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NATIONAL DEFENSE RESEARCH INSTITUTE

Obtaining Life-Cycle Cost-Effective Facilities in the Department of Defense

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Summary

The Department of Defense (DoD) routinely constructs, operates, and maintains a large number of facilities, such as barracks, hangars, and administrative buildings. In fiscal year (FY) 2013, DoD will spend nearly \$10 billion constructing new facilities, and about the same amount or more operating and maintaining existing facilities. These outlays represent different components of life-cycle costs, which include those for initial construction, as well as the energy and water, operations, maintenance, repair, and replacement costs that occur over different time periods in a facility's life. By focusing on reducing the life-cycle costs of its facilities, DoD can minimize its total cost of facility ownership. Accordingly, DoD incorporates life-cycle cost-effective practices into many aspects of the military planning and construction processes.

Congress has expressed concern that DoD construction methods may not obtain the most life-cycle cost-effective facilities. Consequently, it requested that DoD conduct an independent assessment of construction techniques that provide life-cycle cost-effective facilities. The Office of the Deputy Undersecretary of Defense for Installations and Environment (ODUSD[I&E]) in turn engaged RAND to help characterize the DoD process of obtaining life-cycle cost-effective facilities.

The ODUSD(I&E) asked RAND to characterize any process issues in the programming, planning, design, budgeting, acquisition, construction operation, maintenance, or decommissioning of military construction (MILCON) projects that inhibit life-cycle cost-effective projects. This report provides RAND's description and assessment of the process used to obtain life-cycle cost-effective facilities and how that affects DoD construction options and choices. The focus of our work is the *process*, including how the incentives and barriers of various actors involved affect the overall objective of obtaining life-cycle cost-effective facilities.

Our research approach featured structured interviews with more than 30 individuals with varying roles and perspectives on the MILCON and facility sustainment processes. Altogether, we spoke with personnel from various offices within the DoD construction agent organizations who are responsible for assisting with proposed projects and executing construction, with users and maintainers of installations, and with service headquarters decisionmakers. We also spoke with private-sector construction

and facilities managers. Finally, we reviewed MILCON protocols, policies, documents, and contracts to characterize the process of obtaining life-cycle cost-effective facilities.

The life cycle of a DoD facility generally consists of planning, programming, design, construction, operation, maintenance, renovation, and decommissioning. To determine the possible barriers to obtaining life-cycle cost-effective facilities, we first had to characterize the major steps in obtaining and operating DoD facilities that influence costs. We discerned eight steps in a facility’s life cycle at which barriers to life-cycle cost-effectiveness might arise, shown in Figure S.1.

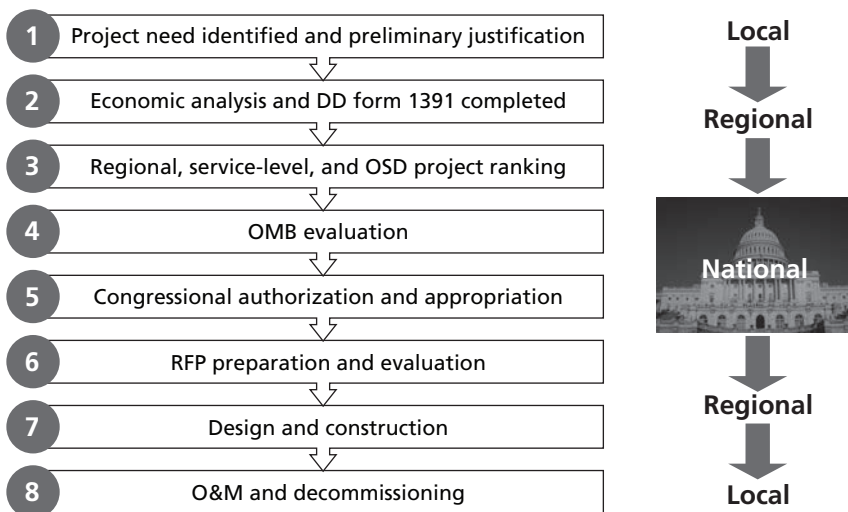
At each step of the MILCON process, there are different entities, roles, incentives, and barriers to obtaining life-cycle cost-effective facilities. Aligning the incentives of these various entities, and removing funding, information, timing, and resource barriers, would enable DoD to obtain facilities that are more life-cycle cost-effective.

