Starting Smart: Key Practices for Developing Scopes of Work for Facility Projects

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STARTING SMART

KEY PRACTICES FOR DEVELOPING SCOPES OF WORK FOR FACILITY PROJECTS

Authored by G. Edward Gibson, Jr., and Michael P. Pappas in conjunction with the Federal Facilities Council, Standing Committee on Organizational Performance and Management

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Executive Summary

Each year federal government agencies contract with private-sector firms for the design, construction, and renovation of facilities with a total project value in excess of $21 billion. A basis must be developed for each project prior to awarding the design contract to a private-sector firm. This basis is developed through a process called preproject planning, which includes all activities from project initiation up to but not including detailed design. These activities include organizing the planning team, evaluating and selecting options, defining the scope of the project itself (i.e., the type of facility the agency wants to build or renovate, its proposed cost, schedule, and quality), and making a decision about whether to proceed with the project. A project scope of work, also called a project definition package, is the product of a preproject planning process.

If the project does proceed, a scope of work for design is then developed to serve as the basis for advertising and awarding a contract for detailed design. The scope of work for design consists of two major parts—the contractual requirements (i.e., the services to be provided by the contractor firm, such as deliverables, format, submission deadlines) and the project scope of work developed through preproject planning. Although most federal facilities projects are successfully completed (i.e., they reasonably meet the agency's requirements and expectations), the perception is that development of the scope of work for design for these projects is challenging and in some cases poorly performed.

Based on this perception, a study was commissioned by the Federal Facilities Council (FFC) of the National Research Council to identify the elements that should be included in a scope of work for design to help ensure that the resulting facility is one that supports the fulfillment of a federal agency's program or mission. Its objectives also included identifying key practices for developing effective scopes of work for design involving new construction or major renovation projects and identifying key practices for matching the scope of work with the acquisition strategy, given a range of project delivery systems and contract methods.

The FFC Standing Committee on Organizational Performance and Management, in collaboration with other federal personnel and FFC staff, provided direction and oversight for this study. G. Edward Gibson, Jr. and Michael Pappas of the University of Texas were tasked with interviewing 25 individuals familiar with facility projects from 13 federal agencies and developing a set of findings based on a large body of related literature, the interviews, and their own experience.

Industry practitioners recognize poor definition of project scope as one of the leading reasons that projects fail to meet owners' objectives and expectations and the contractual requirements related to project cost, schedule, and operational performance. Conversely, thorough preproject planning and project scope definition provide the basis

for developing a comprehensive and effective scope of work for design. In the course of their interviews, the study authors found that the same is true for federal agencies.

CONCLUSION AND FINDINGS

In the course of this study, the authors concluded that *the key practice for developing an effective scope of work for design is to conduct a structured, consistent, and thorough preproject planning process and fully develop a project scope of work*. A series of findings that relate to this conclusion are summarized below.

Preproject planning and the development of an effective project scope of work are a *process* that must be managed by all organizations that build facilities. Findings related to this process include the following:

Finding 1: "Pockets of excellence" for the planning of federal facilities projects exist within the agencies interviewed. However, few mechanisms are in place to widely and systematically share preproject planning lessons learned and successful processes within and between agencies.

Finding 2: Different levels of effort and participant skill sets are required for different types of projects. Preproject planning efforts need to be tailored to the specific project type and its complexity.

Finding 3: The first key element of an effective preproject planning process is to ensure that the agency is pursuing the "right" project. Preproject planning should begin with good leadership, effective and appropriate involvement of key stakeholders, and a detailed determination of project requirements.

Finding 4: To adequately develop a project scope of work, significant design effort by architects, engineers, and consultants is needed to translate project requirements into a basis for detailed design. In effect, a project's scope of work provides a bridge between the operational and business needs that the facility will meet and the technical aspects of project execution.

Finding 5: Project scope verification with key stakeholders is critical. Some agencies use innovative methods to verify the project scope of work, such as planning charrettes, detailed planning checklists, and consensus scope reviews when the project design is 30- to 35-percent complete.

Finding 6: One element of an effective preproject planning process is the structured identification and management of risk. This effort is most effective when performed prior to "locking in" facility budgets and committing funds for detailed design and construction.

Finding 7: Only five of the agencies interviewed use a risk quantification tool prior to requesting detailed design funds. It appears that in many cases project scopes and budgets are locked in prior to significant efforts to define project scope.

Finding 8: Six agencies measure their performance on selected individual projects with respect to preproject planning practice usage, and nine measure project performance. However, none of the agencies interviewed indicated that they measure preproject planning, including project scope definition and team alignment practices, across their project management programs.

Finding 9: Although preproject planning appears to be done thoroughly on some federal projects, the overall planning effort is inconsistent. Most of the agencies interviewed limit their preproject planning efforts, especially relatively costly activities, to major projects.

In order for a preproject planning process to be effective, adequate resources (people, time, and money) must

be applied. The availability of resources was a recurring theme throughout almost every interview, and the following findings relate to resources:

Finding 10: Private industry experience indicates that approximately 2 to 5 percent of a project's total cost will fund a cost-effective preproject planning effort (i.e., one that results in a facility project that is on time and within budget). Only three agencies reported this level of investment.

Finding 11: Some agencies have "fenced" their preproject planning funds, whereas others use operational funds. To ensure that planning efforts do not compete with operational priorities, dedicating funds to projects and/or preproject planning appears to be a better approach than using operational funds.

Finding 12: The length of the federal budget cycle adversely affects the preproject planning process for facilities. With planning horizons of four to seven years, preproject planning requirements are often not taken seriously enough by participants because the project is not an immediate concern, and many believe that the needs will likely change over time.

Finding 13: Few agencies adequately train their staffs about industry- and organization-specific preproject planning processes. With some exceptions, federal agencies rely on experience as the main source of preproject planning expertise and provide few training programs related to planning processes.

Finding 14: The loss of preproject planning expertise continues in federal agencies as large numbers of professionals retire or leave for other reasons. Many more retirements are imminent. The situation is especially problematic for agencies that rely almost exclusively on experience, rather than structured processes, to develop project scopes of work.

Finding 15: The project manager is a key stakeholder and should be involved in the project scope development. In some cases, a project manager is assigned to a project after planning is complete. This can create serious problems with alignment of the team and the loss of project-specific knowledge.

Senior managers in the affected agencies need to be involved in addressing the issues outlined in many of these findings. Senior managers are in a position to provide leadership in supporting and implementing the following actions for improving preproject planning efforts and development of project scopes of work:

- Develop and implement a standardized preproject planning process using experienced, technically proficient personnel and provide them with adequate resources (people, time, and money). The owner organization (the federal agency) should lead the planning effort, although some tasks can be outsourced to contractors.
- Measure the level of effort expended in preproject planning, so that the outcomes of the process can be continuously improved over time.
- Develop an effective acquisition strategy and set realistic and effective project control baselines in the preproject planning process to ensure a smooth transition into the execution phase and overall project success. Without an effective execution approach, the project will likely flounder and require significant management involvement.
- Institute a standardized project scope of work communication process, including contract requirements and transition meetings, based on the agency's available project management resources, mission, and expertise.
- Ensure that the agency pursues the right projects for its strategic direction through appropriate stakeholder involvement and team alignment. Project participants' understanding of the driving factors and priorities for a project is essential if the project scope of work is to reflect critical needs.

Effective preproject planning is not a process that can be consistently incorporated throughout an entire organization in a short time frame. Full implementation of these activities requires cultural and process changes

that may take several years to achieve, but it will improve project team formation and cohesiveness, alignment of goals, and project scope definition. The outcomes will be an improved capacity to develop accurate project scopes of work, the ability to predict cost and schedule performance with greater accuracy, and, consequently, an improved capacity to develop effective contractual requirements for scopes of work for design. Ultimately, taking such actions should result in lower costs and shorter schedules for the execution of facility projects.

DEFINITIONS

Project management terminology varies widely. Several technical terms are used extensively throughout this report and are defined as follows:

Acquisition strategy—the process of evaluating and selecting a delivery system (e.g., design-bid-build, design-build, construction manager-at-risk, etc.) for a particular project.

Alignment—"the condition where appropriate project participants are working within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives" (Construction Industry Institute, 1997).

Approval gate—a step in the project development process where owner approval is required before proceeding to the next step. Synonymous with critical decision or decision point.

Conceptual planning—the American Institute of Architects (1987) calls this phase "conceptual design" and defines it as "[t]he start of the facility design process…includes preliminary project estimate, site analysis, and conceptual architectural drawings." Conceptual planning also includes the investigation and selection of alternatives regarding site and technology options.

Detailed design—the final design effort, based on a detailed definition of project scope and the production of construction documents.

Feasibility analysis—begins with project initiation and includes high-level evaluations of the mission and business needs.

Preproject planning—"the process of developing sufficient strategic information for owners to address risk and decide to commit resources to maximize the chance for a successful project" (Construction Industry Institute, 1995). Includes all activities from initiation of a project to the start of detailed design. These activities include organizing the preproject planning team, evaluating and selecting alternatives, defining the scope of the project, and making a decision on whether to proceed with the project.

Project scope of work—a description of the project that supports development of the project schedule and project cost estimate.

Scope definition—the description and development of the requirements and characteristics of a proposed project.

Scope of work for design—document that serves as the basis for advertising and awarding a contract for detailed design. It details the services to be provided by the designer (deliverables, format, submission deadlines) and the project scope of work.

Stakeholders—key individuals from functional parts of the organization who will be affected by, or have to live with, the project.

1

Introduction

If you don't know where you're going, you'll end up somewhere else.
—Yogi Berra

Each year federal government agencies contract for the design, construction, and renovation of facilities projects with total costs in excess of $21 billion. The federal budgeting process requires agencies to set requirements and priorities before submitting their budget requests to Congress. This process follows federal guidance but differs in practice for each agency. For facilities the setting of requirements begins when an individual or group (e.g., facilities program manager, senior executive, elected official) identifies the need for a program or facility, ideally based on strategic or master planning. The agency then initiates a process to gather information and validate the need for the facility relative to a program and to its mission. The requirements phase (referred to as preproject planning) includes organizing a planning team, selecting and evaluating project options, defining the scope of the project (type of facility, size, cost, quality) that would fulfill the requirements, and then making a decision on whether to proceed with the project.

If the project does proceed, the next step is to develop a document to serve as the basis for advertising and awarding a contract for detailed design. This document is typically referred to as a scope of work for design. It details the services to be provided by the contractor (deliverables, format, deadlines) and the project scope of work (i.e., the type of facility the agency wants to build or renovate, its proposed cost, schedule, and quality). There is no single, standard, governmentwide process for developing scopes of work for design, although there are similarities in the different agencies' approaches. More than 25 individual agencies develop scopes of work for design in the context of preproject planning, programming, and budgeting processes; clients; and organizational mission, programs, culture, and technical skills.

The design and construction of federal facilities have been the subject of government oversight and inquiry since the United States was founded. Several studies over the past 15 years have looked closely at the facility delivery process in the federal government under the auspices of the National Research Council. These documents contain several recurring themes that will be explored in more detail in this report. The themes identified include the following:

- the need to focus more effort on preproject planning as a key ingredient to improving project success (National Research Council, 1989; 1990; 1994; 2000a; 2000b; 2001; Federal Facilities Council, 1998; 2000);
- the importance of early involvement of key stakeholders in the pre-project planning process (Federal Facilities Council, 2000; National Research Council, 2000b; 2001);
- the need to involve design consultants early in the process and leverage decreasing federal expertise due to retirements and downsizing (National Research Council, 1989; 1990; 1998a; 2000b; 2001; Federal Facilities Council, 2000);
- the importance of developing a performance measurement system, including facility postoccupancy reviews, in order to understand and improve the facility delivery process (National Research Council, 1989; 1990; 1994; 2000a; 2000b; 2001; Federal Facilities Council, 1998; 2000);
- the efficacy of effective and comprehensive design reviews, including during the preproject planning process (Federal Construction Council, 1987; Federal Facilities Council, 2000; National Research Council, 1998a; 2000a; 2001);
- the effective training of personnel in the process and technical aspects of preproject planning (and the entire facility delivery process) (Federal Construction Council, 1987; National Research Council, 1998a; 2001);
- the detrimental effect that a long facility budgeting process can have on project success (National Research Council, 1990; 1994; 1998a);
- the need for senior-level involvement and oversight in the facility delivery process, including preproject planning (Federal Facilities Council, 2000; National Research Council, 1998a; 2001).

PROBLEM STATEMENT

Developing a scope of work for design presents a number of challenges. Ideally, the resulting facility should support the fulfillment of an agency's mission and programs for decades and meet the short-term needs of the users, all within cost, schedule, quality, and political constraints.

A facility project has many stakeholders, including, but not limited to, the facility owner, users, contractors who design and construct it, building managers and operators, architects, engineers, technical reviewers such as fire and security personnel, taxpayers, and the surrounding community. Issues that should be addressed when developing a project scope of work include identifying the stakeholders, involving them in the process at appropriate decision points, and establishing clear lines of responsibility. During the development of a project scope of work, objectives for sustainability, accessibility, maintainability, and security, need to be addressed and tradeoffs for purposes of mission or functionality made as necessary.

Facilitating effective communication among and between stakeholders with technical and nontechnical backgrounds representing a wide range of experience and viewpoints can be a challenge. For example, building users may know what functions the facility will need to accommodate but may not understand how those needs translate to space requirements, layout, supporting infrastructure such as roads or utility systems, and so on, and may not understand the cost and schedule implications of changing requirements after the start of detailed design. Architects and engineers, on the other hand, may understand the design requirements but may not be familiar with the functions, programs, and political pressure that the owner and/or user is trying to accommodate. Involving a diverse group of stakeholders in the development of a project scope of work raises issues of lines of authority and accountability for project decisions. Determining who will be responsible for evaluating the performance of individual team members and contractors becomes a critical issue.

Matching the acquisition strategy with the type of project, its schedule, and its funding requirements is a key, but often overlooked, step in delivering facility projects that meet the agency's overall objectives. Selecting the most appropriate acquisition strategy can help ensure a successful outcome. Choosing an inappropriate acquisition strategy, on the other hand, can undermine the best preproject planning effort. The elements that should be included in a scope of work for design will vary depending on the acquisition strategy (design-bid-build, design-build, construction management, etc.).

STUDY PURPOSE AND OBJECTIVES

The original objectives of this study as defined by the Federal Facilities Council (FFC) Organizational Performance and Management Committee were to identify the elements that should be included in a scope of work for design to help ensure that the resulting facility is one that supports fulfillment of an agency's program or mission; identify key practices for developing effective scopes of work for design involving new construction or major renovation projects; and identify key practices for matching the scope of work for design with the acquisition strategy, given a range of project delivery systems and contract methods. Because of budget and time constraints, only a limited amount of research could be conducted regarding the third objective. Where information was gathered, it is summarized in this report; however, additional research in this area is warranted. Issues related to acquisition strategies for federal facilities will be addressed in a future report.

The committee also requested that the following issues or topics be addressed during the course of this study: the core competencies, organizational support, and training needed by the various stakeholders to effectively fulfill their roles and responsibilities; methods for identifying stakeholders and their appropriate roles and responsibilities when developing a scope of work for design; practices used in selected federal agencies to develop scopes of work for design; practices used by nonfederal organizations to develop scopes of work for design and their transferability to the federal sector; the project scope of work and preproject planning decisions that need to be made and the information needed to make them; the elements that should be included in a scope of work for design and what may happen in subsequent phases of acquisition if these elements are not included; identification of variations in the elements of a scope of work for design depending on the acquisition strategy; development of baselines and metrics for measuring the quality and performance of a facility and its relationship to the scope of work for design; and tools and technologies that can be used to support the development of scopes of work for design. All of these issues and topics are addressed, at varying levels of detail, in this study.

HOW THE STUDY WAS CONDUCTED

The FFC Standing Committee on Organizational Performance and Management, in collaboration with other federal personnel and FFC staff, provided direction and oversight for this study. With the assistance of the committee, points of contact were identified in federal agencies directly involved in the development of facilities, and these points of contact provided access to resources. The study focused on building-type facilities, that is, those that are typically designed by architects with the assistance of engineers. Many other facility types are constructed by the federal government, and most of the findings and issues described in this report are applicable to those facilities as well.

Because of the amount of previous research available in the area of project development, interviews were considered the most beneficial method of gathering accurate information on current practices in the federal government, given the scope, budget, and time constraints of the study. The interview questionnaire was not intended to produce statistical results; responses were analyzed by observing the frequency of specific responses and developing common themes from the comments. The authors' intent was to study existing processes at both the policy level and the execution level. Both headquarters and field personnel were interviewed. The authors interviewed 25 personnel from 13 federal agencies, which together spend more than $10 billion annually on the construction of new facilities and major renovation of existing ones. A detailed list of the interviews is provided in Appendix A. An outline of the structured interview is provided in Appendix B.

A scope of work for design has two major parts—the contractual requirements (i.e., deliverables, format, submission deadlines) and the project scope of work (i.e., the type of facility to design, its size, cost, and quality). In the course of the interviews, the authors found that contractual requirements have been improved through experience and are not often an issue. Technical specifications are also relatively standardized. As an example, the Department of Defense is in the process of consolidating its technical criteria into a unified set that will be used by all three military departments (Department of Defense, 2000; Engineering News Record, 2000).

Effectively communicating a project's scope of work is typically more challenging. Therefore, the interviews focused on three preproject planning activities that ultimately impact the quality of a scope of work for design. Proper identification of stakeholders and effective definition of a project's scope of work are key to developing and communicating that scope to the designer. Acquisition strategy is also key and is discussed to some extent. As noted previously, a follow-on study is planned that will address the issue of acquisition strategy in more detail.

In addition, the authors conducted a detailed literature search and attended a one-day conference on preproject planning entitled "Government/Industry Forum on the Owner's Role in Project Management and Pre-project Planning," in Washington, D.C., on November 13, 2001. Information from that conference has been incorporated as appropriate (National Research Council, 2002).

ORGANIZATION OF THE REPORT

This report is divided into five chapters with supporting appendixes. Chapter 1 outlines the problem statement. Chapter 2 discusses standard forms commonly used to prepare scopes of work for design. Chapter 3 gives an overview of the preproject planning process, including definitions, key issues, tools, planning impact, and management actions required. Chapter 4 focuses on federal agency practices for preproject planning, development of project scopes of work, tools used to support preproject planning activities, and areas for improvement. Chapter 5 provides a summary that includes findings of the investigation and identification of key practices. Several tools and processes that support preproject planning and project scope development activities are provided as examples in the appendixes.

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Scopes of Work for Design

We love to expect, and when expectation is either disappointed or gratified, we want to be again expecting.
—Samuel Johnson

INTRODUCTION

The impetus for this investigation was to study how to develop an effective scope of work for design to help ensure that the resulting facility supports the fulfillment of a federal agency's program or mission. Scopes of work for design are contracts. Industry-recognized standard contract forms were considered a natural basis for this study. These documents have been developed through the collaborative efforts of a number of professional associations and sources and are often used as a starting point in developing contracts between facility owners (in this case federal agencies) and designers (typically private-sector architect-engineer firms).

In addition to the standard contractual obligations—services to be provided, standards, payments, schedule—a significant amount of project-specific information must be conveyed from the owner to the designer in order for the designer to produce design and construction documents that will ultimately result in a facility that meets the owner's goals, needs, and constraints. The scope of work for design must be tailored to each specific project and it must consider the acquisition strategy for that project. The two main questions that need to be answered are: (1) What services will be provided by the owner and/or the designer? (2) What is the project scope of work?

