided high security fencing in the area adjacent to their facilities. The Army then tied these NIBC fences together as part of a MILCON appropriation to address security needs on the NIBC campus.

Management and Organization

The common objectives of the NICBR were formalized in the "Constitution for the Coordination of Interactions among Medical Research Organizations Colocated at Fort Detrick, Maryland" in 2003. The constitution has been amended multiple times as new partners have been added. There are also various memoranda of understanding (MOUs) or agreements (MOAs) for research among the agencies (e.g., USAMRIID and NIAID).

While Congress had appropriated funding for construction of new laboratory facilities, additional funding for individual laboratory operations and common infrastructure service needs was not included. Each agency pays for its own operations. Shared infrastructure services are provided by the U.S. Army Garrison Fort Detrick through interagency support agreements—an MOU or MOA lays the foundation for the partnership between the Army and each agency partner for the particular services needed. However, there is no mechanism for a non-Army partner to pay for the capital costs of shared infrastructure. In the case of the CUP, the NIBC partners are paying a private developer for the energy services needed to support their laboratories through a contract administered by the Army. The NIBC partner's payments include a usage fee and an infrastructure fee.

Unique Aspects

The NICBR and NIBC are examples of co-located research facilities from multiple agencies with a unique governance structure and is the first of its kind. This scientific collaboration has expanded over time and the invitation to become a partner in the NICBR follows a formal framework where prospective agencies must clearly articulate their potential contribution to the research partnership.

With state-of-the-art laboratory facilities that include high-containment research capability comes the need for sustainable and up-to-date infrastructure, including utilities (see Central Utility Plant discussion in the next section).

Barriers

Interface of Multiple Agency Processes

As initially defined in its constitution, the NICBR was defined as a "loose confederation" (NICBR 2003). In a loose confederation, agencies and departments follow their own organizational rules and structure (bringing their best ideas forward for collaborations), while interacting with other agencies that may have vastly different rules. As such, there are inherent conflicts with how work gets done, who pays for it and who is responsible for planning, programming, and oversight. Internal to established multifaceted organizations, such as the Federal research agencies, roles, responsibilities, and processes are more clearly defined.

An organized governance structure was put into place immediately in 2002 that consisted of the Fort Detrick Interagency Coordinating Committee (FDICC), an executive steering committee and a board of directors. There was interagency agreement regarding the conceptual development of the NICBR and NIBC and the importance of leveraging resources and capabilities. However, all partners understood that harmonizing agency processes to make collective decisions would be challenging because each agency has its own set of discrete policies, procedures and reporting and turnaround time requirements. Subcommittees were stood up to address environmental impacts, infrastructure, business, scientific interaction, and public affairs needs. Over time, as the NICBR grew and multiplied, the personnel from different NICBR partner agencies participating in these subcommittees and working groups changed. Some personnel immediately defaulted to their own agency procedure, rather than being open to discussion and coming to a mutually agreeable solution. This was subsequently addressed by the Executive Steering Committee's development of the NICBR strategic plan in 2010.

Defining Participation and Representation for Partners without Laboratory Facilities at Fort Detrick

Although CDC is a full voting partner of the NICBR and sits on multiple subcommittees and working groups, it does not have a facility at Fort Detrick. When CDC entered into the NICBR partnership, they did not have the funds to build a new facility, and they do not currently plan to relocate researchers or occupy space in an existing partner facility. FDA also does not have a physical facility on the NIBC, and joined the NICBR as a non-voting member. Both CDC and FDA have been able to participate in NICBR activities, planning, subcommittees, working groups, and research collaborations. However, partners with a smaller campus presence and lack of a facility may not have the resources to participate in all committees and not all committees are relevant to their membership role.

Lack of Assigned Staff Dedicated to Partnership Functions

As the NICBR grew in scope and complexity, agency partners struggled with jointly coordinating the management and execution of each of their laboratory's day-to-day operations. This was an outcome of three issues: first, the NICBR partnership did not initially have dedicated, full-time staff from each agency working on executing the partnership's NICBR commitments; second, some of the partners joined at various stages of the campus's development (construction, operation); and third, there was no centralized or formalized space on the campus to communicate with counterparts in other agencies, particularly on day-to-day operations across partnerships. Without staff dedicated to this purpose, decisions made by senior NICBR leaders did not trickle down and information gathered by subcommittees and working groups did not get communicated up. At times, this resulted in partners not being aware of key decisions that impacted them.

Limitations on How Each Agency Is Authorized to Execute Its Budget

Each agency at the NICBR receives its own congressionally appropriated funding to fulfill its entire agency mission for a given time period. These time periods vary by agency, with some research entities able to execute funding over only one year and others able to do so over multiple years. There is also agency variability according to budget execution of research versus facilities dollars. Within each agency, annual budgetary approval is required and agency and executive office personnel may change from year to year. For some partners, changes in leadership coupled with tightening budget have resulted in a change in priorities. Changing priorities within the agencies may also be a challenge throughout the duration of a partnership because of the long timeframe necessary to plan for and execute funding.

In addition, challenges arise since an increased number of stakeholders must approve a given decision. In particular, interviewees felt it was difficult to ensure approval of the multiple OMB examiners required for any one funding decision since multiple agencies were involved. Different budgetary methods for how laboratories are funded can also be a major stumbling block.

Lack of Provisions for Funding for Common Infrastructure and Activities

The ability to pay for things that are used by all members with funds from each agency is a fundamental issue that the NICBR members are still trying to solve. The first financial challenge that confronted the NICBR partners was that, although Congress authorized the construction of the new laboratories of the NIBC, no provisions were made to support the common infrastructure and services for the laboratories at Fort Detrick. It was understood that each NICBR partner was responsible for the design, construction, operation, and maintenance of its own research facilities collocated at Fort

Detrick. Funds to plan for and finance a broad range of common infrastructure and service requirements were only available through each organization's research budget and required the reprogramming of funds. In addition, proximity of facilities and non-concurrent scheduling of construction projects may increase the complexity of infrastructure projects, leading to potentially higher costs and disruptions to research and missions. One interviewee stated they would also prefer a campus-wide maintenance contract, rather than each agency having its own agreement with the Army Garrison.

The NICBR evaluated options for collectively pooling money to address infrastructure needs. If this approach worked, future efforts could address operational needs such as laboratory equipment, security, etc. In June 2006, an Integrated Process Team (IPT) was formed to more clearly define the various infrastructure challenges. The IPT narrowed the choice to three options: establish a revolving fund, establish a NICBR appropriation, and maintain the status quo.

A revolving fund to address infrastructure requirements initially held the most promise. This approach was eventually discarded at the June 2006 Board of Directors (BOD) meeting in which the BOD agreed that any money funding the revolving fund would have to come out of each organization's budget. The revolving fund was discarded as a viable option due to complexity, management responsibility, and oversight. However, the BOD's guidance did not fix the problem of infrastructure requirements and shortfalls impacting the laboratory research budgets.

In January 2007, the NICBR Executive Steering Committee (ESC) agreed to seek approval for legislative language for a NICBR Appropriation, and senior department leaders were briefed. The OMB liaisons were advised of the concept and the proposed path forward to address the funding shortfalls. Senior members of Congress on the Senate and House Appropriation Subcommittees were also advised of the infrastructure challenges and the proposed legislative solution that was in the process of gaining department approval. Within two weeks of that meeting, some department-level leaders expressed their concerns to OMB about the proposal, effectively killing the initiative. Without department-level consensus and facing ongoing budget battles over the fiscal year 2007 Continuing Resolution, the NICBR funding proposal lost political support and momentum.

This revolving fund or NICBR appropriation could enable the partners to pool resources for research, common equipment such as cyber technology, and other joint-activities. Currently, joint initiatives, such as campus research events and workshops, are typically funded by one agency partner or rotated to another partner each year. Expenses can also be divided into discrete items and each partner commits to covering the cost of that particular item (i.e., partner 1 buys for security, partner 2 pays for communications, partner 3 pays for building rent, etc.). However, there is no guarantee that each agency will cover the costs when its turn comes due. This may prove especially challenging for partners that are not located on the campus and as budgets continue to shrink.