Key Findings

DoD Is Currently Incorporating Life-Cycle Cost-Effectiveness Practices in Many Aspects of the MILCON Process

DoD, through its written design and acquisition policies and subsequent actions in the MILCON process, is currently incorporating many aspects of life-cycle cost-effectiveness into the process. We found that DoD is conducting life-cycle cost analysis when choosing from the preliminary options of new construction, existing facility renovation, or facility leasing. The outcome of this analysis, which occurs early in the

Figure S.1
Major Steps in Obtaining and Operating Department of Defense Facilities



MILCON process, relies on the expertise of the personnel conducting the estimate and the quality of assumptions and data used. Once an option is selected, we also found that there is clear guidance on selecting life-cycle cost-effective building systems, including energy; heating, ventilation, and air conditioning; and plumbing. Life-cycle cost decisionmaking procedures on these systems are provided by Unified Facility Criteria and Unified Facility Guide Specifications documents, and other design guidelines and performance specifications, which apply to contractors designing and constructing facilities. DoD seeks to use Energy Star products or those certified by the Department of Energy's Federal Energy Management Program in construction, which would reduce utility costs. In addition, applicable facilities are constructed to Leadership in Energy and Environmental Design (LEED) Silver facility ratings, with DoD emphasizing to contractors the importance of the energy-savings aspects of these ratings. While these actions address a critical aspect of providing life-cycle cost-effective facilities, challenges and opportunities in the process remain.

Information, Funding, and Organizational Issues Create Barriers to Life-Cycle Cost-Effectiveness for Facilities

We found that several funding and organizational barriers across the institution create challenges in obtaining life-cycle cost-effective facilities. Over the life cycle of a facility, funding is required from three primary sources. New facility design and construction funding is overwhelmingly provided by congressional authorization and appropriation of MILCON projects. Funding for facility maintenance and reinvestment is largely provided by the Sustainment, Restoration, and Modernization (SRM) accounts of the DoD budget. Facility operations funding is generally provided by Base Operations Support or other similar accounts in the DoD budget. In addition, several entities are responsible for separate phases of a facility's life cycle, each with their own incentives and measures of success that together may not align with obtaining life-cycle cost-effective facilities. Meeting mission requirements at the best value to the government through the MILCON program involves maximizing the effectiveness of capital construction expenditures, often through finding ways to provide facilities for lower initial costs. However, decisions regarding facility elements and systems made during the planning, design, and construction phase ultimately affect funding requirements for operating and maintaining facilities over the facility's 25-year or greater operating life.

Finding methods to reward actors across the different funding sources with a portion of life-cycle cost savings could incentivize a greater focus on obtaining these facilities. On a broad scale, this might involve congressional action to provide MILCON, SRM, and Base Operations Support funding in one single appropriation, with the ability to reprogram and optimize funding between these functions. On a more limited scale, Congress and DoD could analyze the life-cycle cost outcomes of the current very limited amounts of construction undertaken with SRM funding to examine if outcomes differ from MILCON programing.

Finally, aligning incentives during the operations and maintenance (O&M) phase of the facility life cycle can reduce costs. If installations are accustomed to receiving reduced O&M funding allocations, preferences toward overdesigning facilities to reduce O&M expenditures will remain. In addition, decisions regarding facility repair, renovation, and new construction are informed through existing facility quality ratings. DoD should examine the facility quality rating system to ensure that ratings are objective and verifiable and that the incentives of the actors involved are aligned with obtaining life-cycle cost-effective facilities.

Requiring Contractors to Demonstrate Life-Cycle Cost-Effectiveness in Proposals Could Raise Costs and Risks Without Guaranteeing Commensurate Savings

During our interviews and review of several MILCON request for proposal (RFP) criteria, we found that life-cycle cost criteria currently play little or no explicit role in RFP evaluation criteria, with many RFPs including initial cost as a heavily weighted evaluation factor. Since contractors will deliver proposals and projects based on DoD evaluation criteria, adding life-cycle cost-effectiveness criteria to performance specifications and proposal-evaluation criteria could potentially obtain facilities that are more life-cycle cost-effective. Yet, the challenges of incorporating nonstandard RFP evaluation criteria, such as those for life-cycle cost-effectiveness, may erode any potential benefits. Nonstandard evaluation factors require consensus on how to write the requirements and evaluation criteria for consistency and objectivity in judging proposals and enforcing results, stressing limited time and resources. A DoD pilot program to include total ownership costs is planned, which, depending on complexity and costs to evaluate, could potentially assist in reducing life-cycle costs from DoD facilities.