COMMONLY USED CONTRACT FORMS

The authors reviewed the most widely used standard forms for contracts between owners and designers from three prominent organizations—the American Institute of Architects (AIA), the Engineers Joint Contract Documents Committee (EJCDC), and the Design-Build Institute of America (DBIA). The forms are:

- Standard Form of Agreement Between Owner and Architect with Standard Form of Architect's Services, AIA Document B141-1997, prepared by the American Institute of Architects (1997)
- Standard Form of Agreement Between Owner and Engineer for Professional Services, EJCDC No. 1910-1, prepared by the Engineers Joint Contract Documents Committee (1996)

- Standard Form of Preliminary Agreement Between Owner and Design-Builder, Document No. 520, prepared by the Design-Build Institute of America (1998a)
- Standard Form of Agreement Between Owner and Design-Builder—Lump Sum, Document No. 525, (Design-Build Institute of America, 1998b)
- Standard Form of Agreement Between Owner and Design-Builder—Cost Plus Fee with an Option for a Guaranteed Maximum Price, Document No. 530, (Design-Build Institute of America, 1998c)

In addition to these standard forms, the authors reviewed some scope of work for design documents used by various federal agencies that were provided by interviewees. All of these documents cover similar topics. They contain boilerplate legal language covering such issues as compensation, termination, dispute resolution, and insurance. The focus of this review is on those contractual clauses that attempt to define the responsibilities of the parties and to communicate the project scope of work and standards of performance to the designer. Given the ownership responsibilities of federal agencies, this chapter emphasizes the owner's accountability and requirements. These standard documents all assume the owner's leadership of the facility procurement process and satisfactory definition of the project scope of work.

Issues Emphasized by AIA

The current (1997) AIA document includes some major changes from the previous (1987) edition, including restructured articles and some entirely new ones. Article 1.1 is a new contract clause entitled "Initial Information" that requires description of the following information: assumptions, project objective or use, physical parameters, owner's program, legal parameters, financial parameters, time parameters, and proposed procurement or delivery method. The clause also requires identification of the owner's and the architect's designated representatives. Article 1.2.3.7 obligates the owner to provide accurate and complete information and states that "[t]he Architect shall be entitled to rely on the accuracy and completeness of services and information furnished by the Owner."

Article 2.1 is a new contract clause entitled "Project Administration Services." Article 2.1.2 describes preparation of the project schedule, and Article 2.1.7.1 describes preparation of the project cost estimate. Each paragraph begins almost identically: "When [the] Project requirements have been sufficiently identified, the Architect shall prepare [the schedule or cost estimate]." Clearly, preparation of an accurate project schedule and cost estimate must be based on a defined project scope of work. The document does not explain the standard of sufficiency or the process of assessing the sufficiency of the information. Suggestions for this evaluation are provided in Chapter 3 of this report. Article 2.3 is a new contract clause entitled "Evaluation and Planning Services" that requires the architect to evaluate project information provided by the owner. Article 2.4 describes the design services to be provided by the architect. Three stages of development are identified: Schematic Design Documents (2.4.2), Design Development Documents (2.4.3), and Construction Documents (2.4.4). The requirements of the Design Development Documents and the Construction Documents include the owner's approval of the previous phase's deliverables and updated cost estimates.

Issues Emphasized by EJCDC

The 1996 EJCDC form emphasizes similar topics. Article 6.01E states that the owner is responsible for "the accuracy and completeness of all . . . information furnished by OWNER to ENGINEER." Article 6.02 requires the designation of project representatives.

Exhibit A, "ENGINEER's Services," identifies three stages of project development pertinent to the scope of this report: Study and Report Phase (A1.01), Preliminary Design Phase (A1.02), and Final Design Phase (A1.03). EJCDC sets forth a process similar to that described in AIA Article 2.4. The requirements of the Preliminary Design Phase and the Final Design Phase each begin with similar language; the new phase is preceded by the owner's acceptance of the previous phase's deliverables, is subject to modifications made by the owner, and requires written authorization to begin.

Issues Emphasized by DBIA

The DBIA forms are specifically designed to support the unique requirements of the design-build project delivery approach that federal agencies use more frequently. The forms are designed to allow separate procurement actions for the schematic design and the detailed design and construction, if desired. A number of the people interviewed for this study described using a design-build approach.

Under the Standard Form of Preliminary Agreement Between Owner and Design-Builder (Design-Build Institute of America, 1998a), the "Design-Builder provides a Schematic Design and a Proposal for the completion of the design and construction." Article 2.2 assumes that the project criteria, including the owner's expectations regarding "use, space, price, time, site, performance and expandability," are sufficiently developed and provided by the owner but includes the option for the contractor to develop these criteria as an additional item of work. Article 2.2.2 requires the design-builder to "review and prepare a written evaluation of [the criteria provided by the owner], including recommendations to Owner for different and innovative approaches." These, along with Article 2.3, clearly indicate that development and mutual understanding of the project scope of work precede the schematic design effort.

Article 2.4.2 requires the design-builder to prepare a schedule for the entire project scope of work, including construction. This comprehensive view of the project is vital for proper management by the owner and the contractor. Article 3 outlines the owner's responsibilities, including the project scope of work, or at a minimum the criteria needed to develop the project scope of work and accurate information regarding the site. Article 4 deals with ownership of the preliminary work product and indemnification issues in the event that a separate contractor performs the detailed design and construction. It is important to clarify these details in advance in order to minimize disputes.

DBIA Forms 525 and 530, respectively, are the Standard Form of Agreement Between Owner and Design-Builder—Lump Sum and Cost Plus Fee with an Option for a Guaranteed Maximum Price. Both documents deal with the detailed design and construction phases of the work.

The owner's "project criteria" is specifically listed as one of the components comprising the contract documents (Article 2.1.7). This provides the foundation for the design. The degree of project scope definition is an important factor in deciding whether to pursue a lump sum or cost plus contract arrangement for detailed design and construction. In short, a lump sum contract should be based on a well-defined project scope of work. If the project scope of work is not adequately developed, a cost plus contract is more desirable. The instructions for Form 530 discuss the option for establishing a guaranteed maximum price, which "should not be established until [the] Owner's Project Criteria are sufficiently defined. . . setting it too early does not permit reasonable opportunity for scope definition and evaluation of Project risk."

ASSIGNMENT OF PROJECT FUNCTIONS OR SERVICES

A significant activity of the owner early in the development of the scope of work for design involves determining which functions or services will be performed by the owner and which by the design contractor. At the end of the "General Information" section of the AIA Standard Form of Agreement Between Owner and Architect with Standard Form of Architect's Services is a section entitled "Identifying the Services Needed for the Project." Sixty-eight services are listed as a starting outline for this discussion. There are functions or services that are best performed by the owner, some best performed by the designer, and a number that can be done by either the owner or the designer, based on the owner's capabilities, the designer's capabilities, and the specifics of the project.

Anderson et al. (1999) provide an implementation guide for owners to use in making critical decisions regarding the division of responsibilities between owner and contractor. The report's perspective covers the entire engineer-procure-construct portion of the facility acquisition process, so construction functions are included, in addition to preproject planning and design functions. This process must be undertaken on both a strategic basis (i.e., what core competencies will the owner organization maintain through its own personnel?) and a tactical basis (i.e., which functions or services will be procured via contract on this particular project?). Table 1 illustrates the

TABLE 1 Potential Competencies for Alignment

Owner Functions	Owner or Contractor Services or Functions	Contractor Services or Functions
Business development	Alliances/partnering	Construction
Financial approval	Benchmarking/metrics	
Project management oversight	Commissioning/start-up/performance testing	
Setting project goals, objectives, and priorities	Conceptual cost estimates	
	Constructability	
	Construction management	
	Convert research to project/scale-up	
	Definitive cost estimates	
	Detailed design	
	Environmental/permits	
	Field quality control	
	Legal/contract administration	
	Lessons learned	
	Maintainability and operability	
	Preliminary design/scope	
	Process/conceptual design	
	Procurement	
	Project controls	
	Project management	
	Planning and scheduling	
	Risk management	
	Safety	
	Team building	
	Technical expertise	
	Total quality management	

SOURCE: Adapted from Anderson et al. (1999).

four functions usually performed by the owner, the one that is almost always outsourced to a contractor (construction), and the 25 additional functions or services whose performance are best determined based on the competencies of the owner, the contractor, and the specifics of the project.

COMMON ISSUES EMPHASIZED BY STANDARD DOCUMENTS

Table 2 summarizes common parameters set forth in the AIA, EJCDC, and DBIA standard documents.

All of these authoritative documents agree that a detailed, comprehensive project scope of work is the critical element prerequisite to developing a scope of work for design. They also assume the owner's leadership in the facility procurement process and definition of the project scope of work. The owner is also responsible for identifying the project representatives, or stakeholders, defined in this report as key individuals from functional parts of the organization who will be affected by or have to live with the project; determining which functions or services will be provided by the owner and which by the design contractor; and using a standard process with clearly defined "approval gates" or decision points.

The role of federal agencies as the owner in facilities acquisition activities is reinforced in *Outsourcing Management Functions for the Acquisition of Federal Facilities* (National Research Council, 2000b). "Inherently governmental functions" are defined as those that are "so intimately related to the public interest that [they] must be performed by government employees" and "commercial" functions as those that may be outsourced and

TABLE 2 Common Issues Emphasized by Standard Documents

Owner's role	• Properly divide project functions between the owner and design contractor • Provide accurate and complete project information to the designer • Provide project scope requirements (or, at a minimum, information to develop project scope requirements) to the designer • Identify project representatives early in the process • Review and approve the work product at various points in the process
Contractual requirements	• Responsibilities of the parties • Services to be provided • Description and timing of deliverables • Payment • Insurance and bonds • Liability • Termination or suspension • Notices, severability, and waivers • Dispute resolution • Ownership of work product
Development process for scope of work for design	• Owner provides assumptions, project objective or use, physical parameters, owner's program, legal parameters, financial parameters, time parameters, proposed procurement or delivery method • Designer evaluates project information provided by owner • Project requirements are sufficiently defined prior to preparation of schedule and cost estimates • Design effort is based on a mutual understanding of the project scope of work • Design development proceeds in a structured manner, each step predicated on the approval of the previous step and subject to project budget and scope modifications

performed by contractors. The report states that a "smart owner of facilities must be capable of performing four interdependent functions related to acquisition: establishing a clear project definition, establishing project metrics, monitoring the overall project process, and providing commitment and stability to the project definition and its achievement (i.e., leadership)." The next two chapters provide specific guidance with respect to implementing these themes.

3

Preproject Planning Processes and Project Scopes of Work

The plans of the diligent lead to profit as surely as haste leads to poverty.
—Proverbs 21:5, 1000 BCE

INTRODUCTION

Preproject planning has long been a subject of discussion in the building industry. Many guides have been developed, and much knowledge resides with experienced practitioners (Griffin, 1972; Pena, 1987; Billings, 1993; Preiser, 1993; Haviland, 1996; Cherry, 1999; American Society of Civil Engineers, 2000). However, in many cases preproject planning is not performed well in the building industry. Consequently, the building sector suffers from poor or incomplete project scope definition, frequently experiencing considerable changes that result in significant cost and schedule overruns (Gibson et al., 1997; Cho et al., 1999; Cho, 2000). A standardized preproject planning process, tailored to a specific organization, provides the foundation for development of effective project scopes of work.

This chapter discusses the preproject planning process, the development of project scopes of work, and the importance of management actions to bring about project excellence. In the course of the discussion, tools available to support preproject planning activities are identified. An underlying assumption is that the primary party responsible for the preproject planning phase of federal projects is the federal agency (the owner), with contractor assistance as needed. There are several reasons for this. First, only owner employees have the proprietary knowledge and perspective of why the facility is needed, how it will be operated and maintained, and what special needs exist. Second, in many cases, government employees will operate and maintain the facility long after contracts for planning, design, and construction are completed and in effect are the facility owners. Third, intentionally or not, even the most enlightened contracts for services or construction encourage contractors to pursue risk-averse approaches to the work. Preproject planning is all about addressing risks and making decisions from the owner's perspective, which is difficult for the contractor to do when operating under these types of contracts.

Finally, it should be noted that effective preproject planning is not a process that can be consistently incorporated throughout an entire organization in a short time frame. It requires process and cultural changes that may take several years to fully implement, but it is critical to the ability to develop consistently effective project scopes of work.

BACKGROUND

The U.S. government is arguably the largest owner of facilities in the world, with a worldwide portfolio valued at more than $328 billion (General Accounting Office, 2003). Its facilities are located in almost every city in the United States and in most countries. Although it is difficult to accurately calculate the amount of annual funding allotted for federal facilities (because of accounting and budgeting differences among agencies), the FY 2001 budget for the design, construction, and major renovation of facilities can conservatively be placed at more than $21 billion[1] and was probably much higher.

Dozens of government agencies are involved in the planning, design, construction, and operation of a myriad of federal facilities, such as institutional buildings, power generation plants, science laboratories, and water treatment plants. Federal projects range in cost from a few thousand dollars to more than $1 billion and vary in complexity from simple building renovations to the design, construction, and operation of massive nuclear test facilities involving cutting-edge technologies. The skill and experience needed to plan and manage these projects vary widely.

There are, however, similarities among all of these projects. First, they are conceived and executed to meet a mission, program, or societal need. Second, each project is executed by a team of individuals made up of both federal employees and contractors. Finally, each project generally follows a process that begins with initiation (need) and continues through a preproject planning phase that ends with deciding whether or not to proceed with a project. If a project proceeds, then a budget must be authorized and appropriated and a scope of work for design developed in order to contract with architect-engineer and construction firms that will design, construct, and commission the facility for use. This report focuses on building-type projects, those for which architects typically fill the lead design role.

PREPROJECT PLANNING

Preproject planning has been defined in many ways.[2] In this report it is defined as "the process of developing sufficient strategic information with which owners can address risk and decide to commit resources to maximize the chance for a successful project" (Construction Industry Institute, 1995). Terms commonly used for preproject planning include front-end planning, front-end loading, feasibility analysis, programming/schematic design, scope definition, scope management, and conceptual planning. A preproject planning process map is shown in Figure 1.

The preproject planning process can be summarized into four major steps: organize for preproject planning, select project alternative(s), develop a project definition package (which is the detailed project scope of work), and decide whether to proceed with the project (Construction Industry Institute, 1995). The preproject planning process includes defining the project's scope and planning for execution. It is during this crucial stage that risks are analyzed, preliminary designs are formulated, critical decisions are made, and the specific project execution approach is defined. The process is structured to include a clear set of approval gates or decision points that require the owner to make a formal decision to proceed to the next step. Incorporating approval gates also provides the opportunity to document progress and the decision on whether to proceed with the project. When personnel turnover occurs between the time a project is initiated and final commissioning, such documentation can be invaluable in providing continuity with respect to decisions made by the team.

Inadequate or poor preproject planning has long been recognized as one of the most significant variables that can negatively affect a facility project (Smith and Tucker, 1983). Inadequate project scope definition inevitably results in the need for changes, which in turn interrupt project sequencing and rhythm, cause rework, increase

[1]This figure was calculated from the 13 appropriations bills enacted for FY 2001, using line items for construction.

[2]The Project Management Institute (2000), for example, divides preproject planning (which it calls scope management) into five major subprocesses: initiation, scope planning, scope definition, scope verification, and scope change control. Other preproject planning process maps are contained in *The Owner's Role in Project Management and Preproject Planning, Proceedings of Government/Industry Forum* (National Research Council, 2002).

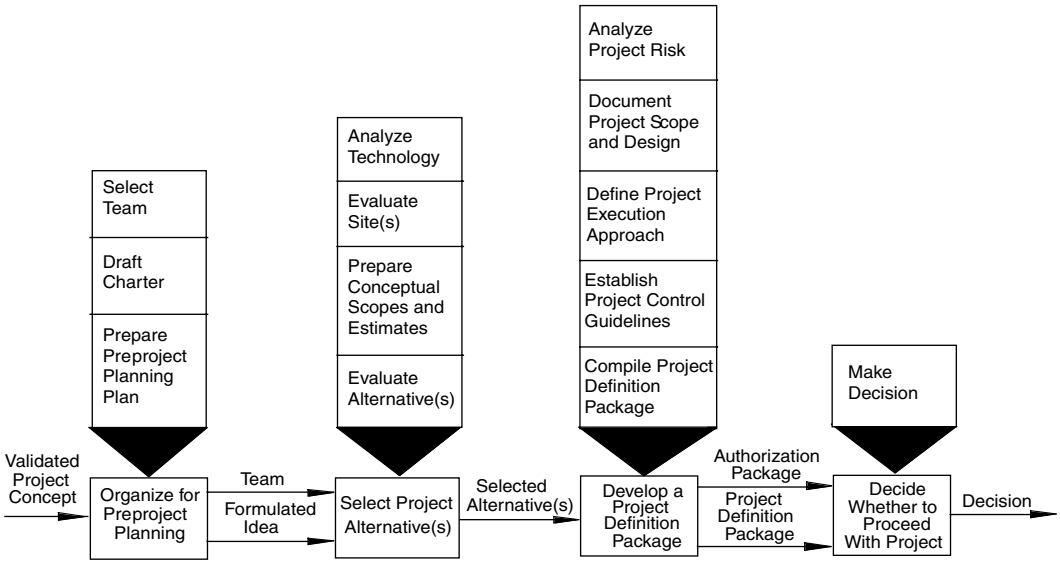

FIGURE 1 Preproject planning process (Construction Industry Institute, 1995).

project time and cost, and lower the productivity as well as the morale of the work force (O'Connor and Vickroy, 1986). A Business Roundtable (1997) report showed that 49 of 50 projects with excellent project scope development met all project objectives, while fewer than one in three with less than adequate preproject planning met their objectives. Presenters from the private sector reiterated the importance of preproject planning at a recent conference sponsored by the National Research Council (2002).

Over the past 10 years, researchers at the University of Texas have conducted several research projects to investigate preproject planning, including the project scope definition process. These studies have included more than 250 facility projects representing approximately $8.2 billion. More than 500 industry practitioners have participated in these studies, and the project planning processes of more than 100 organizations have been analyzed. Research results have shown that thorough preproject planning leads to improved performance (cost, schedule, and operational characteristics) for both industrial and building projects (Construction Industry Institute, 1995; 1996; 1997, 1999; Gibson et al., 1997; Wang, 2002). Findings from these studies have also shown that success during the detailed design, construction, and start-up phases of a project depends heavily on the participation of stakeholders in preproject planning activities, the level of effort expended during the project scope definition phase, and the thoroughness of the project scope of work.

This research has also shown that the preproject planning process needs to be tailored to the specific project type and complexity. Building projects differ from industrial projects in various ways, including the approach to the planning, design, and construction of facilities; the owner's perspective; the architectural focus; and a building's functions. Nonetheless, there are many similarities. Like the industrial sector, the building industry generally suffers from poor or incomplete preproject planning. As in the industrial sector, preproject planning in the building sector is a process that needs to have input from a wide variety of individuals and should have significant owner involvement (Cho et al., 1999). The federal government has many different types of facility projects that require preproject planning, including office buildings, research facilities, prisons, maintenance facilities, courthouses, and military housing. Different levels of effort and participant skill sets are required for different types of projects. Recognizing the appropriate levels of effort and the skills that are needed is difficult yet critical for project success.

IMPACT OF INADEQUATE PREPROJECT PLANNING

Measurement of effective preproject planning has been the subject of much study. Merrow et al. (1981) developed a practice use metric for first-of-a-kind facilities that consisted of several variables, including process flow development, execution approach, and site characterization. This metric became the basis for benchmarking services such as those provided for Department of Energy environmental projects in the mid-1990s (Independent Project Analysis, 1996). A white paper by the Business Roundtable (1997), based on benchmark data, reported that projects with effective preproject planning are more likely to meet cost, schedule, and operational objectives.