The NICBR's experience with obtaining common utilities infrastructure for the NIBC illustrates the challenge of securing cost-effective service even when a public-partnership mechanism is identified (see below).

Central Utility Plant (CUP)

As new NIBC facilities were being planned for Fort Detrick, it became clear that the existing electricity and steam infrastructure was insufficient. The U.S. Army, in agreement with the partner agencies, pursued an enhanced use lease to construct a $150 million CUP, which was completed in 2008. The Army leased underutilized property to a private developer to market, finance, develop, manage, and operate the CUP. Capital funds to construct the CUP will be recovered through an annual assessment over a period of 20 years. The CUP provides steam, chilled water, heating and cooling, and emergency power to the NIBC facilities.

The Army would provide common services and bill partners based on their use of the service. However, in some cases, particularly when the new laboratories' requirements exceeded Fort Detrick's capabilities, the Army normally expects the facility requiring the additional capability to either build the necessary infrastructure or pay the Army to build it. In the CUP, the agency partners are paying a prorated portion of the mortgage and utilities based on their use since a new development was necessary to meet the particular specifications of the new facilities. The NIBC partners are also paying for their utilities based on the amount they use.

Initially there was a lack of agreement and trust between a few of the agencies and the Army regarding the CUP's seemingly high development cost. The CUP consumes 25% of NIAID-IRF's program and research budget; other partners incur similar impacts. The underlying concern is that the cost of the CUP could one day make science too expensive to conduct at Fort Detrick, particularly as budgets get tight. In response, USAMRMC initiated an audit of the contract to build the CUP. USAMRMC hired external experts to review the contract and pricing and concluded that the price was within an appropriate range, though probably towards the top end. Overall, the partners were satisfied with the process of obtaining an independent assessment of the contract and the transparency in the process. NCI has elected not to use the CUP because it does not have the same specific requirements as the NIBC facilities.

Despite using the EUL to address the utility infrastructure shortfalls, gaps in infrastructure supporting NIBC partner facilities have remained. The U.S. Army Commander at Fort Detrick and staff argued to the Defense Advisory Working Group (DAWG) that the greatest portion of the infrastructure shortfalls were due to the construction of the new USAMRIID, which was roughly 2.5 times larger than the other laboratories. The DAWG assessed the situation and provided Fort Detrick with funds to address the "Army only" impacts. The addition of new USAMRIID resulted in the Army paying 60 percent of the bill and the other partners paying the balance. NIAID-IRF, NBACC, NMRC, and USAMRIID will collectively pay tens of millions of dollars annually for 25 years from their program budgets, potentially affecting their ability to meet their scientific missions.

Lessons Learned and Strategies

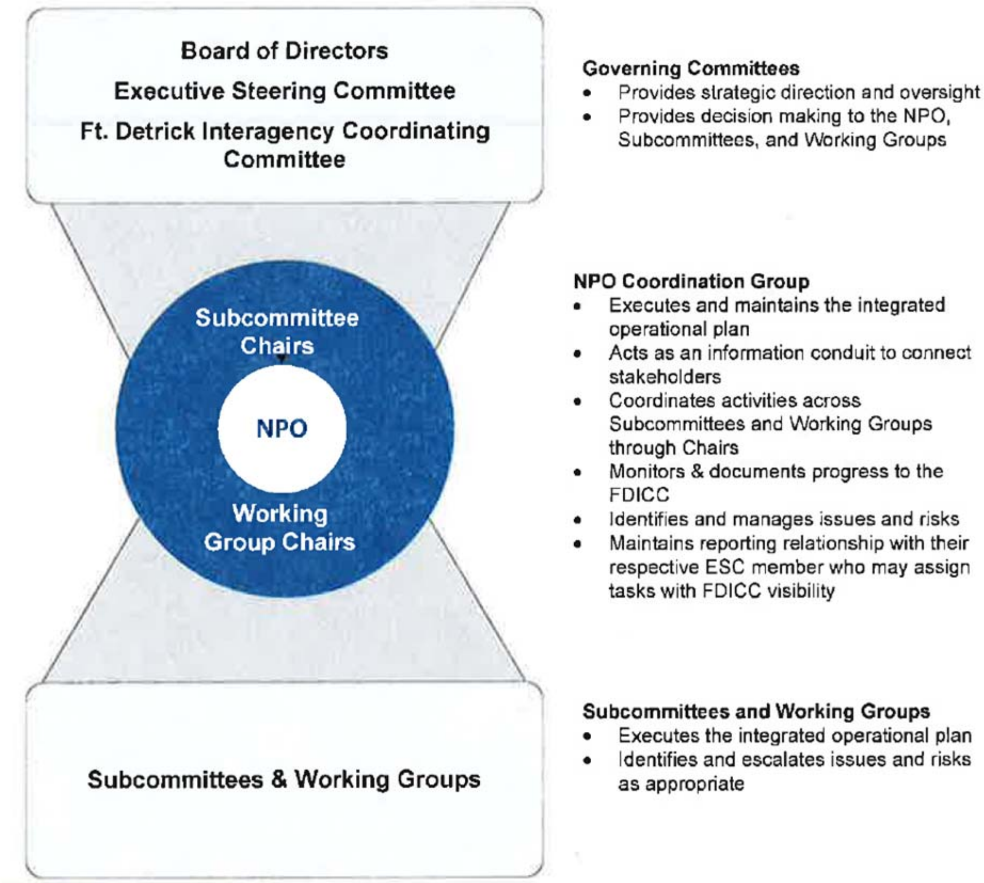
Partnership Formation

Organized Governance Structure

In 2003, the NICBR partnership adopted a constitution that outlined the goals of the partnership. This agreement and its amendments were augmented and followed by a 5-year strategic plan that further defined the partnership's vision, mission and purpose, as well as its organizational structure and committees. The organizational structure consists of the following entities,

- Board of Directors (BOD),
- Executive Steering Committee (ESC),
- Fort Detrick Interagency Coordinating Committee (FDICC),
- Active subcommittees that include scientific interaction, sustainment, financial business practices, security, safety and occupational health, information management-information technology, and public affairs and community relations.
- Thematic working groups that include education outreach, select agent program, in addition to the ad-hoc working groups with legal and medical directors as members.

Several interviewees asserted that engaging high-level leadership through the BOD and ESC is essential to the success of the partnership. The BOD meets twice a year, the ESC meets every other month, and the FDICC meets twice a month. All subcommittees meet monthly. The NICBR Partnership Office, which was put into place in 2010, provides critical staff support for each governance level, particularly the FDICC (see Figure F-1 and the "Maintenance and Operations" section of this appendix for more information on the NICBR Partnership Office).



Source: Archibald (2012).

Figure F-1. NICBR Functional Model

The strategic plan defines the senior governance committees' distinct role. The charter for each subcommittee or working group clearly describes the decision-making process and information sharing across groups. Staff members of all agency partners participate in the subcommittees and working groups. Interviewees reported that discussing and documenting the governance structure in a participative manner clarified the partners' responsibilities and outlined a clear reporting structure among the committees. No major decisions are made without unanimous voting among the partners, a process that could become problematic as the number of partners increases.

Learning and Participating before Joining the Partnership

The FDA, new to the partnership in 2012, spent considerable time exploring synergistic capabilities, discussing areas of scientific collaboration with the NICBR partners, and obtaining support from agency leadership. FDA spent over a year as a NICBR invited guest, participating in select meetings and discussions before it officially joined the NICBR as a non-voting partner. This was an important step in the partnership formation since prospective partners must articulate the mutual benefits of joining the partnership and every partner agency must agree on their inclusion into the partnership. Since FDA has no physical presence on the NIBC but has extensive collaborations and interactions with NICBR partners, it was determined that a non-voting membership would be most appropriate at this time. FDA's participation in the NICBR partnership is managed by the Office of the Commissioner, Office of the Chief Scientist, Office of Counterterrorism and Emerging Threats (OCET). This office helps make NICBR goals and research more visible to FDA's medical product centers that engage in biodefense and biomedical research. It also serves as a conduit for NICBR representatives to obtain technical assistance and subject matter expertise. These types of scientific interactions and collaborations are critical to foster product development necessary for regulatory assessment of medical countermeasures.