Despite the challenges of integrating life-cycle cost-effectiveness into the design and construction process, DoD's greater emphasis on design-build construction and performance-based specifications presents an opportunity for more-integrated design of high-performance facilities. Several other U.S. government agencies have recently experimented with integrated design-build contracts for high-performance facilities and innovative incentives for energy savings, and DoD could obtain lessons learned from these experiments. These approaches, and other methods to incentivize building commissioning and verification of energy savings, may represent design and construction contracting tools available to DoD to realize a portion of promised life-cycle savings.

Improving Standards and Performance Guidelines to Include Life-Cycle Cost-Effectiveness Elements into the Planning, Design, and Construction Processes Remains an Opportunity

DoD design guidelines drive the planning, design, and construction process for the MILCON program, and enhancing these guidelines represents an opportunity to increase DoD's ability to obtain life-cycle cost-effective facilities. This allows value

engineering and life-cycle cost estimations to be performed once and diffused into designs, rather than straining design resources by performing life-cycle cost estimations for each project.

Opportunities to institutionalize life-cycle cost analysis across the services are likely to have a greater impact than simply requiring each project to undertake this resource-intensive initiative individually. This could involve data-based life-cycle cost inputs to the Unified Facilities Criteria and Unified Facility Guide Specifications, incorporating total cost of ownership data into the project development and decision-making process, and design specialization.

Construction Materials Are Largely Dictated by Building Codes Rather than the Services

In constructing buildings and choosing materials, DoD relies on the International Building Code (IBC). The IBC is a set of minimum safety standards for construction put forth and updated periodically by the International Code Council. The IBC specifies five facility construction types based on the combustibility of building materials and other elements used. Type I and Type II facilities must use noncombustible materials, such as concrete and steel, in their construction. Type III buildings must have noncombustible materials for exterior walls but may have other materials for other elements. Type IV buildings must also use noncombustible materials for their exterior walls but may use heavy timber, a type of wood construction with specific requirements in terms of materials and construction to confer fire resistance, for their other elements. Type V buildings may use combustible elements, such as wood, for both exterior and interior elements. Much of the IBC deals with safety issues, including preventing fires and minimizing the impact of any that occur. Given these goals, the IBC limits the size of buildings, both in number of stories above ground and their square feet per story, based on their building type and usage. Adoption of the IBC means that many large DoD facility designs are automatically restricted to certain building types and materials, based on size and usage requirements.

In general, average construction costs per square foot are lower for facilities constructed with combustible materials than facilities with higher levels of fire protection. It is unclear how different types of building materials compare on life-cycle costs over the broad portfolio of DoD facilities, regions, and usage patterns. There is a need for objective data across services, rather than individual case studies, to determine the life-cycle cost-effectiveness of various building materials.

Life-Cycle Cost Benchmarking Across Services and with Comparable Institutions Can Assist Decisionmaking

In this analysis, we have characterized the process that DoD uses to obtain life-cycle cost-effective facilities and identified misaligned incentives and barriers in this process. Yet, a full analysis measuring the extent to which DoD is obtaining life-cycle

cost-effective facilities would require facility-level capital and O&M expenditures data over a time frame sufficient to understand and project cost trends. Using these data, an estimation of the impacts of different building designs, materials, and systems on life-cycle costs could be obtained. However, the collection, standardization, and analysis of these detailed data in the near term would be resource- and time-intensive for DoD. The potential magnitude and budgetary impact of the additional life-cycle cost savings are also unclear, given that constructing, operating, and maintaining facilities generally has represented about 2-4 percent of the DoD budget. Given this reality, in addition to the performance-based specifications and enhancements to life-cycle cost standard and guidelines discussed, an effort to benchmark DoD facility costs using existing available data could assist current decisionmaking, and DoD could incorporate new data as they become available. Benchmarking would include characterizing capital and O&M expenditures by facility type for a limited set of facilities, both within and across services, as well as against comparable institutional facility owners. This effort could potentially identify performance trends, maintenance expense “hot spots,” and best practices for design and construction. Benchmarking facilities against those constructed by institutional and private-sector peers could help establish performance metrics to encourage innovation in DoD’s effort to obtain life-cycle cost-effective facilities.