Inadequate preproject planning is the most significant determinant affecting project performance in the Construction Industry Institute's (CII) Benchmarking and Metrics database. Its relationship with established performance metrics is highly correlated, and CII considers preproject planning to be a best practice. More recently, it has measured preproject planning and other practice use metrics as well as performance metrics (Construction Industry Institute, 2000). Building and industrial projects with thorough preproject planning have consistently outperformed other projects in terms of cost, schedule, and number of change orders, as shown in Tables 3 and 4.

Table 3 compares project performance for a sample of 62 industrial projects worth $3.9 billion using a 200-point Project Definition Rating Index (PDRI)[3] score cutoff. These data show the mean performance for the projects versus execution estimates for cost and schedule and the absolute value of changes as a percentage of total project cost. Projects with a PDRI score under 200 (a lower score is better) statistically outperformed projects with a score above 200 (Wang, 2002). The PDRI score was determined just prior to the beginning of detailed design, and the differences in performance parameters are statistically significant.

TABLE 3 Comparison of Projects with PDRI Industrial Project Scores Above and Below 200

	PDRI Score	
Performance	<200	>200
Cost	3% below budget	9% over budget
Schedule	1% ahead of schedule	8% behind schedule
Change orders	6% of budget	8% of budget
	(*N* = 35)	(*N* = 27)

A similar evaluation was performed on a sample of 78 building projects representing approximately $1.2 billion. Table 4 summarizes the project performance and PDRI score using the same 200-point cutoff. Again, projects with better scope definition (lower PDRI score) significantly outperformed projects with poorly defined scope at the 95-percent confidence level. A subsample of 25 similar projects from one owner organization in this evaluation showed a construction cost savings of 3:1 for every dollar invested in planning (Wang, 2002).

The mean percentage of total project cost spent on preproject planning activities for all of the building projects in CII's database was 2.4 percent, which indicates a significant return on the investment of planning resources compared to total savings in budget, change orders, and time (Construction Industry Institute, 2000).

In summary, in the studies cited here and in many other investigations, preproject planning has proven to be

[3]The PDRI is a tool for measuring the degree of scope development on building projects (Construction Industry Institute, 1999). It consists of a weighted checklist and descriptors that can be used as a project risk analysis tool during the preproject planning process. Additional information about PDRI is included later in this chapter and in the appendixes.

TABLE 4 Comparison of Projects with PDRI Building Project Scores Above and Below 200

	PDRI Score	
Performance	<200	>200
Cost	3% below budget	13% above budget
Schedule	3% ahead of schedule	21% behind schedule
Change orders	7% of budget	14% of budget
	(N = 17)	(N = 61)

a key ingredient in determining whether a project will ultimately support an organization's mission and meet the owner's requirements. An investment of approximately 2 to 5 percent of a project's total cost will fund a cost-effective approach to increase the probability of success in the execution phase of the facility building process and can lead to better life-cycle operational performance. This level of project scope definition is a prerequisite to preparing an effective scope of work for design.

KEY FUNDAMENTALS OF THE PREPROJECT PLANNING PROCESS

The previous sections provide an overview of the preproject planning process and its contributions to project success. Major steps in the process, as shown in Figure 1, include organizing a team, considering and selecting alternatives, developing a project definition package (project scope of work), and making an informed decision regarding whether to proceed with the project. Research results were shown which indicate that effective preproject planning improves both project performance and the predictability of that performance. Key fundamentals of an effective preproject planning process are outlined in the following discussion to assist owner organizations in evaluating and enhancing existing processes or in developing new ones.

The organization should ensure that it is performing the "right" project. This requires leadership and stakeholder involvement. The preproject planning team should ensure that the proposed project will meet the strategic intent of the organization with respect to its mission and needs. Preproject planning should begin with good leadership, effective and appropriate involvement of key stakeholders, and a detailed determination of project objectives and requirements. It is important to ask many questions and manage the expectations of the project sponsor and the project team. The team must be chartered and given adequate resources by project sponsors to allow it to explore and choose the most cost-effective project alternatives in terms of site and technology options.

Research has shown that stakeholder identification and team alignment are critical to project success. A typical preproject planning team is comprised of individuals representing a wide variety of functional groups with diverse priorities, requirements, and expectations. These individuals may be as varied as building managers, maintenance supervisors, construction managers, technical representatives, future tenants, scientists, military officers, or cabinet officials (Construction Industry Institute, 1995).

Figure 2 presents the definition and a graphical representation of alignment (Griffith and Gibson, 2001). Each team member brings different priorities and expectations into the preproject planning process. Alignment is the process of incorporating all of those distinct viewpoints into a uniform set of project objectives that meets the organization's needs. Alignment should be developed and maintained by the project team, and work should be planned and documented to provide the foundation for the project execution phase.

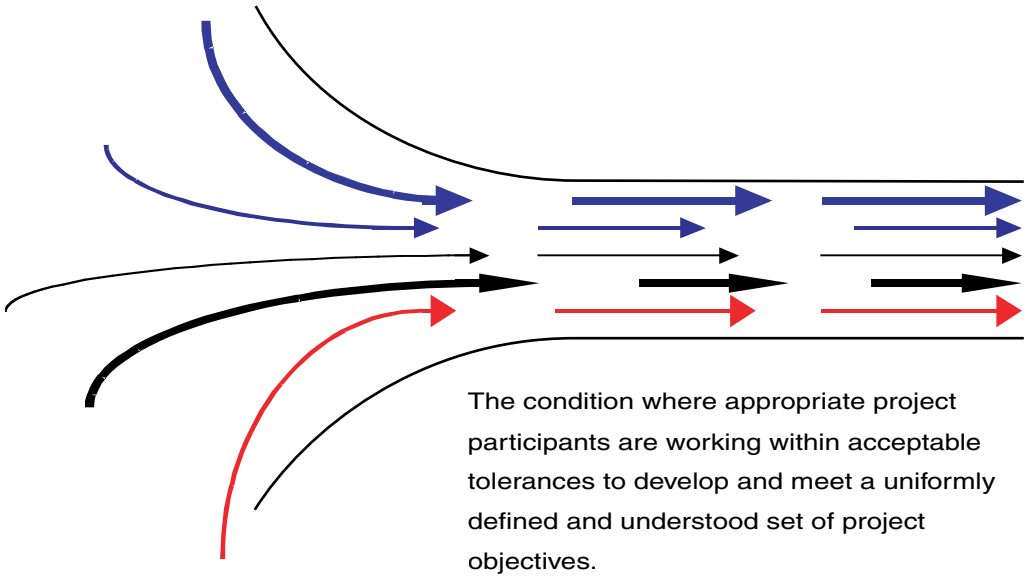

FIGURE 2 Graphical representation and definition of alignment (Construction Industry Institute, 1997).

The final stage of any successful alignment process is the acceptance and commitment of the entire team to the overall project objectives. Alignment cannot be achieved without the commitment of team members and the endorsement of the team sponsors. The arrows in Figure 2 are adjusted to form a uniform flow representing the evolution toward commitment to the overall project objectives. A project's objectives should meet the organization's mission and business requirements. They are formed in the early stages of project scope development and have a critical impact on the ultimate success of the project. In effect, the objective statement should be one of the first elements of the project scope of work to be developed, as it provides a course of direction for succeeding tasks.

Perhaps an appropriate analogy of a misaligned project would be that of driving a car with the front end out of alignment. Three unfortunate consequences generally occur: the ride is uncomfortable for the passengers, the tires wear out quickly, and the car drifts off the road. The same may be said of a project team that is out of alignment. The participants are in a constant struggle to maintain their viewpoints, and no one is entirely satisfied with the project's outcome (Construction Industry Institute, 1997).

Ten critical issues positively influence alignment when properly addressed or can cause difficulty in aligning the team to the task at hand. These critical alignment issues, in order of importance, are as follows:

1. *Stakeholders are appropriately represented on the preproject planning team.* The preproject planning team should include representatives from all significant project stakeholders so that their priorities and expertise are included in the project planning process to achieve optimum results. At a minimum, the team needs to include representatives from the business management group, operations group, construction, and often the general public, in addition to project management and design personnel (Construction Industry Institute, 1997). It is often beneficial to structure a core team of five to seven individuals and to bring in representatives from additional key areas as needed. The exact size and makeup of the core team should be tailored to the specific requirements of the project in question. For instance, on small projects there may be no established team, and the project manager would use expertise from within the organization or consultants as needed.

2. *Project leadership is defined, effective, and accountable.* The organization should be committed to developing and supporting effective team leadership because it will positively influence team members' commitment to the project's objectives. The leadership should be technically proficient and knowledgeable of the preproject planning process. It should also have defined responsibilities, be accountable for results, and remain focused. Ideally, project leadership is established early in preproject planning and maintains continuity through facility commissioning.

3. *The priorities among cost, schedule, and required project features are clear.* Clearly stated priorities among project cost, schedule, and quality features will assist all team members in making more uniform and correct decisions regarding the project and its objectives. Identifying these priorities in advance saves time by allowing more empowered decisionmaking by team members.

4. *Communication within the team and with stakeholders is open and effective*. Establishing open and effective communications between all members of the preproject planning team is essential. This involves breaking down barriers to communication and utilizing advanced technologies to improve communication. Periodic communication with stakeholders outside the preproject planning team will ensure timely input and their alignment with the project direction. This can be accomplished through team meetings, newsletters, e-mail, video conferencing, town hall meetings, and computerized information management systems (Construction Industry Institute, 1997).

5. *Team meetings are timely and productive.* Team leadership should conduct frequent and productive project meetings both to inform the team and to obtain input from team members. Team leadership should ensure that the team follows good meeting practices by providing an agenda, developing meeting minutes, assigning meeting roles, evaluating the meetings, and so forth. Meeting schedules should be set based on the size, pace, and complexity of the project. Too frequent meetings do not allow work to be accomplished in the interim. Too much time between meetings can damage alignment.

6. *The team culture fosters trust, honesty, and shared values*. Team leadership should develop a culture of trust and honesty so that team members can maintain open, synergistic relationships. This culture is influenced by the organizational cultures that interact with it; however, the team should make sure that trust and honesty are fostered in its activities. This can be accomplished through kickoff meetings, establishing the importance of trust in the team's performance, developing long-term working relationships over a number of projects, and providing accurate information (Construction Industry Institute, 1997).

7. *The preproject planning process includes sufficient funding, schedule, and scope to meet objectives.* It is important to establish and follow a prescribed preproject planning process. A comprehensive preproject planning process includes a team charter that outlines team member's roles and responsibilities, budget, schedule, and objectives of the team. The preproject planning process should be given adequate funding and time. Lack of funding is often cited as one of the most significant barriers to gaining alignment and in performing thorough preproject planning.

8. *The reward and recognition system is designed to promote the achievement of project objectives*. Management should develop and implement a reward and recognition system for team members and outside contractors that supports the overall project objectives. Conflicting reward structures for different team members may cause decisions regarding project objectives and planning to be in direct opposition, resulting in less than optimal outcomes.

9. *Teamwork and team-building programs are effective***.** Proper alignment requires that a group of diverse individuals from different functional groups be able to work together as a cohesive team. It is important that

teamwork is developed through both formal and informal team-building programs focused on the project activities.

10. *Planning tools (e.g., checklists, simulations, work flow diagrams) are effectively used.* Proper use of tools by the entire team to develop and manage project organization, scope, schedule, estimates, and work processes fosters alignment during preproject planning. The greatest value in using these tools is that they foster open communication and acceptance of the approved project scope, estimates, schedule, and work processes. Examples of such tools include work process diagrams, scope definition checklists, scheduling techniques, and risk analysis techniques.

Immediately following the formation and alignment of the project team, and still early in preproject planning, the project team should review site and technology options and make critical decisions. Many organizations call this phase conceptual planning. It is important that key decision makers understand and commit to a rigorous analysis of alternatives and to the chosen alternative decisions .[4]

The types of issues that need to be defined and documented early in preproject planning for building projects are outlined below. Properly addressing these issues will ensure that the project team understands the project's requirements and can begin detailed project scope development. Many of these issues require input from project sponsors as well as operations and maintenance personnel. It is critical to document these issues to provide a sound basis for developing the project scope of work.

The lists given below and in succeeding sections are in order of highest to lowest importance (Construction Industry Institute, 1999). Many of these issues are strategic in nature and are required to develop the project scope, whereas others are investigated and developed at the conceptual level in order to compare alternatives. It should be noted that to investigate several alternatives at a detailed level requires significant cost. The first two categories, business or mission need and ownership philosophy, are prerequisites to developing viable alternatives. Many times this process is iterative in nature; if no viable alternatives are possible, these first two categories may need to be revisited.

- *Business or mission need.* These issues should be resolved to ensure that the project requirements are well understood and that the project will meet the strategic intent of the organization:

  —Building use
  —Business justification
  —Business plan
  —Economic analysis
  —Facility requirements
  —Future expansion/alteration considerations
  —Site selection considerations
  —Project objectives statement

- *Ownership philosophies.* The long-term requirements for sustained operations in the facility should be well understood and include:

  —Reliability philosophy
  —Maintenance philosophy
  —Operating philosophy
  —Design philosophy (includes sustainability)

[4]A discussion of alternative selection is given in the *Pre-Project Planning Handbook* (Construction Industry Institute, 1995).

- *Project requirements.* The overall project requirements need to be understood and documented, including:

  —Value-analysis process
  —Project design criteria
  —Evaluation of existing facilities
  —Scope of work overview
  —Project schedule
  —Project cost estimate

The project manager and team should ensure that they develop the "right work product" during preproject planning. Once the team is aligned toward the right project and has selected alternatives to meet the strategic requirements of the organization, the team should identify, address, and document the appropriate scope definition elements to ensure that the project has a good design basis. Basing the scope of work for design on a well-developed project scope of work will ensure a smooth transition from preproject planning to detailed design and construction. Many times definition of the project scope involves the use of outside consultants or architect-engineers. A well-developed project scope of work roughly corresponds to a 15- to 25-percent complete design effort. Major tasks include developing the technical requirements; performing risk management activities; developing the project control baseline, including cost estimates; and documenting this information to form a good basis for detailed design activities.

Project scope definition activities can generally be categorized into the following four major technical areas: extensive site evaluation; good flow design (space planning for buildings); documenting design parameters, including code, regulatory, and user preferences; and identifying equipment requirements in detail. A partial list of the issues that should be defined prior to development of a scope of work for the detailed design of building projects (Construction Industry Institute, 1999) includes the following:

- *Extensive site evaluation.* Uncertainty about the conditions and characteristics of the site and existing facilities can have a devastating impact on the project in the detailed design phase. Issues that should be explored and documented include:

  —Site layout
  —Site surveys
  —Civil/geotechnical information
  —Governing regulatory requirements
  —Environmental assessment
  —Utility sources with supply conditions
  —Special water and waste treatment requirements
  —Security requirements

- *Flow design.* Understanding how people and functions relate to one another is essential for facility functionality and as a basis for detailed design. These relationships should consider building uses as well as horizontal and vertical circulation. Requirements that should be addressed and documented include:

  —Program statement
  —Building finishes
  —Room data sheets
  —Furnishings, equipment, and built-ins
  —Building summary space list
  —Overall adjacency diagrams
  —Stacking diagrams

—Growth and phased development
—Circulation and open-space requirements
—Functional relationship diagrams/room by room

• *Design parameters.* The boundaries for the designer should be developed to ensure that the needs and intent of the building user(s) are met. Among the issues to develop and document are:

—Civil/site design
—Architectural design
—Structural design
—Mechanical design
—Electrical design
—Building life safety requirements, including security
—Sustainable design
—Constructability analysis

• *Equipment requirements.* Non-core equipment requirements should be investigated and documented. These equipment systems may include telecommunications, laboratory, food service, and so on. The team needs to investigate and document:

—An equipment list
—Equipment location drawings
—Equipment utility requirements

Many organizations think that a project scope is adequately developed once general requirements are defined and a preferred alternative is chosen. This is not true. *To adequately develop a project scope, real design activities by architects, engineers, and consultants should be performed to translate project requirements into a design basis.* In effect, the project scope provides a bridge between the operational and organizational needs that a facility will meet and the technical aspects of project execution.

The project manager and team should choose the "right approach" to project design and construction execution. During preproject planning, the team should investigate and choose the right execution approach to ensure a good basis for successfully managing the project during design and construction, if it is decided to proceed with the project. This approach should address the acquisition strategy for design, consulting, and construction services and should ensure that the owner organization has controls in place to manage the project tasks through commissioning and occupancy. These issues are often part of the standard operating procedures of the organization, but it is critical that the process and details of execution be adapted to the project at hand.

The types of execution issues that need to be defined prior to the development of a scope of work for design are outlined below. It should be noted that failure to address design and construction execution issues during preproject planning can severely impact the cost and particularly the schedule performance of a project (Construction Industry Institute, 1999).

• *Procurement.* The strategy and control mechanisms for the acquisition of critical equipment and materials should be developed and documented, including:

—Identify long lead/critical equipment and materials
—Procurement procedures and plans

• *Project control.* Systems and processes should be in place to guard against potential problems that will occur during project execution, including:

—Project cost control
—Project schedule control
—Risk management

• *Project execution plan.* A plan should be in place to ensure that execution will proceed smoothly once the design and construction phases begin, including:

—Project organization
—Owner approval requirements
—Project delivery method
—Design/construction plan and approach

At some point in the development of an execution approach, the scope of work for design is developed. This document depends on the level of project definition and should address the contractual obligations for project delivery as well as specific process requirements of the contractor and owner organization. The scope of work for design can be modified to include significant project scope development activities and process steps if needed.

Overall, processes to ensure that the project will transition smoothly into the execution phase should be developed during the preproject planning phase. Without an effective execution approach, the project will flounder and management involvement will usually be required to assist the project.

ENABLING MANAGEMENT ACTIONS

Having described the basics of the process, it is important to understand the management actions required to make preproject planning a consistent and value-adding process throughout an organization. Even organizations with little project management expertise and poorly defined project processes will occasionally have what appear to be highly successful projects. These occurrences may be the result of lowered expectations, use of experienced contractors or project managers, "Herculean" efforts, or just good luck. Although individual project managers can use the techniques described in this chapter to positively impact their projects, the ability of an entire organization to continuously improve project performance over time requires strong management action. The goal of preproject planning process improvement is not necessarily to have a few spectacular successes offset by some disastrous failures; it should be an overall focus on project improvement so that the performance of the entire project portfolio improves. The following overarching actions have been found to improve the effectiveness of preproject planning (Construction Industry Institute, 1995; 1997; Davis-Blake et al, 2001; National Research Council, 2001):

• existence and consistent use of a detailed preproject planning process, including formal approvals or decisions at the end of each phase or subphase;
• commitment to adequately fund preproject planning activities and to support plans that have been approved;
• fostering an environment that makes no exceptions to conducting the preproject planning process;
• development and use of effective practice metrics for the planning process and performance metrics for projects in order to facilitate improvement;
• discipline to fully support the preproject planning process and to make project scope decisions during preproject planning rather than during detailed design and construction, since this can corrupt the process and lead to cynicism; and
• support for the development and protection of a cadre of experienced project planners, including training programs, progressive assignments, and recognition.

This last point warrants emphasis for federal agencies. According to recent reports, the loss of human capital in the federal work force in the coming years is a critical concern (General Accounting Office, 2000; 2001b). In

a similar study of the private sector, an expected loss of white-collar workers in the project professional ranks over the next few years will be a significant challenge for both owners and contractors (Davis-Blake et al., 2001). The loss of corporate knowledge as workers experienced in facility projects leave or retire is especially important in that experienced personnel who have tacit organizational knowledge and skills to address critical issues are needed to ensure that preproject planning is effectively and consistently performed. The maintenance of core competencies as recommended by the National Research Council (2002) and the Construction Industry Institute (Anderson et al., 1999) is essential for successful management of preproject planning and the entire facilities acquisition process.