Project Planning

Centralized Planning for Common Infrastructure

Each agency funds projects, installations, and facilities separately. There is, however, centralized planning for additional new infrastructure and research, which occurs through communication across subcommittees and working groups. In 2010, the NICBR partners agreed upon a set of business principles and methods for allocating cost sharing for changing requirements that arose on the campus. The subcommittees also discuss several processes, such as environmental regulations, safety, and security to establish a framework for cooperatively working on these issues.

Project Implementation

Strong Commitment in Subcommittees and Working Groups from All Partners

Agency partners are expected to be committed to the operations of the partnership. Although the size, funding, and scope of facilities at the NICBR vary, agency partners with a smaller presence participate by attending as many subcommittee meetings as possible. Partners not located at the NIBC also show their commitment to the NICBR by participating in subcommittees and working groups relevant to their NICBR roles.

Regular Communication and Cooperation

NICBR leadership recognized that those involved, from executive leadership to operational staff, needed to be flexible to allow for differences in agency procedures. The individuals selected to represent each agency were encouraged to cooperate, listen, and learn. Partners made a concerted effort to place the people with flexibility and a willingness to communicate in governance, subcommittee, and working group positions.

When faced with the challenge of meeting the NIBC laboratories' utility needs, the NICBR partners addressed it at different levels. In addition to working possible solutions through their own chain of command/leadership, senior NIBC leaders made the congressional representatives who authorize and approve their budgets aware of the issues and possible solutions. Senior NIBC leaders also held discussions with their liaison officers at the Office of Management and Budget (OMB) to keep them abreast of developments. Finally, the NICBR leadership launched a collective communication strategy to educate and inform key government and congressional leaders about the merits of NIBC and NICBR collaborative research efforts and products.

The NICBR partnership allows each agency to use its own planning processes, rather than forcing procedural conformity to a single agency's decision making. Further, the Army has streamlined approvals by working with agencies on design requirements for some of the partner facilities. According to other partners, Army/USAMRMC focused on establishing a true partnership, instead of acting like a landlord and treating the partners as tenants.[1] The success of the NICBR communication was a result of informed leadership, committed scientists and staff and a willingness to understand the differences in culture among the agencies and creating an environment where everyone felt comfortable.

Rotation of Responsibility and Appropriate Distribution of Financial Support

To ensure participation and support by each partnership agency, the NICBR has set up a rotational framework. Partner agencies, even those not located on Fort Detrick, alternate leading each of the subcommittees of the NICBR governance structure.[2] In addition agencies share funding for certain joint initiatives, such as the annual Spring Research Festival.

Maintenance and Operations

Dedicated Partnership Office and Staff

In 2009, the NICBR ESC requested that a group be formed, the NICBR Partnership Office (NPO), consisting of staff with an assigned representative from each agency dedicated to NICBR efforts. Also in 2009, the USAMRMC used Army funds to set up the Strategic Partnership Office to perform multiple outreach missions for its command, one of which was to support the NPO with dedicated administrative staff services. The

[1] USAMRMC is now separate from US Army Installation Command (the landlord).

[2] There are some exceptions for subcommittees with permanent chairs.

Strategic Partnership Office supported over 300 formal NICBR meetings in 2012 with coordination, scheduling, agendas, minutes, and other management activities.

The NPO serves as a staff action office to the FDICC. The NPO undertakes activities aimed at implementing the NICBR strategic plan through partner collaboration. The NPO strives to identify opportunities to strengthen partnership relations and uses all available NICBR resources to maximize partner success. The NPO serves the NICBR and its respective organizations by identifying, analyzing, assessing, researching and investigating NICBR issues to develop informed recommendations, solutions, or mitigation strategies for consideration (NPO 2010). The NPO also coordinates all governance meetings, including the FDICC, ESC, and BOD. Through the NPO, and with support from the Strategic Partnership office, agencies have significantly improved communication and promoted proactive management of the partnership.

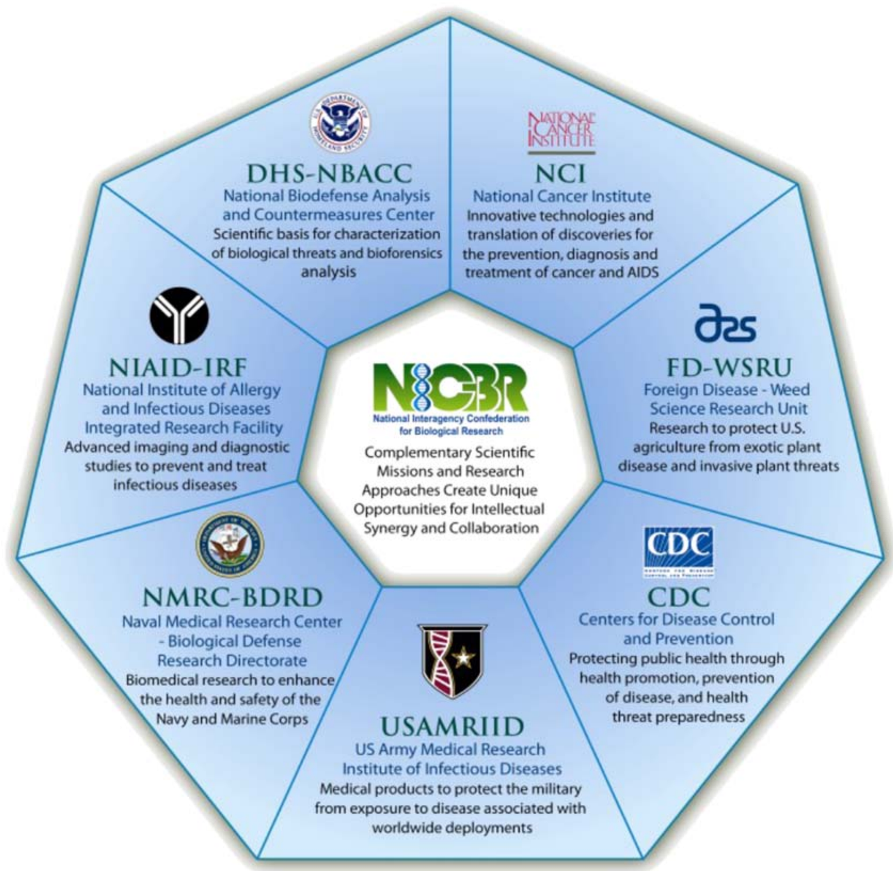
Some of the agency partners have been able to devote full-time staff to the NPO and most have designated primary and alternate representatives. At least one individual from each agency communicates with agency leadership and attends partnership meetings to liaise with other partners. The NPO is staffed by representatives from most of the partner agencies. The NPO has been critical to the success of communication, daily operations, scientific interaction exchanges, and interagency communications among partners.

Benefits and Outcomes

Research-Based

The NICBR partnership contributes to the Nation's biomedical research effort through complementary research programs (see Figure F-2). Each partner agency has signed the NICBR strategic plan outlining a common vision for collaboration.[3] Through the NICBR and NIBC, agencies important to biomedical research now have a coordinated working relationship and are able to deal with various agency research missions through consensus and with a multi-agency perspective.

[3] FDA has not signed the NICBR strategic plan since the signing of the plan pre-dated its membership.



Source: Fort Detrick (2012).

Note: This graphic does not include the Food and Drug Administration (FDA), which joined NICBR in 2012.