TOOLS AVAILABLE TO SUPPORT PREPROJECT PLANNING ACTIVITIES

Many private- and public-sector organizations develop internal processes, checklists, and techniques to ensure the various activities that make up the preproject planning process are performed thoroughly and consistently. These tools and techniques are often structured to address specific types of projects and the proprietary knowledge of the organization. There are many books that describe the preproject planning process, and many of these include checklists and detailed methods (Griffin, 1972; Pena, 1987; Preiser, 1993; Billings, 1993; Construction Industry Institute, 1995; Haviland, 1996; Cherry, 1999; American Society of Civil Engineers, 2000). Some organizations have developed detailed process manuals to ensure that preproject planning is adequately performed (University of Texas System, 1995; Office of Planning and Budget and the Georgia State Financing and Investment Commission, 2001).

In 1997 a tool called the Alignment Thermometer was developed in order to allow a project team to assess its level of alignment during the preproject planning process (Construction Industry Institute, 1997). The book accompanying the tool describes major issues that should be addressed to ensure that the team is effective. The Alignment Thermometer is shown in Appendix C.

A tool called the Project Definition Rating Index has also been developed. The PDRI is a weighted checklist of project scope definition elements that allows self-assessment of a project to determine the current state of scope definition and to identify areas of risk that remain to be addressed. Two versions of the tool exist—one for industrial (process) facilities and one for building facilities (Construction Industry Institute, 1996; 1999). Both tools have been widely used by public and private industry organizations.

The PDRI for building projects consists of 64 elements that are grouped into 11 categories and further grouped into three main sections. The 64 elements are arranged in a score sheet format and are supported by 38 pages of detailed descriptions and checklists (Construction Industry Institute, 1999). The weighted score sheet containing the PDRI's three sections, 11 categories, and 64 scope definition elements is given in Appendix D. As an example of the detail included in the tool, the descriptions for the three elements making up the equipment category are given in Appendix E. The format of the score sheet and descriptions is similar to the industrial projects version of the PDRI that was developed in 1996.

PDRI is a risk management tool that can help a preproject planning team assess and measure project scope definition risk elements and then develop mitigation plans. A risk management analysis is most effective when performed prior to "locking in" facility budgets and committing funds to detailed design and construction. The PDRI is adaptable to small project scope development. Experience has shown that it provides numerous benefits, including a:

- checklist that a project team can use to determine the necessary steps to follow in defining the project scope;
- list of standardized project scope definition terminology throughout the construction industry;
- standard for rating the completeness of the project scope definition to facilitate risk assessment, prediction of escalation, evaluation of the potential for disputes, etc.;
- means to monitor progress at various stages during the preproject planning effort and to focus efforts on high-risk areas that need definition;
- tool that aids in communication between owners and design contractors by highlighting poorly defined areas in a scope definition package;

- means for project team participants to reconcile differences by providing a common basis for project evaluation;
- training tool for organizations and individuals throughout the industry; and
- benchmarking tool for organizations to use in evaluating the completion of project scope definition versus the probability of success on future projects.

The U.S. Army Construction Engineering Research Laboratory has developed tools that can be used to support preproject planning activities to identify client criteria and keep the client involved in the process (*www.cecer.army.mil*). Some of these tools are currently used by the federal agencies interviewed in this study. The tools include:

- *Sustainable Project Rating Tool (SPiRiT),* which is a checklist/rating system for sustainable design. This provides a structured approach to addressing sustainable design issues and meeting sustainable design objectives in project scope development.
- *Design Review and Checking System (DrChecks)* and *Corporate Lessons Learned (CLL) System,* which allow online design reviews by multiple users, support feedback and comments, and capture lessons learned for future reference. These are commonly used to review detailed designs but could also be used to review preliminary design work done during preproject planning.
- *Modular Design System,* which is designed to maintain the client's criteria through the design process. This facilitates the inclusion of stakeholder input.
- *Building Composer* software, which supports the identification of customer criteria and transfers those criteria to the facility model during design. This facilitates the gathering and inclusion of stakeholder input.

Other preproject planning and project scope development tools and techniques currently in use by federal agencies are outlined in Chapter 4.

4

Federal Agency Practices

Plan for what is difficult while it is easy, do what is great while it is small. The most difficult things in the world should be done while they are still easy, the greatest things in the world should be done while they are still small. For this reason, sages never do what is great, and this is why they can achieve that greatness.

—Sun Tzu, *The Art of War*, 1000 BCE

INTRODUCTION

The material presented in this chapter is a compilation of responses to interviews organized around the general themes discussed in Chapters 2 and 3. Where appropriate, specific agencies and practices are identified and their tools and documents cited. Some of the statements include the opinions of the authors based on specific comments and their knowledge of the preproject planning process. This chapter is based on 25 interviews conducted between March and August 2002. Agencies providing at least one interview included:

- Department of Defense (DOD)
- Department of Energy (DOE)
- Department of State (DOS)
- Department of Veterans Affairs (VA)
- General Services Administration (GSA)
- Indian Health Service (IHS)
- International Broadcasting Bureau (IBB)
- National Aeronautics and Space Administration (NASA)
- Naval Facilities Engineering Command (NAVFAC)
- Smithsonian Institution (SI)
- U.S. Air Force Air Combat Command (ACC)
- U.S. Army Corps of Engineers (USACE)
- U.S. Coast Guard (USCG)

SCOPES OF WORK FOR DESIGN

The interviews included questions about the scope of work for design document. The timing of the development of a scope of work for design is related to the discussion in Chapter 2 of structured approval gates in the preproject planning process. Nine of the 13 participating agencies use clearly defined approval gates prior to developing a scope of work for design, and more importantly, they base the scope of work for design on a detailed project scope definition package that has been developed with key stakeholder involvement. Six agencies use standard scopes of work for design, tailored for each project. When asked to describe their standard documents, four agencies stated that they were based on earlier project scope definition documents, one has developed a master specification approach, and two provide space layouts for facility components to the designer. One respondent emphatically stated that the problems he commonly experiences are not with the scope of work for design itself but occur in the project scope definition process and because of poor communication among stakeholders. As mentioned previously, it is critical that a scope of work for design be based on a well-developed project scope of work, which is one of the results of effective preproject planning.

PREPROJECT PLANNING PROCESS

Figure 1 outlines a preproject planning process used by private- and public-sector organizations. Figure 3 is a generic process map for federal government projects that shows, at a very high level, activities performed in the time between identification of the need and authorization of construction funds. The length of the entire project delivery process, from initiation to commissioning, can be from four years (or shorter in case of urgent need) to decades. Figure 3 generally follows the process shown in Figure 1—organizing for preproject planning typically occurs at the point where the need is identified, alternatives are selected in conceptual planning, and development of the project definition package occurs during scope definition/schematic design.

Eleven of the 13 agencies interviewed have an established process for preproject planning. The level of detail of these processes varies. The most effective form is a detailed logic or precedence diagram organized into phases,

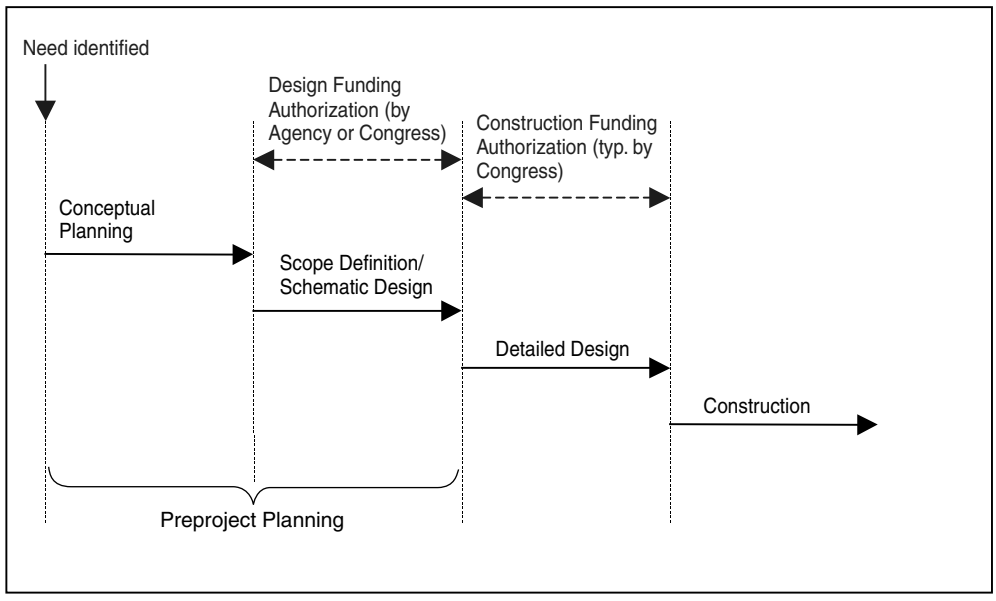

FIGURE 3 Generic process map for federal government projects.

with deliverables identified for each task in the phase and approval gates prior to moving forward to the next phase. Although all agencies have some sort of approval requirement prior to the expenditure of detailed design funds (the approval is typically at the level of authorization for these funds), the study sought to identify clearly defined approval gates in preproject planning processes. Nine agencies had clearly defined approval gates prior to the authorization of detailed design. The others conduct subjective or informal project reviews prior to authorization to proceed with detailed design. Those agencies that have approval gates see them as vital parts of their processes to improve the definition of the project scope of work and the accuracy of the cost estimate that is submitted to Congress for approval.

Many of the preproject planning processes reviewed have been developed on sound project management principles, but they are not implemented on all projects. Eight of the 13 agencies interviewed stated that their preproject planning process is implemented on all major projects. The higher-cost preproject planning activities are most commonly restricted to use on selected projects.

In 12 of the 13 agencies the preproject planning process is managed through contracts as well as by in-house staff; in the wake of recent downsizing and increased outsourcing, this is not surprising. The private sector is experiencing the same shift to outsourcing. Only the IBB, the smallest agency interviewed, continues to conduct preproject planning efforts exclusively with in-house staff.

Seven of the 13 interviewed agencies track the cost of preproject planning. Representatives from three agencies said they typically spend between 2 and 5 percent of project cost on preproject planning; this range is consistent with the average preproject planning costs for building projects in the Construction Industry Institute's (CII) database.

Preproject planning is performed effectively in some federal agencies but not consistently. This inconsistency equates to missed opportunities. Preproject planning processes should focus on the three key elements discussed in Chapter 3:

- The organization should ensure that it is pursuing the *right project*.
- The project manager and team should ensure that they develop the *right work product* during preproject planning.
- The project manager and team should choose the *right approach* to project design and construction execution.

The organization should ensure that it is performing the right project. This requires leadership and stakeholder involvement. As noted in Chapter 3, key elements include leadership, stakeholder identification, team alignment, understanding project requirements, and managing expectations.

Continuity of project leadership is an important feature of a good preproject planning process. The project manager is a key stakeholder and should be involved in the project scope development. Six agencies assign project managers prior to detailed project scope development. The remainder transfer leadership after the project scope of work is developed and in most cases after it has been approved by the agency or submitted to Congress for approval. This risks damaging the alignment of the project team, as the project manager is tasked with executing a project scope of work and many times a budget and schedule that he or she had no input in developing. In situations where continuity will not be maintained, research has shown that a well-defined preproject planning process, specific and detailed documentation of the project scope of work and the decisions made, and a well-structured turnover procedure that includes a turnover meeting and project reviews with new stakeholders can mitigate alignment problems and minimize project scope changes during detailed design and construction.

Stakeholder identification is an integral part of preproject planning and the subsequent development of effective scopes of work for design. Without the representation of appropriate stakeholders, a team cannot gain all the input necessary to effectively communicate the project design requirements to the designer. In addition, stakeholder involvement fosters timely decisionmaking throughout the process.

It appears that all interviewed agencies establish their project teams with good representation from the user/client, facilities/project personnel, operations and maintenance personnel, technical support functions, local representatives, and regulatory agencies. Ten of the 13 agencies have an established process to identify stakeholders.

The ACC, NASA's Johnson Space Center (JSC), and the DOE's National Nuclear Security Administration (NNSA) have each developed checklists to assist in the proper identification of stakeholders. An adaptation of the JSC's stakeholder identification checklist is provided in Appendix F as an example. These checklists are tailored to the specific agency and type of project; generally, representation by the following stakeholder groups is recommended (Construction Industry Institute, 1997):

- Business:
  —Business and market evaluation
  —Financial analyst
  —Human resources
  —Labor relations
  —Legal advisor
  —Project sponsor
  —Public relations
- Operations:
  —Facility operations
  —Maintenance
  —Procurement
  —Research and development
  —Safety
  —Warehousing
- Project Management:
  —Cost and schedule
  —Environment
  —Estimating
  —General engineering
  —Project controls
  —Process engineering
  —Project manager
  —Quality/inspection
- Others:
  —Construction
  —General public
  —Information management
  —Specialist engineering
  —Security

None of the participants interviewed indicated that their agencies measure the effectiveness of their stakeholder identification processes through metrics. Representatives from the GSA, IHS, DOS, and VA specifically mentioned the use of postoccupancy evaluations as a means of gathering feedback from occupants, which would indirectly measure stakeholder input during preproject planning. Two agencies measure effectiveness by the number of complaints received about the final project or their involvement in the process. The use of periodic stakeholder satisfaction surveys throughout the process may be more appropriate than either of these methods.

The long duration of the process for congressionally funded projects is a significant challenge. Changes in mission and personnel between the time of the identification of the facility's needs and its construction often cause requests for new requirements and result in late changes.

Keeping stakeholders involved in the process can be a communication-intensive challenge. To ensure that this occurs, a significant management effort, including an educational/training component, is required. Some agencies have already addressed this in their processes by making stakeholders an integral part of the process through early involvement and extensive coordination. Some specific examples are provided later.

Three agencies specifically mentioned manpower shortages, and two mentioned funding shortages as having an adverse impact on the proper identification and involvement of stakeholders. In particular, the project manager is a key stakeholder and should be identified prior to detailed scope development—not having the involvement of this key member can lead to continuity problems in the leadership of the project team.

A successful project is designed to meet a defined business need. The Office of Management and Budget's (OMB) (1997) *Capital Programming Guide* provides guidance on this issue and offers "Three Pesky Questions" that should be addressed during the strategic planning of a potential new facility:

- Does the investment in a major capital asset support core/priority mission functions that need to be performed by the federal government?
- Does the investment need to be undertaken by the requesting agency because no alternative private-sector or governmental source can better support the function?
- Does the investment support work processes that have been simplified or otherwise redesigned to reduce costs, improve effectiveness, and make maximum use of commercial, off-the-shelf technology?

Five agencies specifically mentioned business case analyses in their processes. An additional six agencies mentioned mission requirements as being an essential consideration in the review of a project. Examples of business analysis or mission requirements include:

- GSA project and business personnel work together to confirm that business and project goals are aligned and to develop a prospectus for each project.
- The DOS recently instituted the requirement for a business case analysis.
- USACE is required by law to document acceptable cost-benefit analyses for civil works projects, such as locks, dams, and shoreline structures.
- The USCG developed a Shore Facilities Capital Asset Management strategy that combines strategic planning and a business approach to facilities management that considers the total cost of ownership and operation over a facility's operational life.
- The VA recently developed a process that requires answers to the "Three Pesky Questions" and includes a total life-cycle cost analysis early in the development of its project proposals.

The project manager and team should ensure that they develop the "right work product" during preproject planning. Planning activities such as team building, alignment, and Project Definition Rating Index (PDRI) reviews have been shown to be a cost-effective investment in the project scope definition process. Representatives from 12 agencies stated that the eventual owners, users, and operations personnel are involved in the development of the project scope of work. Five agencies utilize working meetings to develop the project scope on selected, typically large or complex, projects. For example, the ACC uses analysis and design charrettes to develop project scopes of work. The charrette is a collaborative team effort that focuses on functional relationships and results in an initial design flow.

Six of the 13 agencies interviewed measure the degree or quality of their project scope definition. Most of the measurement tools are in checklist form, and again, the level of detail varies. Those that do not use metrics to evaluate the level of project scope definition have a subjective review process for design authorization that relies primarily on the experience of the reviewers. With a few exceptions, it appears that project life-cycle costs are not routinely analyzed. Such an analysis is often the basis for the entire decisionmaking process in the private sector.

- DOE (NNSA) and GSA currently use CII's PDRI. NASA and DOE's Office of Environmental Management have each customized the PDRI for their internal use (Gibson et al., 2000; Gibson, 2001; Office of Environmental Management, 2001). SI and DOS are beginning to implement PDRI in their processes.
- DOE uses internal and external Independent Project Reviews in conjunction with the PDRI based on project size. These independent project reviews use detailed, internally developed checklists to assess the degree of project scope definition.

- DOS utilizes an Integrated Design Review to expedite the design review and comment process, although these are typically used in the detailed design phase.
- IHS and VA use space layout tools to define the project scopes of work for their medical facilities and to provide the basis for detailed design.

Seven of the 13 agencies interviewed determine successful project scope definition from a program perspective, as opposed to only on an individual project basis. The measures used to determine successful project scope definition from a program perspective are often the same as those used for individual project evaluation, but the program perspective involves analyzing performance trends over time. The most common parameters (three agencies each) measured were change orders and customer satisfaction. Budget and schedule performance were mentioned twice each. Other measures mentioned were time to execution and whether the project was actually built or not.

The project manager and team should choose the "right approach" to project design and construction execution. Acquisition strategy is best considered during conceptual design and is best determined on a project-specific basis. At a summary level, acquisition strategy is determined on a project-by-project basis. Four of the 13 participating agencies consider acquisition strategy very early in the preproject planning process. Most have the option of using design-build or design-bid-build, with a best value selection process being more prevalent than the traditional low bid.

As an example, an acquisition strategy format recently developed by DOE requires a detailed assessment of the acquisition background and objectives and development of a business and contracting strategy before design funds are released (Department of Energy, 2002). The key components of this format are included in Appendix G.

The choice of delivery method can impact stakeholder identification and preproject planning processes, as evidenced by the differences between the Design-Build Institute of America standard design contract forms and those from the American Institute of Architects and EJCDC. One respondent stated that in complex acquisitions, the acquisition plan is instrumental in identifying the important stakeholders and ensuring that they are included in the preproject planning process. Five agencies reported that acquisition strategy does not have a significant impact on their stakeholder identification or preproject planning processes. Allowing the contractor who develops the project scope of work to compete for the detailed design contract provides the opportunity to maintain continuity of project knowledge as well as the project team.

Many agencies utilize Indefinite Delivery/Indefinite Quantity (ID/IQ) contracts for architect/engineer (A/E) services, for both preproject planning and detailed design work. Two agencies incorporate details of their preproject planning processes, which will be discussed later in this chapter, into their design development requests for proposals (RFPs) and their ultimate selection of an architect/engineer (A/E) firm. ACC specifies charrettes and the development of a Customer Concept Document (CCD), and NASA specifies a PDRI workshop at the 30-percent design review. These are effective ways to ensure that the contractor knows the agency's expectations. Most agencies that contract their scope definition functions award the detailed design under a separate contract, and the contractor developing the scope is typically allowed to compete for the detailed design contract. In addition to the typical A/E and construction services, agencies reported hiring consultants for activities such as team building, partnering, PDRI facilitation, and training.

None of the agencies interviewed measure the effectiveness of their acquisition processes through metrics, although some track lessons learned and success stories of various projects and acquisition strategies. For instance, respondents anecdotally indicated that most design-build projects result in comparable costs and faster delivery than traditional design-bid-build projects.

FUNDING, PROCESS, AND OTHER RELATED ISSUES

Respondents were asked what challenges or limitations they faced in their planning processes. The execution of effective preproject planning seems to be easily derailed by resource constraints and, in some cases, congressional add-ons that require a project scope and cost estimate for authorization in as little as one day. These and other issues are discussed below.

Funding Issues

Eleven agencies mentioned resource constraints as having a negative impact on their preproject planning efforts—eight cited funding shortages, and five cited manpower shortages. It is interesting to note that representatives from some agencies reported that they generally have adequate planning funds because they include funds for preproject planning in their budget requests.

Adequate resources are essential for thorough preproject planning. The issue of funding has become more significant with increased outsourcing of preproject planning activities. Eight agencies fund preproject planning efforts with money from their operations budgets. This can be effective if 2 to 5 percent of the planned capital expenditure is set aside for preproject planning activities in the development of the budget, but at times these funds have been shifted to other operational priorities. NASA, USACE (Civil Works), DOE, VA, and USCG fund preproject planning efforts with capital funds set aside at the headquarters level. This appears to be a better approach, as the preproject planning efforts do not compete with operational priorities for the same funds. NAVFAC is in the process of designating early project planning as a mission-funded activity in order to ensure that funds are available for planning.

In some cases, Congress or the agency locks in the budget, or the agency adopts a position regarding the budget, prior to detailed development of the project scope. In effect, the budget is viewed with much more accuracy than it deserves, based on the information supporting it. Funding a project based on an early estimate that contains a significant level of inherent uncertainty leads to unpredictable cost performance. In cases where projects are overfunded, the scope generally expands to match the budget. In cases where projects are underfunded, there are only two options—increase funding to meet scope, or reduce scope to meet the budget; in essence, the project scope is used as contingency. Five agencies reported using a project scope definition quantification tool prior to developing a scope of work for design.

Some agencies accurately capture preproject planning costs so that future budget requests can include adequate amounts for planning. As discussed earlier, preproject planning can provide a significant return on investment and improve project cost performance through reducing rework and change orders.

Process Issues

There are also a number of process-related aspects that hinder effective preproject planning. The long duration of the congressional approval process is a challenge, as people, administrations, and even missions can change in the time between identification of the need and construction of the facility.

One agency has a significant backlog of projects that have been authorized but not funded. If these delays are significant, the project requirements can change between authorization and funding. In the event of a significant delay between authorization and funding, the project team should reverify/update the project scope of work prior to developing a scope of work for design. IHS and VA have steps in their processes specifically designed for this situation.

Execution pressure can cause mistakes. Thorough scope definition is often not completed if it would risk the project missing a congressional approval window. However, submitting poorly defined projects for funding approval will almost certainly result in increased actual costs as well as increased uncertainty surrounding project costs. It appears that in some cases project scopes of work and budgets are locked in by Congress and/or agency headquarters prior to significant project scope definition efforts.

Organizational reluctance to spend time and money on a project that has not yet been authorized can cause problems. The first key element of an effective preproject planning process, as discussed in Chapter 3, is that the project manager and team should ensure that it is performing the "right project." The proper time to do this is prior to congressional authorization; part of the reason for the investment in preproject planning is to determine whether the project should proceed.

Some field-level participants mentioned that they are asked to develop a scope of work for design for which they did not participate in the project scope definition process. Lack of key stakeholder continuity is a problem in this situation.

Another field participant stated that sometimes there is an opportunity to modify a scope and budget prior to congressional approval, based on further refined planning. However, the agency headquarters does not approve the revisions either because they are considered too large or the agency considers the budget to be locked in based on its preliminary approval for design funds.

Core Competencies and Training

Preproject planning processes in a significant number of agencies rely heavily on their experienced planning personnel. This may currently be effective, but the participants in this study had an average of 28 years of work experience. Much of this knowledge may be lost as these employees retire within the next decade. "Lessons learned" programs and organizational processes can aid in institutionalizing this knowledge in order to maintain continuity in agencies' ability to effectively manage projects. Effective training and mentoring are necessary in order to successfully implement these processes and transfer the planning experience to new managers.

Six agencies conduct training on their preproject planning processes and tools, but the level of detail varies. DOE is developing a comprehensive training program, while another agency relies solely on the experience of its project managers and on-the-job training. GSA, NASA, and SI have recently hired consultants to conduct facilitation and training on subjects such as planning best practices, PDRI, and partnering. Two agencies make training available to clients—NASA conducts PDRI orientation sessions with facility tenants, and IHS makes its annual Health Systems Planning software training sessions available to tribal representatives, facility managers, and tenants, in addition to engineers and area planners. A well-developed training plan will facilitate consistent performance across an agency's project portfolio.

PERFORMANCE MEASUREMENT

The use of proper metrics provides a measure of performance that can be used to improve the preproject planning process. Nine of the 13 agencies interviewed measure project performance. The most common parameters (eight agencies each) were cost and schedule performance, followed by postoccupancy reviews or other forms of customer evaluation (five agencies). The next most common parameters (three agencies each) were technical/quality and the timing of funding obligations. Although useful as a metric, obligation rate is a measure of overall program or budget execution, rather than project performance; it only tracks whether an agency obligates its money "on time," without regard for how effectively the money is spent. Other parameters included change orders and the scope or size of the project. Some agencies utilize project-reporting systems to collect performance data and conduct periodic performance review meetings.

PREPROJECT PLANNING ACTIVITIES IN SELECTED AGENCIES

This section highlights the preproject planning processes or innovative aspects of those processes of some but not all of the agencies interviewed.

Department of Energy

An example of a documented process is DOE (2000) Order 413.3, which clearly defines five "critical decisions" as approval checkpoints, as shown in Figure 4. The process includes definitions of, actions authorized by, and prerequisites for each critical decision. This process is being refined and is not yet uniformly used across the department. For the purposes of this study, DOE's preproject planning process ends at Critical Decision 2 (CD-2), which establishes the project baseline (cost, schedule, and scope). CD-0 requires a justification of mission need, acquisition strategy, preconceptual planning, and an Independent Project Review prior to proceeding with conceptual design. These independent project reviews use detailed, internally developed checklists to assess the degree of readiness to proceed to the next phase. CD-1 requires an acquisition plan, conceptual design report, preliminary project execution plan and baseline range, project data sheet for design, verification of mission need, and preliminary

DOE O 413.3

PROJECT ACQUISITION PROCESS AND CRITICAL DECISIONS

Project Planning Phase		Project Execution Phase			Mission
Preconceptual Planning	Conceptual Design	Preliminary Design	Final Design	Construction	Operations
CD-0 Approve Mission Need	**CD-1** Approve Preliminary Baseline Range	**CD-2** Approve Performance Baseline	**CD-3** Approve Start of Construction	**CD-4** Approve Start of Operations or Project Closeout	

CD-0	**CD-1**	**CD-2**	**CD-3**	**CD-4**
Actions Authorized by Critical Decision Approval				
• Proceed with conceptual design using program funds • Request PED funding	• Allow expenditure of PED funds for design	• Establish baseline budget for construction • Continue design • Request construction funding	• Allow expenditure of funds for construction	• Allow start of operations or project closeout
Critical Decision Prerequisites				
• Justification of mission need document • Acquisition Strategy • Preconceptual planning • Mission Need Independent Project Review	• Acquisition Plan • Conceptual Design Report • Preliminary Project Execution Plan and baseline range • Project Data Sheet for design • Verification of mission need • Preliminary Hazard Analysis Report	• Preliminary design • Review of contractor project management system • Final Project Execution Plan and performance baseline • Independent cost estimate • National Environmental Policy Act documentation • Project Data Sheet for construction • Draft Preliminary Safety Analysis Report • Performance Baseline External Independent Review	• Update Project Execution Plan and performance baseline • Final design and procurement packages (**) • Verification of mission need • Budget and congressional authorization and appropriation enacted • Approval of Safety documentation • Execution Readiness Independent Review	• Operational Readiness Review and acceptance report • Project transition to operations report • Final Safety Analysis Report **After CD -4** **Closeout** • Project closeout report

(**) To the degree appropriate to initiate construction as scheduled

FIGURE 4 DOE project acquisition process and critical decisions.

hazard analysis report prior to the authorization to expend design funds and begin preliminary design. Project scope definition continues to be developed during the preliminary design phase, leading to the development of a project performance baseline at CD-2. This preproject planning process generally follows the process outlined in Chapter 3. For example, the NNSA undertook a thorough preproject planning effort in order to write the RFP for a recent design-build project. That particular project was completed ahead of schedule and under budget, with no project scope changes. DOE currently requires that acquisition execution plans be reviewed by the chief financial officer's

organization on all projects in excess of $5 million. The contents of the acquisition strategy requirements have been previously discussed in general and are provided in Appendix G (Department of Energy, 2002).

Department of Veterans Affairs

The VA recently revamped its Capital Investment Planning Process. The *VA Capital Investment Methodology Guide* (*www.va.gov/budget/capital*) "requires that facility investment proposals be clearly tied to Department goals and objectives before they will be considered for funding." This process uses OMB's (1997) *Capital Programming Guide* as a reference and requires that OMB's "Three Pesky Questions" be answered before a proposal is considered for review.

Formulation is the first step in the process and consists of three phases: functional development; technical review; and strategic review. During the functional development phase, strategic needs are analyzed, capital and other assets are planned to meet those needs, and data are developed to help evaluate and prioritize spending projects. Templates and instructions for completing the application and conducting analyses for cost effectiveness, alternatives, and risk are provided. The project scope is further developed in the technical review phase. Investment proposals are evaluated and prioritized by a board or council of subject matter experts. Evaluation criteria vary by asset type and may be updated annually.

In the strategic review phase, proposed projects are evaluated, prioritized, and measured against the VA's strategic plan and OMB's requirements to determine the best combination of assets to meet the department's mission, obligations, goals, and objectives. Each project proposal undergoes quality control to ensure that the supporting data, documentation, and analyses are valid. Regarding alternative selection, the validity check requires that at least three viable alternatives be fully evaluated and compared to the chosen option. Following validation, each proposal is scored on twenty criteria and, based on that score, strategically prioritized with other project proposals for approval by the VA Capital Investment Board. Finally, this process includes an execution review after proposals have been approved and funded but prior to the project being initiated. Proposal teams submit progress reports to determine if schedules and costs are on target. An earned value analysis tool has been developed to aid the proposal team in this step.

General Services Administration

General Services Administration project needs are typically generated by their regional offices. A feasibility study is developed into a design prospectus, which is reviewed by staff at GSA headquarters and the OMB, and then is submitted to Congress for planning and design funding. The cost estimate at this point in the process is generated from the General Construction Cost Review Guide (GCCRG), a benchmark-type cost estimating system. GSA ensures that the project meets the defined business need by specifically emphasizing the alignment of business goals (developed by real estate portfolio personnel) and project goals (developed by project personnel). An occupancy agreement outlines the future lease responsibilities of GSA and the tenants.

A consultant, typically under an ID/IQ contract, develops a Program Development Study (PDS), which is a detailed definition of the project scope that the scope of work for design is based on. The consultant preparing the PDS may continue with the detailed design, but this does not always occur. GSA attempts to involve the design contractor early enough in the process to allow the designer to participate in preproject planning and to have some influence on the final PDS. A new cost estimate based on the PDS is then submitted to Congress for construction authorization.

GSA adds prospective construction management firms to the project team where possible. Short-listed firms provide construction input early in the design phase, and the quality of their input is considered in the construction management selection process. GSA also uses partnering consultants to improve team performance and PDRI reviews to validate project scope definition.

Indian Health Service

The IHS conducts three phases of preliminary planning prior to awarding a detailed design contract. Project needs are identified by area managers in field offices. Phase 1 consists of a headquarters preliminary screening of the need. Phase 2 involves headquarters validation of the need based on population demographics and conceptual facility requirements. Detailed project scope development begins in Phase 3. Area offices with support from two engineering services offices manage this phase, which includes charrette-type work sessions with stakeholders (Indian Health Service, 2000). IHS has developed a Health Systems Planning Manual to develop comprehensive project scopes of work for health care facilities. The project scope of work developed in Phase 3 is documented in a Program Justification Document (PJD), which specifies the size of the facility, medical services, and other functions to be included in the facility and provides a cost estimate. The PJD is reviewed by staff at the headquarters level. Upon approval of the PJD, the project is placed in a priority list ready for funding from Congress through a budget formulation process. The project scope of work is further developed using a computer program that tailors architectural templates and/or layouts for each required functional area. The templates include information on equipment and finishes and adjacency requirements for the various functions and are provided to the designer in an electronic format. This automated system "allows an area planner to plan for the expansion or replacement of a facility in a matter of days instead of the months it took in the past" (Indian Health Service, 2001). This software-based planning tool can be a very effective approach for planning similar facilities, such as what IHS constructs. The resulting package is the Program of Requirements (POR). After Congress provides initial funding for the project (which can be years after the PJD is approved), the area planners update and revise the POR for execution, and that becomes the basis for the scope of work for design.

National Aeronautics and Space Administration-JSC

The NASA-JSC process map is shown in Figure 5. A key feature of the process is that JSC conducts PDRI reviews three times prior to beginning detailed design—once during establishment of the initial requirements, once during an interim assessment in the planning process, and once at the 30-percent design review stage. This third PDRI score is used to assess the official schedule and budget for the project and leads to the basis for the scope of work for design. JSC specifies this final PDRI workshop in its design development RFPs; this is a vital part of

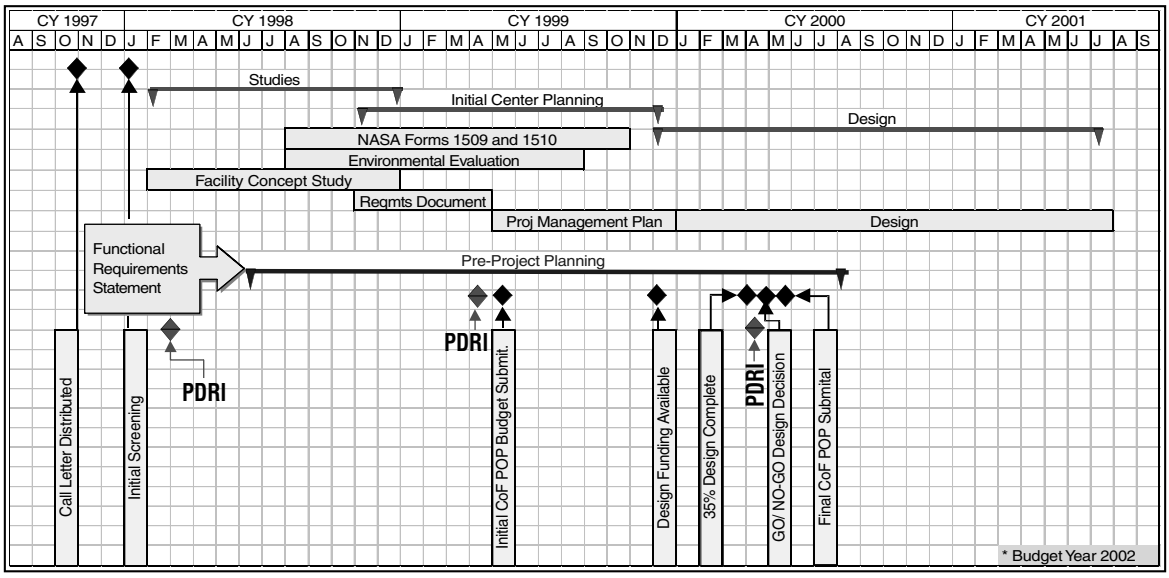

FIGURE 5 Example of pre-project planning time line with PDRI evaluation points (Gibson et al., 2000).

the acquisition strategy that clearly communicates the importance of this evaluation to the design development contractor.

JSC project staff members often partner with design consultants and contractors are included on the team to gain input regarding project constructability. As a result, JSC has experienced improved information flow and improved customer satisfaction, as indicated by surveys.

Naval Facilities Engineering Command (NAVFAC)

NAVFAC identified three initiatives related to preproject planning and developing scopes of work: the Functional Area Concept Development (FACD), the NAVFAC Design-Build Master (NDBM), and the Business Management System (BMS). These initiatives are in differing stages of development.

The Functional Analysis Concept Development (FACD) process is currently used to confirm project scope and budget, improve understanding by all involved parties of project issues, and to minimize redesign and associated expenses, among other purposes. The process begins with a working meeting, where all key stakeholders and design personnel evaluate project requirements/needs, costs, goals, and objectives over the course of a few days (charette for small projects) or through an intense two-week workshop (for major projects). Concepts are then presented, issues are identified and resolved or plans are developed to resolve them. The FACD report represents the final, confirmed project scope and the preliminary design, which becomes the basis for later submittals. Value Engineering concepts and principles are applied. NAVFAC emphasizes effective communication and alignment of project objectives by building this process around customer input.

The NAVFAC Design-Build Master (NDBM) is a Web-based tool for projects using a Request for Proposal (RFP) format; when deployed, it will be hosted by the National Institute of Building Sciences (NIBS). The NDBM takes the best of the design-build processes currently being used in the Navy, combines them with newly created, performance-based technical specifications and design criteria to provide a single source for documents to prepare a Design-Build RFP.

The NDBM will include seven Unified Facilities Criteria documents—design guides organized by technical discipline—which provide guidance for the RFP preparer and design requirements for the Contractor's Designer of Record. They will apply to both design-bid-build and design-build projects. The process of creating the NDBM and the resulting Web site will clarify Navy policy, promote common practice within the Navy, promote design-build as a procurement method, and create uniform RFPs for Navy projects.

The Business Management System (BMS) is being deployed in phases. BMS will provide NAVFAC's employees and clients with Web-based access to its business processes. One of these, the Capital Improvements Acquisition Process, consists of seven steps:

(1) Project Initiation to develop the acquisition strategy (design and construction) and schedule
(2) Other Business Line Coordination (e.g., obtaining environmental services and NEPA compliance and finalizing real estate actions)
(3) Operational Outfitting Considerations (e.g., collateral and other equipment; operating permits; and the like)
(4) Construction Document Strategy Execution to develop scope of work and project requirements; execute A/E services contracts; develop acquisition clauses and finalize construction contract documents. The FACD and NDBM processes support this step
(5) Bids, Proposals and Contract Award
(6) Finalize Design and Build the Facility
(7) Project Closeout: Contract and Financial Closeouts; Client Feedback

The FACD, design-build procurement, and capital improvements acquisition processes have some similarities with other federal agency processes described in this chapter and to the preproject planning process described in Chapter 3. The early focus is on development of the project scope of work and the acquisition strategy. This process is compatible with the DBIA standard contract forms discussed in Chapter 2 in that the project scope is sufficiently developed prior to the award of the contract.

Smithsonian Institution

The SI has project managers permanently assigned to each building or bureau, so they are involved from the initiation of any project. The process was recently revised to create a control (baseline) scope and budget and to add a review at 35 percent design to reconfirm project scope prior to proceeding. This decision point was instituted to reduce the risk of changed project scopes of work and renegotiations. The new process includes charrettes and three PDRI reviews for some larger projects, the last of which is conducted at the 35-percent design review. This revised process is similar to the one used by NASA presented in Figure 5.

U.S. Air Force Air Combat Command

The ACC uses planning and design charrettes to involve stakeholders in project scope development. ACC finds these charrettes very helpful in developing a team approach to early scope definition. ACC considers charrette experience a prerequisite for A/E selection and includes the charrette requirements in its architect-engineer RFPs. ACC also documents project scope for all major projects in a Customer Concept Document (CCD), which becomes the foundation for the scope of work for design. This planning document details user requirements, project siting, base constraints, parametric cost estimates, general floor layouts, and any models. The standard Scope of Work for a CCD is contained in Appendix H.

The ACC spends a maximum of $50,000 to develop a CCD, including the design charrette. The CCD is completed during preproject planning and provides the basis for detailed design. The CCD is considered a critical step in gaining and documenting buy-in from the team members for the remainder of the project. ACC has experienced a steady decrease in the growth of military construction project costs: 4.3 percent for FY 1998 projects, 2.6 percent for FY 1999, and 1.6 percent for FY 2000. The improvement is attributed to ACC's preproject planning process, specifically its effective use of charrettes and CCDs.