Figure F-2. Biomedical Focused Research of NICBR Agencies

The proximity of multiple agencies with unique and particular areas of expertise also enhances research outcomes. Whereas some interagency collaboration took place among partner agencies at Fort Detrick through existing interagency agreements and professional seminars before the NICBR and the NIBC were established, research collaboration began to increase even before construction of new research laboratories was completed. This is because proximity and the creation of an interagency organizational structure with regular meetings and common goals provided the means for true dialogue and discovery. It has allowed agencies to discern how to overcome administrative challenges in order to share scientific resources, such as next generation sequencing, that are not available within their own agencies. It has catalyzed researchers from multiple agencies to share similar scientific ideas and successfully secure collaborative research grants. It has made it possible for NICBR partners to host professional seminars on new countermeasures and biotechnology advancements, which contributes to networking and research collaborations across the NICBR. For example, NCI's cancer mission benefits from the enhancement of infectious disease research. The partners are beginning to track research collaborations based on coauthorship of publications. They expect this indicator to grow exponentially and highlight the success of the partnership in enhancing research and creating collaborations. Leveraging each other's expertise, advanced technologies, and agency resources enables the potential for unprecedented future research collaboration.

Non-Research-Based

- *Safety and Security*: Each agency partner benefits from the security layers from other partners. In addition, the Safety and Occupational Health Subcommittee exchanges lessons learned on scientific procedures, equipment, and processes. The subcommittee is in the beginning stages of collaborating on training. The ESC members receive an annual threat awareness briefing from the FBI to ensure that agency leaders have a common understanding of threats and risks.
- *Cost Savings*: The partnership minimizes duplication because each agency takes into account the collaborative functions of the other facilities. For example, the proposed Medical Countermeasures Testing and Evaluation Facility will not be built because the Department of Defense reexamined the requirements and determined that the mission could be accomplished by integrating it into the new USAMRIID facility, currently under construction, rather than undertaking additional infrastructure construction. This led to government savings of hundreds of millions of dollars. As more facilities and agencies join the campus, economies of scale are obtained and costs for security for original partners, such as NCI and the Army, have decreased.
- *Occupational Exposure*: Basic triage and management procedures for workers with potential occupational exposure in high-containment laboratories were agreed upon by all partners. In the event of an accidental exposure to a select agent while working in a high-containment laboratory at the NIBC, staff will have access to NIH's Special Clinical Studies Unit for assessment and treatment, rather than each agency laboratory needing to establish a self-contained unit.
- *Public Affairs*: The NICBR implemented a communication strategy to help the partners present a consistent message for public affairs. This is particularly helpful in community engagement because partners strive to speak with a consistent voice and are aware of each other's positions on the public's questions and concerns.
- *Laboratory Certification*: The partnership shares lessons learned with each other regarding processes that impact facilities and infrastructure operations, such as certification. CDC certification for high-containment laboratories is a meticulous and demanding process, requiring repeated checking and correction

to ensure safety and compliance. There is coordination among the partners so one facility can learn from the challenges experienced by another.

- *Education and Training*: Partners work together on education and training outreach activities. The NICBR hosts outreach events, such as research festivals and forums.

Policy Suggestions

Interviewees suggested the implementation of policies that could have helped to facilitate the formation and implementation of the NICBR and NIBC partnership:

- *Congress could establish a separate NICBR appropriation or authority for a common fund.* Funding for the partnership through an appropriation in the budget of each partner agency physically located on the campus could increase efficiencies in funding shared infrastructure and promote greater scientific collaboration. Congress could also pass legislation that authorizes agencies the flexibility to create a common pool of non-specific funding for joint facilities and infrastructure or co-funded activities. Though one interviewee pointed out that the partners may not have worked as hard on building the relationships and resolving their funding issues if they each had a mechanism to pool their funds.
- *Agencies and partnerships could develop clear policies on responsibilities for shared infrastructure.* Although the partner agencies' laboratory requirements were ultimately met through the EUL mechanism funding the CUP, it was an expensive process. The partners could have benefited from establishing a clear policy for how funding would be solicited when future infrastructure needs for the campuses arise.
- *OMB and agencies could establish mechanisms for better coordination with multiple OMB examiners when implementing co-funded partnership projects.* Interagency coordination could be facilitated if OMB and agencies established mechanisms that would improve communication when dealing with these types of partnerships. This could include improving communication channels within OMB so that examiners from various agencies coordinate their efforts on the project. This could also include greater formal and informal communication among OMB examiners and partnership leadership.
- *Agencies could explore mechanisms and policy to facilitate the secure, digital exchange of scientific and operational information between different Federal agencies.* Presently the information security requirements and information system restrictions prevent posting information and data to a shared account. Collaboration between partner agencies could be enhanced if there were policies

that guided partners on implementing methods of sharing access, development, and storage of information.

Appendix G.
Physical Sciences Facility at Pacific Northwest National Laboratory

Table G-1. Summary of Findings on Physical Sciences Facility

Parties Involved	Department of Energy Office of Science (DOE-SC) Department of Energy Office of Environmental Management (DOE-EM) National Nuclear Security Administration (NNSA) Department of Homeland Security (DHS)
Motivations	Legislative requirements and State-level agreement for nuclear facility clean-up Maintain research capabilities in existing facilities at the Pacific Northwest National Laboratory (PNNL)
Barriers	Complex coordination of multiple funding sources and partners Funding uncertainties throughout the project's implementation
Lessons Learned and Strategies	**Project Formation** Selecting a lead managing agency Defining core capabilities for the new facilities Forming an interagency integrated project team **Project Planning** Identifying and formalizing cost shares Planning for contingencies using risk-based analysis Incorporating agency feedback to establish an organizational structure and project execution plan Galvanizing support from agency leadership and other stakeholders Communicating with multi-agency research staff on design **Project Implementation** Working through funding uncertainties Integrating innovative alternatives and other partners to finance components of the project Using the integrated project team to support execution Documenting lessons learned **Maintenance and Operation** Incorporating participation and feedback from partners in performance evaluations
Benefits	Successfully preserved the core mission-critical research capabilities at PNNL Decreased funding uncertainties by redistributing funding across partners
Policy Suggestions	Agencies could enhance policies on alternative financing Agencies could develop a policy on joint-Federal funding practices Agencies could provide guidance on the roles and responsibilities of partners Agencies could encourage and seek out OMB's involvement early in the project planning process Agencies and laboratory staff could initiate innovative mechanisms to obtain line-item funding up front.

Background

On May 1989, the Department of Energy (DOE), the Environmental Protection Agency (EPA), and the State of Washington signed a Tri-Party Agreement that outlined actions and priorities to comply with the regulations for nuclear site clean-up of the Hanford Site 300 area. This area is located in south Washington where the Pacific Northwest National Laboratory (PNNL), a DOE Office of Science (DOE-SC) laboratory, has various facilities. To meet the DOE's commitments under this agreement, the clean-up efforts were accelerated in 2004, driving the DOE and PNNL to identify options for replacing the existing research facilities on the site.

The DOE-SC established an integrated project team that included sponsors of the research at the existing facilities and relevant offices related the site clean-up—the National Nuclear Security Administration (NNSA), Department of Homeland Security (DHS), and the DOE Office of Environmental Management (DOE-EM). The team evaluated alternatives to replace the facility and developed a conceptual plan for the Physical Sciences Facility (PSF) as part of a larger project, the Capability Replacement Laboratory (CRL).

Description

The PSF is located in Richland, Washington, at PNNL. The PSF was part of a larger effort to modernize over one-third of PNNL's facilities through the CRL project, which began in 2004. The CRL consisted of three facility complexes: the PSF, the Biological Sciences Facility, and the Computational Sciences Facility. The PSF project, completed in 2011, comprised over 250,000 gross square feet in five laboratory buildings and upgraded existing nuclear and radiological capabilities and functions (Table G-2).

Goals and Objectives

The main goals of the PSF and the CRL were to preserve the research-mission-critical capabilities threatened by the facility disposition and remedial action clean-up of the Hanford Site 300 area. The CRL provided the necessary infrastructure to relocate existing capabilities at PNNL, including people and equipment. Other main objectives of the project were to complete the replacement facilities by the end of FY 2011 and minimize disruptions to ongoing DOE and other research programs.