U.S. Coast Guard

The USCG has developed the Shore Facilities Capital Asset Management (SFCAM) strategy, which combines strategic planning and a business approach to facilities management that considers the total cost of ownership and operation over a facility's operational life. The USCG couples this SFCAM strategy with regional strategic planning to ensure that facility projects and priorities are driven by mission requirements. This integrated decisionmaking approach is supported by the use of information technology to handle the data. The USCG also collects and distributes lessons learned and best practices in its facilities management program.

Department of State

The Department of State's Office of Overseas Buildings Operations (OBO), in conjunction with all its stakeholders, including the OMB and Congress has developed a long-range overseas buildings plan (LROBP).The LROBP outlines the facilities requirements—new construction, major renovation, security, and other programs with a long-term focus—necessary to support the State Department's priority diplomatic readiness goal. It provides the basis for proceeding in a logical and focused fashion to improve the safety and security of facilities overseas. Although it is not a budget document, the LROBP is an important planning tool to inform the budget decision-making process and to measure financial performance.

The OBO has specific and distinct areas of planning, design and construction. The planning office is responsible for both the LROBP and for Project Analysis Packages which outline project scope, cost, and schedule parameters. The Design and Engineering Division is responsible for managing the designs according to the Project Analysis Packages and for developing the RFPs for most major design-build projects. The Construction and Commissioning Division handles construction management and support.

Much of OBO's work for new construction uses a Standard Embassy Design (SED) and a design-build contracting strategy. OBO has developed a standard Request for Proposal (RFP) format for SED projects that

includes standard drawings, specifications, and an "Application Manual" to address site specific needs. OBO personnel report that this approach has significantly reduced project cycle time. The SED also incorporates a Lessons Learned module of ProjNet, a Web-based application developed by the U.S. Army Construction Engineering Research Laboratory to integrate continual feedback and improvement into the program. Each year SED documents are updated to incorporate lessons learned as well as new standards and guidelines. OBO has developed standardized scopes of work for multiple building types to be used for renovations and projects using a design-bid-build contracting strategy.

SUMMARY

Many processes, methods, and tools are used by federal agencies to conduct preproject planning and to develop scopes of work for design. One of the goals of this study is the dissemination of knowledge and experience gained by agencies in the successful execution of projects. Elements contributing to successful execution include a formal, structured preproject planning process; training to develop and maintain core competencies; projects that support agency mission and accurate business case analysis; identification and involvement of project stakeholders; selection of an appropriate acquisition strategy; use of processes and tools that encourage effective communication; risk quantification and assessment; and structured reviews of the project scope of work throughout development.

5

Policy Implications

Even if you are on the right track, you'll get run over if you just sit there.
—Will Rogers

Properly initiating a facility project is a complex task that involves significant effort in the areas of acquisition strategy, stakeholder identification, and preproject planning. An effort to improve the development of project scopes of work for federal facilities and the overall preproject planning process is challenging and requires consideration of diverse elements such as organizational behavior, architecture, engineering, project management, and law. This report is intended to be generic enough to be applicable to a diverse range of organizations and missions. However, it is important to point out issues that can provide a basis for improvement.

During the course of this investigation, it became clear that "pockets of excellence" exist for the planning of federal facility projects. Despite downsizing, loss of expertise due to retirements, and perceived administrative and legal hurdles, the interviewees were achieving good results in planning on at least some of the projects in their diverse portfolios. It was also enlightening to see the unique approaches of the different agencies, driven in large part by their distinctive mission requirements and histories.

The following discussion focuses on two areas—process and resources. Based on research and the authors' experience, agencies that address the findings pertaining to each of these areas can realize significant opportunities to positively impact the performance of their facilities programs and portfolios.

CONCLUSION AND FINDINGS

After reviewing the literature on this subject and conducting interviews, the authors concluded that *the key practice for developing an effective scope of work for design is to conduct a structured, consistent, and thorough preproject planning process and fully develop a project scope of work.* The preproject planning process incorporates a series of approval gates and involves organizing for the effort; selecting project alternatives; developing a project definition package; and making a decision on whether to proceed with the project. It is during this crucial stage that risks are analyzed, preliminary designs are formulated, critical decisions are made, and the specific project execution approach is defined.

Organizations that understand the importance of this process, that develop detailed process guidelines,

that measure the results (both level of effort and effectiveness) of the process, and that continuously improve over time will reap positive dividends. Consistency in applying these practices can improve an organization's entire project portfolio. The following findings relate to process.

Finding 1: "Pockets of excellence" for the planning of federal facilities projects exist within the agencies interviewed. However, few mechanisms are in place to widely and systematically share preproject planning lessons learned and successful processes within and between agencies.

Eleven of the 13 agencies interviewed have an established process for preproject planning. Nine of the agencies have clearly defined approval gates prior to the authorization of detailed designs; these agencies see the approval gates as a vital part of the process to improve the definition of project scopes of work and the accuracy of their cost estimates. More importantly, they base the scope of work for design on a detailed project scope definition package that has been developed with key stakeholder involvement. However, the study authors found that sharing of lessons learned and successful practices is not taking place on a consistent or widespread basis within or across agencies.

Finding 2: Different levels of effort and participant skill sets are required for different types of projects. Preproject planning efforts need to be tailored to the specific project type and its complexity.

Recognizing the appropriate level of effort and the skills needed to preplan for different types of facility projects is difficult yet critical for project success. Building projects differ from industrial projects in various ways, including the approach to the planning, design, and construction of facilities; the owner's perspective; the architectural focus; and the building's functions. It is often beneficial to structure a core team of five to seven individuals and to bring in representatives from additional key areas as needed. Clearly stated priorities among project cost, schedule, and quality features will assist all team members in making decisions regarding the project.

Finding 3: The first key element of an effective preproject planning process is to ensure that the agency is pursuing the "right" project. Preproject planning should begin with good leadership, effective and appropriate involvement of key stakeholders, and a detailed determination of project requirements.

Ideally, proposed facility projects will support the strategic intent and mission of an organization. The leadership should be technically proficient and knowledgeable of the preproject planning process, have defined responsibilities, be accountable for results, and remain focused. Team leadership should develop a culture of trust and honesty through kick-off meetings, establishing the importance of trust in the team's performance, developing long-term working relationships over a number of projects, and providing accurate information.

Research has shown that stakeholder identification and team alignment are critical to project success. A typical preproject planning team is comprised of representatives from a wide variety of functional groups with diverse priorities, requirements, and expectations. At a minimum, the team needs to include representatives from the business management group, operations group, construction, project management, and design personnel. If success is to be achieved, their objectives must be aligned through the development of a uniform set of project objectives that meets the organization's needs.

Ten of the 13 agencies interviewed have established processes for identifying stakeholders, and all of the agencies appear to establish their project teams with good representation from the user/client, facilities/project personnel, operations and maintenance groups, technical support functions, local representatives, and regulatory agencies.

Finding 4: To adequately develop a project scope of work, significant design effort by architects, engineers, and consultants is needed to translate project requirements into a basis for detailed design. In effect, a project's scope of work provides a bridge between the operational and business needs that the facility will meet and the technical aspects of project execution.

Staff in many organizations seem to think that project scope is adequately developed once the general requirements are defined and a preferred approach is chosen. However, significant design effort is needed to translate project requirements into a basis for detailed design. A well-developed project scope of work corresponds roughly to a 15- to 25-percent complete design effort. Major tasks include developing the technical requirements; performing risk management activities; developing the project control baseline including cost estimates; and documenting this information. The technical requirements should focus on site evaluation, flow design, design parameters, and equipment requirements.

Finding 5: Project scope verification with key stakeholders is critical. Some agencies use innovative methods to verify the project scope of work, such as planning charrettes, detailed planning checklists, and consensus scope reviews when the project design is 30- to 35-percent complete.

Proper use of tools and other techniques by the project team fosters open communication and acceptance of the project scope, schedule, estimates and work processes. Examples of such tools include work process diagrams, scope definition checklists, scheduling techniques, and risk analysis techniques. Periodic communication with stakeholders outside the preproject planning team can be accomplished through team meetings, newsletters, e-mail, video conferencing, town hall meetings, and computerized information management systems.

Finding 6: One element of an effective preproject planning process is the structured identification and management of risk. This effort is most effective when performed prior to "locking in" facility budgets and committing funds for detailed design and construction.

Finding 7: Only five of the agencies interviewed use a risk quantification tool prior to requesting detailed design funds. It appears that in many cases project scopes and budgets are locked in prior to significant efforts to define project scope.

The first key element of an effective preproject planning process is to ensure that the organization is performing the right project. One reason for investing in preproject planning is to determine whether a project should proceed. The proper time to do this is prior to congressional authorization. When the budget is locked in prior to detailed development of the project's scope, it is essentially viewed with more accuracy than it deserves. Funding a project based on such an estimate will almost certainly lead to project cost overruns or significant project scope changes during design and construction.

Processes and tools can be used to help the preproject planning team assess and measure scope definition risk elements and then develop mitigation plans. The Project Definition Rating Index developed by the Construction Industry Institute is one risk management tool that is being used by some private-sector organizations and some federal agencies.

Finding 8: Six agencies measure their performance on selected individual projects with respect to preproject planning practice usage, and nine measure project performance. However, none of the agencies interviewed indicated that they measure preproject planning, including project scope definition and team alignment practices, across their project management programs.

Measurement of preproject planning has been the subject of much study. Building and industrial projects with thorough preproject planning have consistently outperformed other projects in terms of cost, schedule, and number of change orders.

Six of the 13 agencies interviewed measure the degree or quality of their project scope definition, primarily through the use of checklists. Specific measures used to determine successful project scope definition for an individual project and from a program perspective were change orders, customer satisfaction, budget (cost) performance, schedule performance, time to execution, and whether the project was actually built or not. Some agencies use project-reporting systems to collect performance data and conduct periodic performance review

meetings. Those agencies that do not use metrics evaluated the level of scope definition through subjective review processes that rely primarily on the experience of the reviewers.

Finding 9: Although preproject planning appears to be done thoroughly on some federal projects, the overall planning effort is inconsistent. Most of the agencies interviewed limit their preproject planning efforts, especially relatively costly activities, to major projects.

Consistency in preproject planning efforts leads to better cost and schedule predictability as well as real cost savings. Experience in the private sector has shown that facility project portfolios with inconsistently applied preproject planning efforts tend to result in mediocre project performance and little improvement over time. It has also shown that smaller projects may be properly managed using abbreviated versions of the preproject planning processes and tools. Eight of the 13 agencies interviewed implement their preproject planning processes on all major projects.

In order for a preproject planning process to be effective, adequate *resources* (people, time, and money) must be applied. The availability of resources was a recurring theme throughout almost every interview, and the following findings relate to resources.

Finding 10: Private industry experience indicates that approximately 2 to 5 percent of a project's total cost will fund a cost-effective preproject planning effort (i.e., one that results in a facility project that is on time and within budget). Only three agencies reported this level of investment.

A comprehensive preproject planning process includes a team charter that outlines team members' roles and responsibilities, budget, schedule, and objectives. Lack of funding is many times cited as one of the most significant barriers to gaining alignment among team members on a project's objectives and in performing thorough preproject planning. Eleven of the 13 agencies interviewed mentioned resource constraints—funding and manpower shortages—as having a negative impact on their preproject planning efforts.

Finding 11: Some agencies have "fenced" their preproject planning funds, whereas others use operational funds. To ensure that planning efforts do not compete with operational priorities, dedicating funds to projects and/or preproject planning appears to be a better approach than using operational funds.

Eight of the 13 agencies interviewed fund preproject planning through their operations budgets, which allows the agencies to shift funds from planning to other operational priorities. Five agencies fund planning efforts with capital funds set aside at the headquarters level; representatives from these agencies thought their planning funds were adequate.

Finding 12: The length of the federal budget cycle adversely affects the preproject planning process for facilities. With planning horizons of four to seven years, preproject planning requirements are often not taken seriously enough by participants because the project is not an immediate concern, and many believe that the needs will likely change over time.

The long duration of the process for congressionally funded projects is a significant challenge. Changes in mission and personnel between the identification of project requirements and facility construction often cause requests for new requirements and result in late scope changes. Preproject planning documentation can help control project scope changes.

Finding 13: Few agencies adequately train their staffs about industry- and organization-specific preproject planning processes. With some exceptions, federal agencies rely on experience as the main source of preproject planning expertise and provide few training programs related to planning processes.

Effective training and mentoring are necessary to successfully implement preproject planning processes and to transfer institutional experience to new managers. Six of the 13 agencies interviewed conduct training on their preproject planning processes and tools, but the level of detail varies. Some agencies rely solely on the experience of their project managers and on-the-job training.

Finding 14: The loss of preproject planning expertise continues in federal agencies as large numbers of professionals retire or leave for other reasons. Many more retirements are imminent. The situation is especially problematic for agencies that rely almost exclusively on experience, rather than structured processes, to develop project scopes of work.

A recent study of the private sector found that the loss of white-collar workers in the project professional ranks over the next few years will be a significant challenge for both owners and contractors. The loss of corporate knowledge as experienced workers leave or retire is a key issue in that experienced personnel have the tacit organizational knowledge and skills to ensure that preproject planning is effectively and consistently performed.

In 12 of the 13 agencies interviewed, the preproject planning process is managed through contracts as well as by in-house staff. The persons interviewed for this study had an average of 28 years of work experience. "Lessons learned" programs and organizational processes can aid in institutionalizing tacit knowledge in order to maintain the continuity of federal agencies' capacities to effectively plan and manage facility projects.

Finding 15: The project manager is a key stakeholder and should be involved in the project scope development. In some cases, a project manager is assigned to a project after planning is complete. This can create serious problems with alignment of the team and the loss of project-specific knowledge.

Continuity of project leadership is an important feature of a good preproject planning process. Six of the 13 agencies interviewed assign project managers prior to detailed project scope development. The others transfer project leadership after the project scope of work is developed. In situations where continuity of leadership and project management will not be maintained, research has shown that a well-defined preproject planning process, documentation of the project scope of work and the decisions made, and a well-structured turnover procedure that includes a turnover meeting and project reviews with new stakeholders can mitigate alignment problems and minimize project scope changes during detailed design and construction.

KEY PRACTICES

The requirements and processes needed to effectively initiate a facility project are well known in many organizations, both public and private. Examples of the preproject planning process, resources needed, and available tools are discussed in Chapters 2, 3, and 4 of this report. Based on research and the study authors' experience, the following key practices could help federal facilities organizations improve their development of project scopes of work and preproject planning processes:

- Develop and implement a standardized preproject planning process using experienced, technically proficient personnel and provide them with adequate resources (people, time, and money). The owner organization (the federal agency) should lead the planning effort, although some tasks can be outsourced to contractors.
- Measure the level of effort expended in preproject planning so that the outcomes of the process can be continuously improved over time.
- Develop an effective acquisition strategy and set realistic and effective project control baselines in the preproject planning process to ensure a smooth transition into the execution phase and overall project success. Without an effective execution approach, the project will likely flounder and require significant management involvement.
- Institute a standardized project scope of work communication process, including contract requirements and transition meetings, based on the agency's available project management resources, mission, and expertise.

• Ensure that the agency pursues the right projects for its strategic direction through appropriate stakeholder involvement and team alignment. Project participants' understanding of the driving factors and priorities for a project is essential if the project scope of work is to reflect critical needs.

PATH FORWARD

It is well understood by experienced practitioners in the construction industry that poor facility project scope definition is one of the major factors leading to poor project performance. As related here, past research gives solid evidence that proper preproject planning provides the foundation for effective communication through a project scope of work document and can significantly enhance the predictability of project performance, improve user satisfaction, and provide real cost and schedule savings. Individual project managers and participants, using the tools and techniques identified in this report, can improve project performance and ensure the effective use of resources. Given that the federal government spends in excess of $20 billion annually on facility projects, cost savings of even single-digit percentages are significant.

However, on a programmatic level, none of these steps will be successful without upper-management involvement and support. Once preproject planning is complete and a project enters detailed design, the study authors believe that management should defend the project plans developed by the team and not encourage or allow scope changes unless absolutely necessary. Senior-level managers, in the authors' opinions, should adopt the practice of delegating effective authority to project managers and back up project managers' decisions in order to keep projects on schedule and on budget. They should support the idea that every project will be effectively planned, should understand the process, and should ensure that effective preproject planning is being conducted through questioning at project review meetings; providing resources to support process implementation and training; assuring adequate strategic flexibility (including cost and schedule contingency); maintaining discipline in sticking to the plan; and benchmarking performance.

Preproject planning is a process that works best with experienced and knowledgeable planning personnel. Given the current potential crisis in the federal work force in terms of resource levels and imminent retirements, it is important to protect and foster this expertise in each organization.

With an effective preproject planning process in place and the participants trained, management can monitor the process through in-process audits, performance benchmarking, and direct observation/interaction. Project team members can be held accountable for the level of planning completed and for project performance. Identifying projects as being in trouble late in the execution phase is not an effective means of preventing problems or monitoring progress.

Implementation of these principles can improve project team formation and cohesiveness, alignment of project goals, and project scope definition. The results will include the ability to accurately transfer requirements to designers and construction contractors through contract documents, the ability to predict cost and schedule performance with greater accuracy, and the realization of savings through fewer change orders and shorter schedules in the execution of construction projects.

FUTURE STUDY

Although this study looked at 13 federal agencies and a large body of literature, it was limited in its scope. A more detailed and wide-ranging study could include many more interviews and agencies, analysis of completed project data, and comparison of planning and performance metrics among government agencies and with private industry. The objective would be to go into more depth in identifying the issues that are most important, and sometimes unique, about preproject planning for facility construction by government agencies. One topic that was particularly difficult to develop because of the limited nature of this study was that of matching acquisition strategy with project delivery method, including the level of scope definition required for different acquisition strategies. As noted in Chapter 1, the Federal Facilities Council will sponsor a follow-on study to address this particular issue.

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Appendixes

A

Record of Meetings and Interviews

November 13, 2001	Government/Industry Forum on the Owner's Role in Project Management and Pre-Project Planning, Washington, D.C.
February 15, 2002	Stanley Kaczmarczyk, Office of Governmentwide Policy, General Services Administration, Washington, D.C., and Co-chair, Federal Facilities Council Standing Committee on Organizational Performance and Management
February 18, 2002	Bill Stamper, Senior Program Manager, Facilities Engineering Division, National Aeronautics and Space Administration, Washington, D.C., and Co-chair, Federal Facilities Council Standing Committee on Organizational Performance and Management
February 22, 2002	Federal Facilities Council Organizational Performance and Management Committee Meeting, Washington, D.C.
March 15, 2002	Bob Hixon, Director for Construction Engineering, Office of the Chief Architect, General Services Administration, Washington, D.C.
March 18, 2002	Steve Campbell, Chief, Project Management Office, NASA Johnson Space Center, Houston, Texas
March 28, 2002	Mike Ethier, Chief of Construction (West), Headquarters, Air Combat Command, U.S. Air Force, Langley, Virginia.
	Steve White, Project Manager, Headquarters, Air Combat Command, U.S. Air Force, Langley, Virginia
April 11, 2002	Robert Thompson, Deputy Chief Engineer and Associate Director, Design and Engineering Operations, Naval Facilities Engineering Command, Washington, D.C.