Table G-2. Buildings, Capabilities, and Functions at the Physical Sciences Facility at Pacific Northwest National Laboratory

Building	Capabilities and Functions
Materials Science and Technology Laboratory	Develop and test high-performance materials in next-generation energy, construction, and transportation systems. Researchers work with metals, ceramics, polymeric materials, composites, specialized coatings, and surface treatments.
Radiation Detection Laboratory Ultra-Trace Laboratory	Develop and apply radiation detection methods for identifying weapons of mass destruction and terrorist activities and in support of international treaties and agreements.
Large Detector Laboratory	Develop and test radiation detection technologies to be deployed at U.S. borders and ports of entry.
Deep Laboratory	Support national and homeland security missions such as developing and advancing radiation detection technologies. Located 40 feet below grade with a 20 feet overburden above grade.
Radiochemical Processing Laboratory (Building 325) Life Extension	Extend the useful life to accommodate radiochemical processing. Construct and install nuclear facility hot cells and glove boxes for materials examination, develop seismic upgrades to the building, develop nuclear authorization basis, and conduct operational readiness assessment for this existing Hazard Category II Non-Reactor Nuclear Facility.

Source: PNNL (2010).

Funding Process

The PSF was jointly funded by the DOE-SC, the NNSA, and the DHS. The partners established a funding strategy for cost sharing over the expected project life cycle (from FY 2007 to FY 2011) through a memorandum of understanding (MOU), which was approved by the Under Secretaries for each agency. The MOU outlines how the DOE-SC would manage the project and cover any additional funding growth to the project (DOE 2006c).

The total project cost of the CRL included $224 million for the PSF from the three agencies. The project also included PNNL overhead funding to update existing infrastructure and transition staff into the new buildings, as well as additional State and private financing to expand PNNL's utilities infrastructure (Table G-3). The CRL depended on the approval of line items in two separate Federal agency budgets funded through two appropriations bills and coordinated through three Office of Management and Budget (OMB) examiners.[1] The budget examiners coordinated this work with assistance from staff in the DOE-SC.

[1] The Energy and Water Development and Related Agencies Appropriations Bill for DOE Office of Science and the National Nuclear Security Administration and the Homeland Security Appropriations Bill for the Department of Homeland Security.

Table G-3. Partners and Cost Share for the Capabilities Replacement Laboratory Project, including the Physical Sciences Facility at Pacific Northwest National Laboratory

Facility Projects/ Partners	Total Cost Share (thousands)
Physical Sciences Facility Design and Construction	**$224,000***
Department of Energy Office of Science	$98,444
National Nuclear Security Administration	$69,623
Department of Homeland Security	$55,934
Biological Sciences Facility and Computational Sciences Facility	**$77,500**
Cowperwood Company	$77,500
Supportive Infrastructure or Utilities	**$17,000**
Department of Energy Office of Environmental Management	$12,000
State of Washington	$5,000
Renovation of Existing Buildings	**$7,700**
Pacific Northwest National Laboratory	$7,700†
Relocation and Staff Transition	**$28,800**
Pacific Northwest National Laboratory	$28,800†
Total	**$355,000**

Source: Department of Energy (2006c).

* Not exact sum due to rounding.

† PNNL overhead funding was used for renovating some of the buildings for the life extension program.

As part of the larger CRL project, the PSF was planned and funded alongside the other facilities. The CRL underwent the DOE's program and project management process for the acquisition of capital assets.[2] This process includes requirements for approvals of the design, construction, commissioning, operations, and transition of the new facilities. The approvals also involved only one OMB examiner since the project was considered solely a DOE project.

Due to the complexity of funding sources and the scope of the CRL, the DOE Deputy Secretary designated the CRL as a Major Project (typically, projects over $750 million). In all Major Projects, the Deputy Secretary serves as the acquisition executive responsible for final approval of capital asset projects and funding profiles.[3]

Management and Organization

As the lead agency on the CRL, the DOE-SC designated a program manager at its headquarters and a Federal project director at the PNNL Site Office in Washington. The program manager, who was the main liaison between the Federal partners, reported directly to the acquisition executive. The Federal project director was a full-time staff

[2] See DOE Order 413.3B (DOE 2010), which canceled the previous DOE Order 413.3A (DOE 2006b) on November 29, 2010.

[3] Once the preliminary design is approved, the acquisition executive's authority is delegated to the Under Secretary for Science.

member in charge of executing the project, with the support of an integrated project team. The integrated project team comprised representatives of the partner agencies as well as other Federal and contractor staff working on the project on a daily basis or at least half-time. PNNL is managed by Battelle Memorial Institute, a management and operating contractor for the DOE. Battelle provided a contractor project director and staff for technical support and oversight of the design through the start-up of the facility.

Unique Aspects

Several unique aspects of the PSF project are related to its funding strategy and project implementation:

- *Joint Federal funding for the construction of an entire facility and multiple buildings*: Although there are various instances of joint Federal funding for supportive infrastructure and maintenance services for a facility, it is much rarer to jointly fund the design and construction at the scale of the PSF project. In fact, other than co-funding of large instrumentation in user facilities, co-funding in a single facility did not occur in any of the other examples the study team identified.
- *Timely and efficient project implementation*: Despite having to coordinate multiple funding sources and uncertainties across annual appropriations, the PSF project was completed on time and within budget.
- *Recognition for project implementation*: The project was recognized by the DOE and given an Award of Excellence for its management and implementation. Some of the areas that were recognized were zero lost workdays or accidents, an innovative funding strategy, and a collaborative project management team. In 2011, the project was a finalist for the Project of the Year Award by the Project Management Institute, a nonprofit association for project-management professionals.[4]

Barriers

Complex Coordination of Multiple Funding Sources and Partners

The CRL project brought together financing from three agencies, State partners, and private organizations. The DOE-SC coordinated the activities of all these stakeholders and was responsible for updating agencies' leadership, Congress, and the OMB.

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[4] For information about PMI's Project of the Year Award, see http://www.pmi.org/About-Us/Our-Professional-Awards/Project-of-the-Year-Award.aspx.

Coordination with the OMB examiners to establish the business case for the private financing aspects was also a lengthy process. The alternative financing proposal was critical to the overall project. In its preliminary review, the OMB concluded that the initial proposal did not meet the alternative financing criteria. At the time, the DOE did not outline the specific tenant improvements that would be required for the laboratories above and beyond those of a traditional building. Interviewees felt that a contributing factor to this misunderstanding was the lack of clear, documented Federal guidance on third-party project financing. The DOE and PNNL liaised with the program examiner for about 1 year to settle on the costs of tenant improvements that would be necessary to meet researcher needs. Multiple OMB staff were involved in the discussions, some from offices that did not appear to be relevant for the proposal under review.

Funding Uncertainties throughout the Project's Implementation

The OMB made PSF funding dependent on its approval of the third-party financing of the other two facilities in the CRL. Although private financing was not a part of the funding for the PSF, it was critical for the project to move forward since the DOE developed the CRL as one project. Thus, private financing approval was necessary to receive initial agency approval of the mission need in the DOE's capital acquisition process.

Moreover, the partnership faced funding uncertainties due to annual budget cycles and agency, legislative, and executive-level approvals throughout the project. Even though each agency's leadership championed the PSF project and formalized its commitments through a MOU, approval of each agency's budgets had to be justified annually. For example, In FY 2006, the project faced a major obstacle when the DHS rescinded its funding commitment for that year, mainly because of broader budgetary issues the agency was facing at the time.

Lessons Learned and Strategies

Partnership Formation

Selecting a Lead Managing Agency

The formation of the PSF partnership was driven by the DOE-SC and the need to replace existing research capabilities at PNNL in a timely fashion. PNNL sought Federal partners with existing interests in the facilities to develop the plan for the replacement laboratories. The partners agreed a single agency should manage the project. DOE-SC was chosen because the replacement facilities were located at PNNL, a DOE-SC laboratory, and the DOE has an established project management process. The DOE-SC also conducts a sophisticated review method to ensure projects are well executed and any deficiencies in performance are resolved quickly.[5] Since the DOE-SC had the overall responsibility of managing the project, the DOE was responsible for any cost overruns. This provided the DOE staff an incentive to manage the project on schedule and within budget; the project did not incur any additional expenses.

Since the project was managed by a single agency, the other Federal partners did not need to approve related acquisitions, but partners did participate in the acquisition reviews. The partners transferred funds to the DOE based on their cost share commitments. These annual line items were also approved by agency leadership and the OMB.

Defining Core Capabilities for the New Facilities

In September 2004, the DOE Deputy Secretary approved the justification of the mission need as the first stage of the approval process for the CRL. To then define the project's conceptual design, the DOE-SC and DOE-EM, the NNSA, and the DHS convened a workshop in 2005. Workshop participants identified the capabilities that were critical to their respective missions, starting with those at existing PNNL facilities on the Hanford 300 site. Core capabilities were research areas that were necessary and essential for performing the agency's work. This outline of primary interests for each partner was used to identify the capabilities that would eventually be housed in the CRL and the PSF. This process involved multiple iterations and discussions regarding what capabilities would be moved into the new facilities and housed in existing but renovated facilities.

Note that the Mission Need Statement for the CRL project called for all 300 Area buildings to be demolished and PNNL to find replacement space for all the capabilities. This decision was driven by the DOE-EM. The partners realized the office was unlikely to secure funding to replace all the laboratories, so certain existing laboratories would need to be retained. The DOE-SC reviewed three PNNL buildings proposed for retention and agreed to maintain select buildings through an MOU with the DOE-EM. In addition, not all capabilities were identified as core by the partners, and some were not included in the definition for the replacement facilities. Identifying core capabilities took several months, and partner discussions to decide which capabilities to keep took over a year.

Having each agency identify and define the capabilities of the CRL brought commitment from the partners, who could see how critical their contribution would be to the success of the project. Project decisions were ultimately based on this outline of core capabilities.

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[5] The Department of Energy Office of Science implements a project peer-review and evaluation procedure, known as the "Lehman Review" after Daniel Lehman, the Director of the Department of Energy's Office of Project Assessment.

Forming an Interagency Integrated Project Team

The DOE-SC formed an interagency integrated projects team with participation from all partners to coordinate and provide documentation necessary throughout the DOE's facility acquisition process,. The integrated project team streamlined coordination and encouraged timely communication among the partners.

Project Planning

Identifying and Formalizing Cost Shares

The individual agency commitments for the PSF were based on the costs of each agency's share of the space to support the core capabilities identified at the 2005 workshop. In developing the cost shares, the partners considered how many of the PNNL mission-critical capabilities were core to their interests and how much corresponding square feet was required. The cost shares were formalized through an MOU. Interviewees said that once the MOU was signed, each of the partners had an incentive to provide its committed funds and keep the project moving on schedule.

Planning for Contingencies Using Risk-Based Analysis

Interviewees stated contingency planning was key to the project's success. The project management team identified costs, schedule, a firm completion date, and contingencies based on risks to the project. Contingency analysis included the probability and severity of various risks. Mitigation strategies for these risks were incorporated into the project's baseline budget and schedule, and they were documented in a risk-management plan. Of the PSF's total project cost of $224 million, contingencies made up more than 20 percent (about $50 million). A schedule contingency of 5 months was also incorporated into the project. Contingencies were based on risk assessment at the level of individual work elements, or elements describing the technical scope of the project, such as project management, construction, and operational start-up, among other functions (Table G-4 shows select examples of planned contingencies in four example areas).

During the course of the project, the baseline cost estimate for a construction contract was over budget by $28 million (PNNL 2011). This was due to receiving only one contractor bid and market conditions for the work at the time. To address this, a series of value-engineering reviews were undertaken to reduce the cost of the proposed work.

Table G-4. Select Examples of Planned Contingencies for the Development of the Physical Sciences Facility at the Pacific Northwest National Laboratory

Description	Percent	Risk Assessment		Contingency ($ million)	Comments/Rationale
		Cost	Schedule		
Project management and oversight	10%	Low	Low	$1.2	Project management costs are well established
Design	15%	Moderate	Low	$3.0	Contract negotiations nearing completion for PSF Will be reduced based on scope reduction
Construction	30%	Moderate	Moderate	$26.5	Largely standard construction. Increased risk for radiological facilities
Operational start-up	30%	High	Moderate	$1.5	—

Note: Modified from DOE (2006a).

Incorporating Agency Feedback to Establish an Organizational Structure and Project Execution Plan

The authority and responsibility for managing the project resided within the DOE; the organizational structure had managers from the DOE's headquarters, the PNNL site office, and PNNL laboratory staff. Partner agencies were included in planning through the integrated project management team and regularly updated on progress at meetings and reviews.

The project management team developed a project execution plan in 2007 that defined the organization and responsibilities of individuals managing the project. The plan described internal interfaces (e.g., site office, PNNL, and project management team) and external interfaces (e.g., Federal partners, State of Washington, City of Richland) that would occur throughout the project. All three Federal agency partners reviewed and approved the project execution plan.

Galvanizing Support from Agency Leadership and Other Stakeholders

The PSF project drew the attention of leadership across the partner agencies as well as Congress. Interviewees attributed the efficient project management to the project's high visibility and the continued commitment from leadership across the partnering agencies. This led to increased pressures and support for the project. Communication with other stakeholders occurred frequently (e.g., briefings with congressional staff and annual reports to the OMB). Some interviewees would have preferred the OMB to be more engaged throughout the planning stages and to provide further guidance on the alternative financing components of the project.

Communicating with Multi-Agency Research Staff on Design

Communication with research staff at the existing PNNL facilities was crucial to the design and requirements of the PSF. To assist with the technical requirements needed for the PSF, the project management team and partners identified the facility users early in the design process. Program managers from the DHS research programs provided input into the requirements. During the procurement and construction phases of the project, the project management team also held follow-up meetings with research staff. These were particularly useful for communicating any necessary design changes. Project managers used multiple methods of communicating progress to the partner agencies and the public, including fact sheets, newsletters, online videos, and blogs.

Project Implementation

Working through Funding Uncertainties

The PSF's progress depended on approvals for the private financing proposal because third-party financing was a critical part of the CRL project. The DOE implemented best management practices for third-party financing. These practices were identified by examining third-party financing projects at the Argonne National Laboratory and the Oak Ridge National Laboratory. As a result, two practices proved useful in facilitating the partnership:

- Ensure that the agency proposal involves and represents the viewpoints of other offices in the DOE, such as the procurement executive, general counsel, and the chief financial officer, in addition to those of the Office of Science.
- Have a headquarters program manager dedicated to the business case review and approval by the OMB.

When the OMB initially reviewed the CRL proposal, it did not recommend going forward with the project based on the business case presented. PNNL hired a consultant with close knowledge of private sector transactions. The consultant began liaising with the OMB examiner to resolve any questions and work through the business case. There were two main concerns:

- How tenant improvements were applied to properly compare costs for the fair market value of the facility.

- How the criteria language for assessing third-party financing projects was revised, specifically the fair market value of the facility, and the impact on interpreting this revision.[6]

The DOE was able to resubmit the proposal and include additional information to place the project in context with the agency's priorities. The agency also outlined specific aspects of the business case and obtained OMB approval. The third-party business case approval process resulted in minimal delays for the CRL.

In FY 2006, DHS rescinded its funding commitment for that year, mainly because of broader budgetary issues the agency was facing at the time. The DOE was able to reallocate funding from the other partners to cover the DHS's cost share for that year. To avoid this uncertainty in future years, the DOE and PNNL staff worked with the DHS and Congress to receive DHS's share for the remaining years of the project in the following year.