April 11, 2002	Walter Borys, Office of Engineering and Technical Services, International Broadcasting Bureau, Washington, D.C.
April 11, 2002	Wayne Lewis, Value Engineer, U.S. Army Corps of Engineers, Northwestern Division, Omaha, Nebraska
April 15, 2002	Chip Wanner, President, Pacific Connection, Phoenix, Arizona
April 15, 2002	Dan Lehman, Director, Construction Management Support Division, Office of Science, Department of Energy, Germantown, Maryland, and Jim Carney, Engineering and Construction Manager, Office of Science, Department of Energy, Germantown, Maryland
April 16, 2002	Bill Sloan, Deputy Director, Capital Improvements, Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina.
April 18, 2002	John Irby, Director, Federal Facilities Division/Washington Headquarters, Real Estate and Facilities Directorate, Department of Defense, Washington, D.C.
April 22, 2002	Raleigh Leef, Deputy Chief, Planning and Policy Division, Directorate of Civil Works, U.S. Army Corps of Engineers, Washington, D.C.
April 23, 2002	Kyle Jones, Program Area Manager, Mississippi River and Tributaries Project, U.S. Army Corps of Engineers, Washington, D.C.
April 25, 2002	David Eakin, Chief Engineer, Office of the Chief Architect, General Services Administration, Washington, D.C.
May 2, 2002	Willie Clark, Director, Office of Project Management and Engineering Support, National Nuclear Security Agency, Department of Energy, Germantown, Maryland
May 2, 2002	Robert Neary, Chief Facilities Management Officer, Office of Facilities Management, Department of Veterans Affairs, Washington, D.C.
	Tom Anglim, Director, Project Management Services, Office of Facilities Management, Department of Veterans Affairs, Washington, D.C.
May 6, 2002	Kirby Perry, Principal, Pi Architects and Engineers, Austin, Texas
May 8, 2002	Bob Ridgely, Senior Architect/Design Manager/Team Leader, Office of Engineering, Design, and Construction, Smithsonian Institution, Washington, D.C.
May 17, 2002	Capt. Jose Cuzme, Director, Division of Facilities Planning and Construction, Indian Health Service, Rockville, Maryland
May 22, 2002	Christine Hendzlik, Project Manager, Military Branch, U.S. Army Corps of Engineers, Kansas City District, Kansas City, Missouri
June 25, 2002	Nancy Wilkie, Design Quality Assurance Coordinator, U.S. Department of State, Arlington, Virginia

July 12, 2002	Lt. Comdr. Jack Dempsey, Capital Asset Manager, Shore Facilities Capital Management Division, Office of Civil Engineering, U.S. Coast Guard, Washington, D.C.
August 8, 2002	John Tato II, Director, Project Evaluation and Analysis Division, U. S. Department of State, Arlington, Virginia

B

Structured Interview Instrument

Date and time:

Background information:
Name -
Position -
Address -
Telephone/e-mail -
Experience, _____ years total / _____ years at current organization
What is the approximate yearly capital budget for your organization?
How many projects?
Types of projects?

Breakdown of new construction vs. maintenance/repair projects?

Stakeholder Identification Process:
Does your organization have a process for stakeholder identification?
Does your organization measure the effectiveness of the stakeholder identification process? How?
Describe your stakeholder identification process.
Who is typically included in your project team?
How is this process influenced/limited by federal agency planning, programming, and budgeting processes?

Preproject Planning Process:
Does your organization have a process for preproject planning?
Does your organization measure PPP usage—process metrics?
Does your organization measure project performance?
How do you know when you have succeeded in defining the project scope (from a program perspective)?
Describe your PPP process.
At what point in the process does it become a "project", have a Project Manager assigned, etc.?

At what point in the process do you develop the scope of design services?
Do you have a standard scope of design services?
What are its strong points?
In what areas should it be improved?
At what point in the process do you award the design (or design-build) contract?
How frequently does the delivered facility match the approved scope? What process is in place to ensure this occurs?

How do you fund planning activities?
How much is typically spent on planning (percentage of Total Installed Cost)?
How is this planning process influenced/limited by federal agency planning, programming, and budgeting processes?

Acquisition Strategy Process:
Does your organization have a process for acquisition strategy?
What are your limitations with respect to acquisition alternatives?
Does your organization measure the effectiveness of the acquisition strategy process? How?
Describe your acquisition strategy process.
How does your acquisition strategy process influence your stakeholder identification and preproject planning processes?
How is this process influenced/limited by federal agency planning, programming, and budgeting processes?

Best practices:
Does your organization do anything unique in planning, stakeholder identification/input, or acquisition strategy that you would consider a best practice?
What do you consider the most important components of your organization's planning, stakeholder identification, and acquisition strategy processes?
What do you think could be improved in your planning, stakeholder identification, and acquisition strategy processes?
Do you conduct training into the details of your PPP process and planning techniques?
Does your agency measure/estimate the benefit/cost ratio (with respect to cost and/or schedule savings) of these processes?
What guidance would you give to this study to improve facilities planning in the U.S. Federal Government?

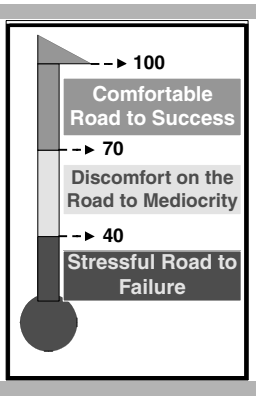
Thank you very much for your time!

C

Alignment Thermometer

Pre-Project Planning(PPP) Alignment Thermometer

(Five Steps to Greater Success)



Step 1. **Circle the number in the column that best shows your Level of Agreement with each of the following statements:**

Legend:
1=Strongly Disagree
5=Strongly Agree

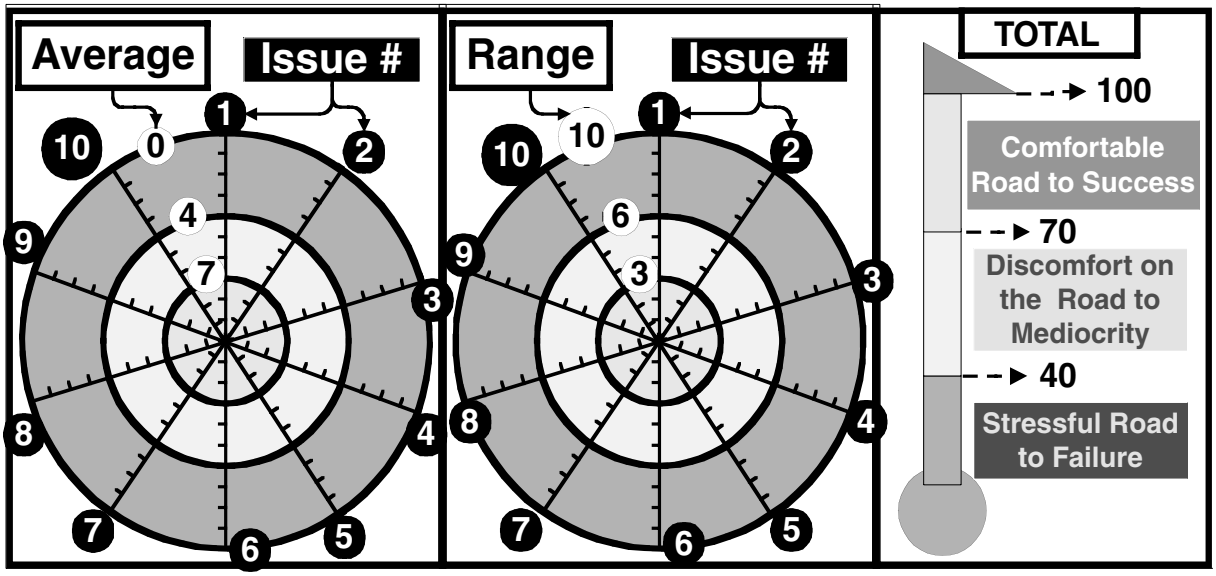
Project Name:	LEVEL OF AGREEMENT					
ALIGNMENT ISSUES	**1**	**2**	**3**	**4**	**5**	**SCORE**
1. Stakeholders are appropriately represented on the Project Team.	0	3	5	8	10	
2. Project leadership is defined, effective, and accountable.	0	3	5	8	10	
3. The priority between cost, schedule and required project features is clear.	0	3	5	8	10	
4. Communication within the team and with stakeholders is open and effective.	0	3	5	8	10	
5. Team meetings are timely and productive.	0	3	5	8	10	
6. Our team culture fosters trust, honesty, and shared values.	0	3	5	8	10	
7. The PPP process includes sufficient funding, schedule and scope to meet our objectives.	0	3	5	8	10	
8. Reward and recognition systems promote meeting project objectives.	0	3	5	8	10	
9. Teamwork and team building programs are effective .	0	3	5	8	10	
10. Planning tools (e.g., checklists, simulations and work flow diagrams) are effectively used.	0	3	5	8	10	
					TOTAL SCORE	

Step 2. **Place the circled number in the Score column. Add the column to obtain your total score.**

Step 3. Plot your teams answers in the appropriate column and calculate the Average, Range (high score - low score) and Range Average.

TEAM SCORE	Respondent									
Issue	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Calculated Average**	**Calculated Range**	**Range/ Average**
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
						TOTAL				

Step 4. Plot the Average and Range for each question and the Total on the Thermometer.



Step 5. All questions with results in the outer ring require discussion to either improve the situation or to determine why it is not an important issue for this project. A large Range Average likely indicates an issue for special concern.

D

PDRI for Buildings Score Sheet

(CII, 1999)

SECTION I - BASIS OF PROJECT DECISION							
CATEGORY Element	Definition Level 0	1	2	3	4	5	Score
A. BUSINESS STRATEGY (Maximum = 214)							
A1. Building Use	0	1	12	23	33	44	
A2. Business Justification	0	1	8	14	21	27	
A3. Business Plan	0	2	8	14	20	26	
A4. Economic Analysis	0	2	6	11	16	21	
A5. Facility Requirements	0	2	9	16	23	31	
A6. Future Expansion/Alteration Considerations	0	1	7	12	17	22	
A7. Site Selection Considerations	0	1	8	15	21	28	
A8. Project Objectives Statement	0	1	4	8	11	15	
CATEGORY A TOTAL							
B. OWNER PHILOSOPHIES (Maximum = 68)							
B1. Reliability Philosophy	0	1	5	10	14	18	
B2. Maintenance Philosophy	0	1	5	9	12	16	
B3. Operating Philosophy	0	1	5	8	12	15	
B4. Design Philosophy	0	1	6	10	14	19	
CATEGORY B TOTAL							
C. PROJECT REQUIREMENTS (Maximum = 131)							
C1. Value-Analysis Process	0	1	6	10	14	19	
C2. Project Design Criteria	0	1	7	13	18	24	
C3. Evaluation of Existing Facilities	0	2	7	13	19	24	
C4. Scope of Work Overview	0	1	5	9	13	17	
C5. Project Schedule	0	2	6	11	15	20	
C6. Project Cost Estimate	0	2	8	15	21	27	
CATEGORY C TOTAL							
Section I Maximum Score = 413					**SECTION I TOTAL**		

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

SECTION II - BASIS OF DESIGN							
CATEGORY Element	Definition Level **0**	**1**	**2**	**3**	**4**	**5**	**Score**
D. SITE INFORMATION (Maximum = 108)							
D1. Site Layout	0	1	4	7	10	14	
D2. Site Surveys	0	1	4	8	11	14	
D3. Civil/Geotechnical Information	0	2	6	10	14	19	
D4. Governing Regulatory Requirements	0	1	4	8	11	14	
D5. Environmental Assessment	0	1	5	9	12	16	
D6. Utility Sources with Supply Conditions	0	1	4	7	10	13	
D7. Site Life Safety Considerations	0	1	2	4	6	8	
D8. Special Water and Waste Treatment Requirements	0	1	3	6	8	11	
CATEGORY D TOTAL							
E. BUILDING PROGRAMMING (Maximum = 162)							
E1. Program Statement	0	1	5	9	12	16	
E2. Building Summary Space List	0	1	6	11	16	21	
E3. Overall Adjacency Diagrams	0	1	3	6	8	10	
E4. Stacking Diagrams	0	1	4	7	10	13	
E5. Growth & Phased Development	0	1	5	8	12	15	
E6. Circulation and Open Space Requirements	0	1	4	7	10	13	
E7. Functional Relationship Diagrams/Room by Room	0	1	3	5	8	10	
E8. Loading/Unloading/Storage Facilities Requirements	0	1	2	4	6	8	
E9. Transportation Requirements	0	1	3	5	7	9	
E10. Building Finishes	0	1	5	8	12	15	
E11. Room Data Sheets	0	1	4	7	10	13	
E12. Furnishings, Equipment, & Built-Ins	0	1	4	8	11	14	
E13. Window Treatment	0	0	2	3	4	5	
CATEGORY E TOTAL							
F. BUILDING/PROJECT DESIGN PARAMETERS (Maximum = 122)							
F1. Civil/Site Design	0	1	4	7	11	14	
F2. Architectural Design	0	1	7	12	17	22	
F3. Structural Design	0	1	5	9	14	18	
F4. Mechanical Design	0	2	6	11	15	20	
F5. Electrical Design	0	1	5	8	12	15	
F6. Building Life Safety Requirements	0	1	3	5	8	10	
F7. Constructability Analysis	0	1	4	8	11	14	
F8. Technological Sophistication	0	1	3	5	7	9	
CATEGORY F TOTAL							

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

SECTION II - BASIS OF DESIGN (Contd)							
CATEGORY Element	Definition Level 0	1	2	3	4	5	Score
G. EQUIPMENT (Maximum = 36)							
G1. Equipment List	0	1	5	8	12	15	
G2. Equipment Location Drawings	0	1	3	5	8	10	
G3. Equipment Utility Requirements	0	1	4	6	9	11	
						CATEGORY G TOTAL	
Section II Maximum Score = 428						***SECTION II TOTAL***	

SECTION III - EXECUTION APPROACH							
CATEGORY Element	Definition Level 0	1	2	3	4	5	Score
H. PROCUREMENT STRATEGY (Maximum = 25)							
H1. Identify Long Lead/Critical Equip. & Materials	0	1	4	7	10	14	
H2. Procurement Procedures and Plans	0	1	3	6	9	11	
						CATEGORY H TOTAL	
J. DELIVERABLES (Maximum = 11)							
J1. CADD/Model Requirements	0	0	1	2	3	4	
J2. Documentation/Deliverables	0	1	2	4	6	7	
						CATEGORY J TOTAL	
K. PROJECT CONTROL (Maximum = 63)							
K1. Project Quality Assurance and Control	0	1	3	4	6	8	
K2. Project Cost Control	0	1	4	7	10	13	
K3. Project Schedule Control	0	1	4	8	11	14	
K4. Risk Management	0	1	6	10	14	18	
K5. Safety Procedures	0	1	3	5	7	9	
						CATEGORY K TOTAL	
L. PROJECT EXECUTION PLAN (Maximum = 60)							
L1. Project Organization	0	1	3	5	8	10	
L2. Owner Approval Requirements	0	1	4	6	9	11	
L3. Project Delivery Method	0	1	5	8	12	15	
L4. Design/Construction Plan & Approach	0	1	4	8	11	15	
L5. Substantial Completion Requirements	0	1	3	5	7	9	
						CATEGORY L TOTAL	
Section III Maximum Score = 159						**SECTION III TOTAL**	

PDRI TOTAL SCORE (Max. Score 1000)

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

E

Example PDRI Element Descriptions

Note: The three element descriptions given in this appendix comprise one category and are provided for illustrative purposes. Descriptions for the 61 other elements are contained in CII Implementation Resource 155-2 (Construction Industry Institute, 1999).

G. EQUIPMENT

G1. Equipment List

Project-specific equipment should be defined and listed. (Note: Building systems equipment is addressed in element F4, Mechanical Design, and F5, Electrical Design). In situations where owners are furnishing equipment, the equipment should be properly defined and purchased. The list should define items such as:

- ❑ Process
- ❑ Medical
- ❑ Food service/vending
- ❑ Trash disposal
- ❑ Distributed control systems
- ❑ Material handling
- ❑ Existing sources and characteristics of equipment:
  - ❑ Relative sizes
  - ❑ Weights
  - ❑ Location
  - ❑ Capacities
  - ❑ Materials of construction
  - ❑ Insulation and painting requirements
  - ❑ Equipment related access
  - ❑ Vendor, model, and serial number once identified
  - ❑ Equipment delivery time, if known
  - ❑ Other

G2. Equipment Location Drawings

Equipment location/arrangement drawings identify the specific location of each item of equipment in a project. These drawings should identify items such as:

- ❑ Plan and elevation views of equipment and platforms
- ❑ Location of equipment rooms
- ❑ Physical support requirement (e.g., installation bolt patterns)
- ❑ Coordinates or location of all major equipment
- ❑ Other

G3. Equipment Utility Requirements

This evaluation should consist of a tabulated list of utility requirements for all major equipment items such as:

- ❑ Power and/or all utility requirements
- ❑ Flow diagrams
- ❑ Design temperature and pressure
- ❑ Diversity of use
- ❑ Gas
- ❑ Water
- ❑ Other

F

Stakeholder Identification Checklist

(Adapted from NASA, 2001)

	Function	**POC**
1.	Architectural	
2.	Civil	
3.	Structural	
4.	Mechanical	
5.	Electrical	
6.	Energy Monitoring and Control Systems	
7.	Environmental	
8.	Operations	
9.	Construction	
10.	Safety, Reliability, and Quality Assurance	
11.	Security	
12.	Information Systems	
	Telephones	
	Data Communications	
13.	Pressure Systems	
14.	Energy Conservation Manager	
15.	Special Purpose Maintenance	
16.	Industrial Health	
17.	Client Organization	
18.	Facility Manager	
19.	Space Allocation.	

G

DOE Acquisition Strategy Format

(DOE, 2002)

The Mission Needs Statement (MNS) and associated justification will have identified the conceivable range of acquisition alternatives. The Acquisition Strategy (AS) should be a logical extension narrowing the range of acquisition alternatives to the one or set best suited to the project. Each Acquisition Strategy is prepared pursuant to the following elements with the understanding that some elements listed may not apply in all instances. The Acquisition Strategy may be tailored to suit the size, risk, and complexity of the project. Tailoring is in the degree of detail, based on the project's size, risk, and complexity, not in omitting the requirements altogether. A brief statement in the Acquisition Strategy explaining why an element is not applicable or tailored to a project is required for the Secretarial Acquisition Executive/Acquisition Executive. The Acquisition Strategy should focus on quality rather than quantity.

The Acquisition Strategy documents the Integrated Project Team's consideration of the following required elements and recommended format:

I. ACQUISITION BACKGROUND AND OBJECTIVES
   A. Introduction
      1. Summary project description, need, and benefits to be realized
      2. Identification of authoritative source documents, e.g., Operational Requirements Document, DOE Strategic Plan, Legislation, approved MNS
      3. Status of requirements definition (e.g., not yet complete; complete and current; being revised)
      4. State all significant conditions affecting the project related to compatibility, capability, or performance with existing systems

   B. Program Structure
      1. Summary diagram of the Program elements, activities, and organizations
      2. Acquisition Steps
         a. Identify the Phase and what is to be accomplished, including the Criteria, Maturity of system design and system specification at end of each step, Other projects or steps
         b. Key Events and Milestones (e.g., design reviews; tests)

3. Integrated Project Team (IPT)
   Identify the IPT lead and members. The IPT is led by the Federal program or project manager. The IPT includes other DOE functional areas such as budget, financial, legal, safety, and contracting. Describe each member's functions, roles and responsibilities, line and matrix reporting relationships, and contact data for the proposed project. List the individuals who participated in preparing the AS.
4. Interfaces
   Describe interfaces with other DOE organizations, National Laboratories or outside stakeholders. When a site is subject to the requirements of DOE Acquisition Letter 2000-08 of August 18, 2000, requiring a Site Utilization and Management Plan, the project is to be consistent with that site plan. Discuss the impact of this project and its associated contracts and how coordination among programs/projects at the site has been considered for the attainment of the site's mission.