Integrating Innovative Alternatives and Other Partners to Finance Components of the Project

The CRL project was financed using a mix of Federal funds among various agencies, private funds, and State funds. Though including multiple stakeholders complicated coordination of funding and agreements, interviewees felt that the innovative use of alternative financing was critical to the success of the overall project. In particular, the approval of third-party financing of other facility complexes in the CRL project made it possible to proceed with the PSF partnership.

Using the Interagency Integrated Project Team to Support Execution

The integrated project team worked during planning and also throughout the implementation of the project. Team members varied at different phases based on the functions and expertise necessary to manage the project. Because the integrated project team included all three of the partners and the Federal project director, if there was an issue or work was not progressing according to the project management team's expectations, it would be documented and quickly resolved.

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[6] According to Office of Management and Budget (OMB) Circular No. A–11 (OMB 2012), the following criteria are used to distinguish lease purchases and capital leases from operating leases:

- Ownership of the asset remains with the lessor during the term of the lease and is not transferred to the Government at or shortly after the end of the lease period.
- The lease does not contain a bargain-price purchase option.
- The lease term does not exceed 75 percent of the estimated economic lifetime of the asset.
- 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 inception of the lease.
- The asset is a general purpose asset rather than being for a special purpose of the Government and is not built to unique specification for the Government as lessee.
- There is a private-sector market for the asset.

Partners also reviewed and provided feedback on any design changes through the integrated project team. According to interviewees, construction contractor change-order proposals were addressed in a timely manner and the process was well managed. The project management team did recognize, however, that it could have communicated feedback to the construction contractors more frequently to better understand change-order proposals and resolve them more quickly.

The partners coordinated with each other through the integrated project team, and members of the integrated project team frequently communicated with each other. Formal communication included monthly meetings and annual on-site project reviews, but partners could be reached on a day-to-day basis if necessary.

Documenting Lessons Learned

At the completion of the PSF project, a lessons-learned report was prepared, distributed, and recorded in the project records. The lessons-learned report was provided to the project management team and agency partners in the hope that the document could address issues that may be relevant to future facility acquisition and renovation projects.

Maintenance and Operation

Incorporating Participation and Feedback from Partners in Performance Evaluations

The DOE performs annual evaluations for all of its laboratories. The CRL project was assessed as part of PNNL’s performance evaluation and measurement plan, which identified agreed-on objectives for projects. The performance metrics are aligned to eight goals, including facilities and infrastructure management. For the PSF, the partners participate in this evaluation process by providing feedback on the facility management. The DHS’s Office of National Laboratories coordinates feedback from the department’s research programs related to the performance of the work at the laboratory. The DOE site office at PNNL also sought input from NNSA, integrating all feedback into its overall performance evaluation.

Benefits and Outcomes

Research-Based

The PSF project successfully preserved the core mission-critical research capabilities at PNNL for multiple Federal agencies.

Non-Research-Based

The DOE staff agreed that the PSF could not have been built without the participation and committed funding from partnering agencies. It is unlikely the PSF would have been approved if it was funded solely by the DOE-SC. Though multi-agency funding can increase the overall resources devoted to a project, it may lead to more uncertainty. Securing funding from all the partners is more difficult in a multi-agency project than in a single-agency-funded project. The PSF partners addressed this challenge when DHS could not provide funding in FY 2006 by redistributing the commitment to the other partners. In subsequent years, DHS made up the loss. Agencies should therefore think carefully about the risks of relying on funding from multiple agencies.

Policy Suggestions

Interviews with DOE and PNNL staff highlighted several policy suggestions that could improve the development and implementation of future Federal partnerships for facilities and infrastructure:

- *Agencies could enhance policies on alternative financing.* Alternative financing was one aspect of the funding sources for the CRL. Agency policies could provide clearer guidance regarding the use and appropriateness of alternative financing. Agencies could also encourage alternative financing as one of many options Federal partnerships could pursue when planning for future Federal facility needs.
- *Agencies could develop a policy on joint-Federal funding practices.* Interviewees would have preferred agency leadership to issue guidance, such as models for interagency partnership agreements or lessons learned from past Federal partnerships. This guidance could also include ways to consider uncertainties and risks when developing a partnership, particularly those where costs to construct an entire facility are shared among one or more agencies.
- *Agencies could provide guidance on the roles and responsibilities of partners.* For example, to facilitate effective communication among the partners, agencies could provide guidance on designating responsibilities across Federal partners and management staff.
- *Agencies could encourage and seek out the OMB's involvement early in the project-planning process.* Interviewees felt that participation from the OMB staff was limited to providing an audit-like function to the project. Interviewees would have preferred the OMB to have greater involvement to guide the project management. They believed that doing so would have resolved funding approval issues. On the other hand, agencies should involve their examiners to better

ensure that they have sufficient validation of the costs for their projects before submitting their proposals to the OMB.

- *Agencies and laboratory staff could initiate innovative mechanisms to obtain line-item funding up front.* Funding uncertainties are present when allocating budgets for projects over multiple years. This makes the partnership process more tenuous. To decrease funding uncertainties, the partners worked with Congress to secure future line-item funding commitments earlier than planned in the MOU and budget requests. When funding challenges threaten the progress of a project, agencies and laboratory staff could initiate a similar mechanism to obtain funding up front.

Appendix H.
Additional Federal Partnerships

Table H-1. Additional Federal Partnerships for Facilities, Infrastructure, and Large Instrumentation

Name of Facility	Type of Partnership	Federal Partners	Website
Academic Research Fleet	Co-funding of large instrumentation	DOD-Navy and NSF	http://www.unols.org/
Joint-Use Intelligence Analysis Facility	Not clear	DOD-Army and Intelligence Community/ODNI	http://www.dia.mil/public-affairs/releases/2008-08-12.html
Large Hadron Collider	Co-funding of large instrumentation	DOE and NSF	http://atlas.ch
National Infrastructure Simulation and Analysis Center	Co-funding of a single facility	DHS and NNSA	http://www.sandia.gov/nisac/
NIST-Boulder Laboratories	Co-location; Co-operation and integration of management and operations	NIST and NOAA	http://www.boulder.doc.gov/
Pike's Peak Research Laboratory	Co-operation and integration of management and operations	DOD-Army and USDA	http://www.usariem.army.mil/index.cfm/about/locations/offsite
Plum Island Animal Disease Center	Co-funding a single facility	DHS and USDA	http://www.ars.usda.gov/AboutUs/AboutUs.htm?modecode=19-40-00-00
Sample Receipt Facility/ Chemical Evidence Forensic Examination Facility	Co-funding of a single facility	DHS, DOD-Army, FBI	https://www.ecbc.army.mil/ip/fs/Fact%20Sheet_SRF_30%20Mar%2010.pdf
Stanford Synchrotron Radiation Laboratory	Co-funding of large instrumentation	DOE-SC, BNL, and NIH, among others	http://www.bnl.gov/ps http://www-ssrl.slac.stanford.edu

References

Archibald, D. 2012. "USAG Participation in the NICBR."

Ball, J. E. 2004. "Fort Detrick Briefing: Society of American Military Engineers." October 21.

BioSync. 2002. "Biological Applications of Synchrotron Radiation: An Evaluation of the State of the Field in 2002." http://www-ssrl.slac.stanford.edu/content/sites/default/files/documents/biosync-report-2002.pdf.

Brookhaven National Laboratory (BNL). 2006a. "Conceptual Design Report." http://www.bnl.gov/nsls2/project/CDR/NSLS-II_Conceptual_Design_Report.pdf.

______.2006b. "NY State Supports Joint Photon Sciences Institute at BNL." http://www.bnl.gov/newsroom/news.php?a=1470.

______.2008. "NSLS & NSLS-II Scientific Strategic Planning Workshop Summary, Life Sciences." http://www.bnl.gov/nsls2/sciOps/LifeSci/docs/pdf/Jan2008-LifeScienceSSP.pdf.

______.2009. "Light Source Directorate Strategic Plan." December. http://www.bnl.gov/ls/docs/LS_Strategic_Plan_12-09.pdf.

______.2011. "Draft User Access & Instrument Development: Partnerships at Major User Facilities." http://www.bnl.gov/nsls2/docs/pdf/UserAccessPolicy.pdf.

______.2011. "NSLS-II Beamline Development Policy." http://www.bnl.gov/nsls2/docs/PDF/NSLS-II_Beamline_Development_Policy.pdf.

______.2012. "New Light Source Construction More Than 70 Percent Complete." http://www.bnl.gov/newsroom/news.php?a=11409.

Department of Energy (DOE). 2006a. "CRL Revised Options Analysis." Received from DOE Office of Science.

______.2006b. "DOE O 413.3A: Program and Project Management for the Acquisition of Capital Assets." https://www.directives.doe.gov/directives/0413.3-BOrder-a/view.

______.2006c. "Memorandum for the Deputy Secretary, Approval of Revised Alternative Selection and Cost Range for the Capability Replacement Laboratory (CRL) Project at Pacific Northwest National Laboratory (PNNL)." Received from PNNL staff.

______.2010. "DOE O 413.3B: Program and Project Management for the Acquisition of Capital Assets." https://www.directives.doe.gov/directives/0413.3-BOrder-b/view.

Fort Detrick. 2012. "An Interagency Confederation." *The Standard.* January 19. http://www.detrick.army.mil/standard/entry.cfm?entry_id=ABA5D9E5-AEC8-4369-7E9CD208A1067C96.

General Services Administration (GSA). 2012. "The Special Order Program: MIPR Guidance." http://www.gsa.gov/graphics/fas/12-00316_MIPRGuidance_final508.pdf.

Hollings Marine Laboratory (HML). 2012. "Annual Report." http://coastalscience.noaa.gov/about/docs/HML%202012%20Annual%20Report.pdf.

______.Undated. "Summary of Joint Project Agreement." Received from HML on January 23, 2013.

National Research Council (NRC). 1999. *Cooperative Stewardship: Managing the Nation's Multidisciplinary User Facilities for Research with Synchrotron Radiation, Neutrons, and High Magnetic Fields*. Washington, D.C.: National Academies Press. http://nsf.gov/attachments/122291/public/coop_stewardship.pdf.

______.2012. *Evaluation of the Lovell Federal Health Care Center Merger: Findings, Conclusions, and Recommendations*. Washington, D.C.: National Academies Press.

National Institutes of Health (NIH). 2009. "Workshop of the National Institutes of Health National Center for Research Resources and the National Institute of General Medical Sciences on Plans for Support of Future Life Science Synchrotron Research at NSLS-II." NIH NSLS-II Panel Report. June 4–5. http://www.bnl.gov/nsls2/sciOps/LifeSci/docs/pdf/June2009-NCRR-NIGMS-NSLS-IIMeeting-report.pdf.

National Interagency Confederation for Biological Research (NICBR). 2003. "Constitution for the Coordination of Interactions among Medical Research Organizations Colocated at Fort Detrick, Maryland."

NICBR National Partnership Office (NPO). 2010. "Draft Charter." Received from NPO staff. Office of Management and Budget (OMB). 2012. "Circular No. A–11, Preparation, Submission, and Execution of the Budget." http://www.whitehouse.gov/sites/default/files/omb/assets/a11_current_year/a_11_2012.pdf.

Pacific Northwest National Laboratory (PNNL). 2010. "Physical Science Facility." PNNL brochure. http://www.pnnl.gov/rcf/pdf/PSF_Trifold.pdf.

______. 2011. "Capability Replacement Laboratory: Physical Sciences Facility Initial Project Closeout Report." Received from PNNL staff.

Parks, D. 2012. "NOAA Signs CRADA with Biosortia Pharmaceuticals." http://techpartnerships.noaa.gov/TechPartnershipsHome/tabid/225/CategoryID/49/CategoryName/CRADA/PID/1272/global/yes/Default.aspx. .

Public Law 111-84. 2009. National Defense Authorization Act for Fiscal Year 2010. http://www.intelligence.senate.gov/pdfs/military_act_2009.pdf.

Sandifer, P. A., Becker, P. R, Burnett, L. E., Frederick Holland, A., Lacy, E. R., Scott, G. I., Van Dolah, R. F. 2005. "The Hollings Marine Laboratory: A New Model for Government-Academic Partnering." Proceedings of the 14th Biennial Coastal Zone

Conference, New Orleans, Louisiana, July 17 to 21. http://www.csc.noaa.gov/cz/CZ05_Proceedings/pdf%20files/posters/Sandifer.pdf.

Shea, D. 2007. "The National Biodefense Analysis and Countermeasures Center: Issues for Congress." Washington, D.C.: Congressional Research Service.

Abbreviations

ARS	Agricultural Research Service
BER	Office of Biological and Environmental Research
BES	Office of Basic Energy Sciences
BNL	Brookhaven National Laboratory
BSL-3	Biosafety Level 3
BOD	Board of Directors
BRAC	Base Closure and Realignment Commission
CCEHBR	Center for Environmental Health and Biomolecular Research
CRADA	Cooperative Research and Development Agreement
CDC	Centers for Disease Control and Prevention
CRL	Capability Replacement Laboratory
CUP	Central Utility Plant
DAWG	Defense Advisory Working Group
DOD	Department of Defense
DOE	Department of Energy
DOE-EM	Department of Energy, Office of Environmental Management
DOE-SC	Department of Energy, Office of Science
DHS	Department of Homeland Security
ESC	Executive Steering Committee
EUL	Enhanced Use Lease
F&I	Facilities and Infrastructure
FDA	Food and Drug Administration
FDICC	Fort Detrick Interagency Coordinating Committee
FHCC	Federal Health Care Center
FI&I	facilities, infrastructure and instrumentation
FY	fiscal year
HHS	Department of Health and Human Services
HML	Hollings Marine Laboratory
IPT	Integrated Process Team
IRF	Integrated Research Facility
IT	information technology
MILCON	Military Construction
MOA	memorandum of agreement
MOU	memorandum of understanding
NBACC	National Biodefense Analysis and Countermeasures Center
NCCOS	National Centers for Coastal Ocean Science
NCI	National Cancer Institute

NIAID	National Institute of Allergy and Infectious Diseases
NIBC	National Interagency Biodefense Campus
NICBR	National Interagency Confederation for Biological Research
NIGMS	National Institute of General Medical Sciences
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NMRC	Naval Medical Research Center
NNSA	National Nuclear Security Administration
NOAA	National Oceanic and Atmospheric Administration
NPO	NICBR Partnership Office
NSLS	National Synchrotron Light Source
OMB	Office of Management and Budget
OSTP	Office of Science and Technology Policy
PNNL	Pacific Northwest National Laboratory
PRT	Participating Research Team
PSF	Physical Sciences Facility
SCDNR	South Carolina Department of Natural Resources
SRM	standard reference material
STPI	Science and Technology Policy Institute
USAMRIID	U.S. Army Medical Research Institute of Infectious Diseases
USAMRMC	U.S. Army Medical Research and Materiel Command
USDA	Department of Agriculture
VA	Department of Veterans Affairs

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14. ABSTRACT
Federal partnerships revitalize Federal laboratory facilities, infrastructure, and large instrumentation by pooling resources across Federal laboratories, departments, and agencies to fund a project of shared interest. In the process, such partnerships bring about scientific collaboration and enhance research capabilities. STPI identified existing Federal partnerships for facilities, infrastructure, and large instrumentation and conducted a handful of in-depth case studies. The goal was to identify motivations for, barriers to, and strategies of partnerships to provide guidance or models for those wishing to form them. Despite evidence of forward progress, challenges remain, both for current and new partnerships. Implementing the policy suggestions outlined through executive or legislative action, interagency coordination, and agency and laboratory policy and guidance could help further streamline and facilitate Federal laboratory facilities, infrastructure, and large instrumentation partnerships.

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