C. Risk and Risk Assessment
   Summarize technical, schedule, and cost risks. Coverage should include the following (1, 2, 3, 4). Major types of contractors proposed should be based upon the risk analysis and integrated with the RMP
   1. Technical Analysis and Mitigative Strategies
   2. Schedule Analysis and Mitigative Strategies
   3. Cost Analysis and Mitigative Strategies
   4. Programmatic and Contract Analysis and Mitigative Strategies

D. Approach to Managing Program/Project Cost and Performance
   1. Establishing cost objectives
   2. Managing trade-offs between cost and performance including anticipated evolution of trade space, how trade-offs will be encouraged, and DOE's role in managing or approving trade-offs
   3. Total Project Cost (TCP) Range
      List the TPC Range, which tracks to the Budget, and summarize the supporting rationale. Identify and discuss cost differences between the Budget and the AS. TPC consists of all the costs included in the TEC of a construction project, plus Other Project Costs, which are costs specifically allocated to the project, such as conceptual design, and research and development, as well as the costs associated with the operational phase, such as training and startup costs. Discuss the following related cost concepts to be employed, as appropriate:
      a. Discuss how life-cycle cost will be considered and the cost model used to develop the estimate.
      b. Describe the design-to-cost objective(s) and underlying assumptions. Describe how objectives are to be applied, tracked, and enforced.
      c. Describe the application of should-cost analysis to the project.

E. Acquisition Trade-offs and Streamlining
   Summarize the pros and cons of alternative acquisition approaches used to down select from Critical Decision-0 to Critical Decision-1. The AS should be a logical extension of the alternatives identified at Critical Decision-0 narrowed to the one plan or set best suited for satisfying the mission need in the most effective, economical, and timely manner. Each identified alternative course of action should include, in addition to new construction, use of similar facilities at other sites, renovate existing space, rent space, and so forth. Each alternative would also include: do nothing, DOE to directly execute the PM functions, DOE execute direct contract with a construction manager, M&O/M&I contractor execute the PM functions, a combination DOE private sector PM and other Federal agency PM, etc. Discuss the expected consequences of trade-offs among the various cost, capability or performance, and schedule goal ranges. Discuss plans and procedures to encourage industry participation by using draft solicitations, pre-solicitation conferences and other streamlining initiatives.

F. Program Management
   1. General philosophy and approach
   2. Responsibilities
   3. Resources
      a. Funding
      b. Staffing
         1) DOE
         2) Contractor support
   4. Internal controls
   5. Tailoring and streamlining plans
      a. Requests for relief or exemption from requirements
      b. Other tailoring or streamlining plans

G. Support Concepts and Strategy for Implementing Information Technology

II. PLAN OF ACTION—BUSINESS AND CONTRACTING STRATEGY

A. Sources

Indicate the range of prospective sources of supplies and services that can meet the need. Include consideration of small business, small disadvantaged business, and women-owned small business concerns. Address the extent, results and planned market research.

B. Competition

Discuss the methods of competition that will be sought, promoted, and sustained throughout the course of the project. If full and open competition is not contemplated, discuss the basis of the application of that authority; identify the source(s) and summarize the decision why full and open competition cannot be obtained. If there are known barriers to increasing competition, address how to overcome them.

C. Source-selection Procedures

Discuss general source-selection procedures, including the estimated timing for submission and evaluation of proposals and a general discussion of prequalification and evaluation factors.

D. Contracting Considerations

For each major contract contemplated discuss the contract type selected; special contract method alternatives, e.g., design-build, design-negotiate-build; special clauses (e.g., Value Management) or deviations required; whether sealed bidding, negotiation, or best value will be used and why; and lease or purchase decisions.

E. Budgeting and Funding

Explain how budget estimates were derived and the schedule for obtaining adequate funds at the time they are required. Explain any differences from the Budget.

F. Product or Service Descriptions

Explain the choice of product or service description types (e.g., design specifications, performance-based contracting descriptions) to be used in the acquisitions.

G. Priorities, Allocations, and Allotments

Specify the method of obtaining and using priorities, allocations, and allotments and the reasons for them, if applicable.

H. Contractor vs. Government Performance
Address the consideration given to OMB Circular A-76.

I. Inherently Governmental Functions
Address the consideration given to Office of Federal Procurement Policy Letter 92-1.

J. Management Information Requirements
Discuss, as appropriate, what management system will be used by the Government to monitor the contractor's effort, e.g., earned value management system. Discuss Federal staffing, skills and structure that will be required to manage the project.

K. Test and Evaluation
To the extent applicable, describe the test program of the contractor and the Government for each major phase of the acquisitions.

L. Logistic Considerations
Discuss the assumptions determining contractor or agency support over the life of the acquisition, including computer-aided acquisition systems, maintenance and servicing, and other technical considerations.
Describe the requirements for contractor data and data rights, their estimated cost, and the use to be made of the data.
Describe the reliability, maintainability, and quality assurance requirements including any planned use of warranties.

M. Government-Furnished Property
Indicate any property to be furnished to contractors, including material and facilities, and discuss any associated considerations, such as availability or the schedule for its acquisition.

N. Government-Furnished Information
Discuss any Government information such as manuals, drawings, and test data to be provided to prospective offerors and contractors.

O. Environmental and Energy Conservation Objectives
Discuss applicable environmental and energy conservation objectives.
Discuss the applicability of an environmental assessment or environmental impact statement, the proposed resolution of any environmentally related requirements to be included in solicitations and contracts.

P. Security Considerations
For acquisitions dealing with classified matters, discuss how adequate security will be established, maintained, and monitored.

Q. Safety Requirements and Considerations
Describe Environment, Safety, and Health requirements, including applicability of an Integrated Safety Management System.

R. Contract Administration
Describe how the contract will be administered, including roles and responsibilities for inspection, acceptance, validation, and verification of performance.

S. Other Considerations
Discuss any other matter that is germane to the plan and is not covered elsewhere.

If new construction, state the square footage and address the elimination by transfer, sale, or demolition of excess buildings and facilities of equivalent size by site. This excess reduction to new construction formula does not apply to environmental management closure sites.
If applicable, sustainable building design principles are to be applied to the siting, design, and construction of new facilities.

T. Milestones for the Acquisition Cycle
Address the expected sequencing of major contracts and their major steps, e.g., contract acquisition plan approval, issuance of synopsis, issuance of solicitation, evaluation of proposals, negotiations, and contact award. List long-lead procurement items with a capital funds budget request and the acquisition strategy for obtaining them, if applicable.

H

Air Combat Command
Scope of Work for Customer Concept Document

I. Scope of Work

A. General. This Scope of Work supplements Section C of the Basic Contract and sets forth the specific requirements for the performance of the Architect-Engineer (A-E) services required under this Delivery Order. The Architect-Engineer, as an independent contractor and not as an agent of the Government, shall, in accordance with the terms and conditions more particularly set forth below, furnish all labor, management, facilities, supplies, equipment and material (other than those to be furnished by the Government as hereinafter specified), and do all things necessary for the performance of the work as set forth below. The Architect-Engineer shall accomplish the required services and furnish to the Government, reports and other data together with supporting material developed during the period of service. During the prosecution of the work, the Architect-Engineer shall provide adequate professional supervision and quality control to assure the accuracy, quality, completeness, and progress of the work. The A-E shall submit, to the Contracting Officer, the qualifications of any key personnel that differ from those submitted on the SF 255 used for selection of the Basic contract.

B. Work To Be Performed. The work includes the accomplishment of a program verification/user survey, site survey, AT/FP meeting, and charrette (concurrently over a period of 3-5 days), at Cannon AFB NM. The A-E shall subsequently prepare a Charrette Report/Customer Concept Document (CR/CCD) based on the information gathered and developed during the surveys and the Charrette. The project Scope, Programmed Amount (PA), and Description of Proposed Construction are defined in the attached DD Form 1391. The estimated construction cost limitation is $3.1 million dollars. The sequence of work is as follows:

1. Program Verification/User Survey. The A-E shall conduct program verification/user survey interviews with representatives of the Using Agency, Base Civil Engineers, and HQ ACC. The intent of the survey is to verify all programming and user requirements. The user survey shall include gathering information concerning: user activities, number of personnel, equipment, utility requirements and site requirements.

2. Site Survey. The A-E shall visit the proposed site to verify and document visible site utilities and existing conditions that may affect the construction of the project. Site surveys shall include gather-

ing existing information concerning: the site topography, utilities, soil data, environmental data, and infrastructure. The A-E is to obtain site and utility drawings at the Program Verification/User Survey. The A-E shall review the existing documents pertaining to the site and evaluate existing conditions in the immediate proximity of the project to determine if such conditions may affect any proposed construction. The A-E shall photograph the site, using color digital photography, to show the initial conditions affecting the design. Color digital photographs of the site shall be included in the CR/CCD. The A-E must comply with regulations governing the use of photographic equipment on the site visited. Digital photographs shall be provided to the Government in jpeg file format with a minimum resolution of 640x480 pixels.

3. Charrette. The A-E shall conduct a charrette with representatives of the Using Agency, Base Civil Engineers, and HQ ACC. The intent of the charrette is to plan the building and site by defining: user functional relationships between activities, square meter requirements for each activity, floor plan layouts, exterior elevations, and construction cost estimates.

a. The A-E shall provide all necessary equipment to provide drawings and costs of the site layout, floor plans, and exterior elevations developed during the charrette.

b. The A-E shall present the selected site and building concept drawings and a programmatic cost estimate on the last day of the charrette.

4. Charrette Documents. The A-E shall prepare the charrette meeting notes and submit them along with the documents developed at the charrette including the block floor diagram, elevations, site plan and a one page programmatic cost estimate in an 8½" x 11" format, for the selected plan.

5. CR/CCD. The A-E shall prepare a CR/CCD report, in bullet format, describing all proceedings of the charrette including the program verification/user survey minutes, validated project description, special design considerations, site photographs, site opportunities and constraints, General Plan information, facility organization diagram, programmatic cost estimate, and open action items. The “Charrette Notes & Minutes” for the AGE Complex at Cannon AFB is provided as an example for the CR/CCD document. The CR/CCD report shall include sections for each of the areas described in paragraph h below and shall be presented in an 8.5"x11" brochure type format. Drawings larger than 8.5"x11" may be submitted in half-size scaled 11"x17" foldout sheets. Any drawings developed on CADD and inserted into the report shall be produced using DWG format AutoCAD 2000.

a. Project Description. Provide a short narrative project description that includes considerations for: civil design, fire protection, electrical systems, communications systems, and force protection features.

b. User Requirements. The user requirements shall include each activity, the main function of the activity, the number of people involved in the activity, the equipment involved in the activity, space requirements, storage requirements, communications requirements, security requirements, and any unusual civil, structural, mechanical, electrical or other special requirements.

c. Project Site. The A-E shall describe the project site, where it is located and any special considerations required for the treatment of the site. The A-E shall provide information showing the project’s relationship to the overall General Plan and Base circulation. The A-E shall show the relationship of the project site to clear zones, noise contours, and explosive Q/D arcs. The plan shall include site issues such as: parking, vehicular circulation, pedestrian circulation, delivery and refuse

circulation, site orientation and landscaping. The A-E shall provide generalized calculations on parking requirements.

d. Environmental concerns. The A-E shall address potential environmental concerns affecting the site and/or the facility. These shall include: noise or noise abatement, clear zone waivers, explosive Q/D waivers, endangered species, hazardous waste, flood plains, wetlands, operating permits, and construction permits. The A-E shall identify all operating and construction permits required which may include: air quality, hazardous waste, solid waste, drinking water, and storm water permits. The A-E shall identify any other environmental actions required.

e. DD Form 1391 Validation. The A-E shall validate the DD Form 1391, including force protection assessment criteria, as part of the CR/CCD submittal.

f. Cost Estimate. The A-E shall develop a programmatic cost estimate including the major line items for the building and supporting features.

g. Antiterrorism/Force Protection (AT/FP) Analysis. The A-E shall gather together, in a separate meeting from the charrette, the Facility User, the base Security Forces AT/FP Officer, the BCE planner, and the local AFOSI for a review of the AT/FP requirements in accordance with DoD Interim Antiterrorism/Force Protection Construction Standards (available at http://wwwmil.acc. af.mil/ce/cep/cepc). The analysis shall utilize the AT/FP DoD Interim Construction Standards to:

(1) Identify the facility design threat and level of severity of the threat (expressed in Table AP3.T1 of the DoD Interim AT/FP Construction Standards.
(2) Identify the Level of Protection that the project will provide to counteract the threat from Table AP3.T2.
(3) Identify the type of Facility from Table AP4.T2.
(4) If the threat is considered only minimum (50# TNT, Placed), indicate the appropriate part of the Programmed Amount (PA) dictated by the DoD Interim AT/FP Construction Standards in paragraph C1.3 which will be used to provide all the minimum standards contained in Appendix 2 to the project.
(5) If the threat is more than the minimum (50# TNT Placed), identify the appropriate part of the Programmed Amount (PA) to mitigate the threat and provide the level of protection selected for the specific type facility from Tables AP4.T5 through AP4.T22. This amount of money will be identified in the CR/CCD to alert the designer of the project that AFM 32-1071, Volumes II and III must be utilized to determine specific design measures, beyond the minimum standards in Appendix 2 to the DoD Interim AT/FP Construction Standards to mitigate the increased threat.

h. Additional Guidelines. Adequate information shall be provided to ensure that the follow-on designer has enough information to proceed with technical design. The CR/CCD shall include sections that will address each of the following areas:

(1) Summary/Project Description/Goals
(2) Site/Infrastructure Issues in bullet format:
—Location and Orientation
—Force Protection Standards
—Environmental
—Communications & TBMS

—Fire Protection
—Electrical

(3) Drawings (from charrette report): site plan, floor plan, and elevations of the selected scheme.
(4) DD Form 1391
(5) One Page Programmatic Cost Estimate
(6) Meeting Minutes and Annotated Review Comments
(7) Appendices: (site photos, space adjacency matrix, etc.)

C. Technical Criteria and Standards. The work shall be performed in accordance with the Basic Contract, Section C, this Scope of Work and all furnished design instructions. The project design shall incorporate the following technical considerations:

1. Design Instruction No. 1

2. DD Form 1391 dated xxxx, with supporting data.

3. Design Data as indicated in Exhibit 1.

D. Submittal Schedule and Requirements. The design and other related data and/or services required in accordance with the "Basic Delivery Order" shall be accomplished within the limitation of cost and project scope indicated above. No work shall be accomplished beyond this original contract scope of work unless specifically directed by the Contracting Officer. The initial schedule for delivery of data to the Contracting Officer is in calendar days after date of receipt of Notice to Proceed by the A-E. Other submittal requirements are in calendar days from written approval of prior submittal, award of option, or as otherwise noted. All narratives shall be accomplished utilizing Microsoft Word processing software. Delivery of completed work shall be accomplished such that the materials will be protected from handling damage. Each package shall contain a transmittal letter or shipping form, in duplicate, listing the materials being transmitted, being properly numbered, dated and signed. Shipping Labels shall be marked as follows:

U.S. Army Engineer District Albuquerque
Attn: Dan Lenz
4101 Jefferson Plaza, NE
Albuquerque, New Mexico 87109-3435
Contract No. DACAxx-xx-x-xxxx, Delivery Order No. xxx

SUBMITTAL SCHEDULE

Requirement	Delivery Schedule
1. Design Quality Control Plan	14
2. Charrette Documents	14*
3. Final CR/CCD Report	42**
4. Corrected Final CR/CCD Report	21**

* - Calendar days after Charrette Meeting
** - Calendar days after receipt of review comments.

E. Progress Schedule and Written Reports. (See Section C of the Basic Contract.)

F. Information to Be Furnished By the Government:

1. General Data. The Government will furnish the A-E with data and information concerning functions and principal features of each identified project. Specific data to be furnished by the Government are set forth in the attached Exhibit I. All such data or correspondence that are marked "For Official Use Only" shall be protected for use by only those personnel needing the data.

2. Review Comments. Review comments will be provided after each submittal stage. The A-E shall notify the Government if any comments conflict or are incomplete. The Government is responsible for resolving all conflicting comments. These comments will be furnished electronically in MS Word format. All comments will be provided a minimum of 3 days before scheduled review conferences.

G. Architect-Engineer Services.

1. Design Quality Control (DQC) Plan

a. The A-E DQC Plan shall provide and maintain an effective quality control program that will assure that all services required by this Delivery Order are performed and provided in a manner that meets professional architectural and engineering quality standards. The A-E's DQC Plan shall be prepared in accordance with CESPDR-1110-1-8, "Quality Management Plan," Appendix D, http://www.spd.usace.army.mil/. As a minimum, all documents shall be technically reviewed by competent, independent reviewers, as identified in the DQC Plan. Performance of the independent technical review (ITR), should not be accomplished by the same element that produced the product. In addition, the DQC Plan shall incorporate the Lessons Learned Databases provided by the Government. Errors and deficiencies in the design documents shall be corrected prior to submitting them to the Government.

b. The A-E shall include in the DQC plan, a time-scaled bar chart or Critical Path Method (CPM) design schedule showing the sequence of events involved in carrying out the project tasks within the specific period of service. This should be at a detailed level of scheduling sufficient to identify all major tasks including those that control the flow of work. The bar chart or schedule shall include review and correction periods proper to submittal of each item. This should be a forward planning, as well as a project-monitoring tool. The bar chart or schedule reflects calendar days and not dates for each activity. When a modification to this Delivery Order occurs, the A-E shall submit a revised bar chart or schedule reflecting the change within seven calendar days of receipt of the change. The A-E shall include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. These completed checklists shall be submitted at each design phase as part of the project documentation. Example checklists can be found in ER 1110-1-12, "Engineering and Design quality Management".

c. The DQC Plan shall be implemented by an assigned person within the A-E's organization who has the responsibility of being present during the times work is in progress, and shall be cognizant of and assure that all documents on the project have been coordinated. This individual shall be a person who has verifiable engineering or architectural design experience and is a registered professional engineer or architect. The A-E shall notify the District, in writing, of the name of the individual and the name of an alternate person assigned to the position.

d. The Contracting Officer will notify the A-E, in writing, of the acceptance of the DQC Plan. After acceptance, any changes proposed by the A-E are subject to the acceptance of the Contracting Officer or the authorized representative.

2. General Design and Study Requirements. The A-E shall furnish design submittals to the addressees indicated in the attached Distribution Schedule (Exhibit II). Distribution shall be made in sufficient time to ensure arrival of submittals to each recipient in accordance with the "Submittal Schedule". The content of submittals as well as level of completion required is indicated in HQ ACC Guidelines for Development of CCD's. The following information is supplemental thereto:

a. Micro-Computer Automated Cost Estimating System (M-CACES). A programmatic cost estimate is required. The Corps of Engineers current Work Breakdown Structure (WBS) M-CACES Gold software program, may be used. A PC version of M-CACES identical to the Composer Plus program is available from the Albuquerque District Office. The Corps of Engineers will hold a retainage of $2,000.00 for any copies of the M-CACES software furnished to the A-E. Pending satisfactory return of the M-CACES Gold software, the retainage will be refunded.

b. Designs are required to be submitted in AutoCAD format. All final drawings that are to be prepared and furnished under the Contract shall be original plotted tracings produced from CADD, and compatible with AutoCAD Release 14 CAD software of Autodesk Inc. All drawings shall be prepared to conform with applicable provisions of the SWD Architectural and Engineering Instruction Manual (AEIM), Chapter VIII, "Drafting Standards," and the Tri-Service CADD/GIS Systems Technology Center's Architectural, Engineering and Construction (A/E/C) CADD Standards. The Tri-Service CADD Standards can be obtained on the Internet at (*http://tsc.wes.army.mil/html/standards/aec/default.htm).* CADD files shall be furnished in addition to reproducible drawings. Upon completion of the work, data media shall become the property of the Government. The final drawing size shall be sized to fit into the CR/CCD. (See Exhibit III for file verification and naming.) The A-E shall maintain one set of archived CAD files.

c. This project shall be designed in "Soft" Metric - SI with IP value shown in parentheses system of measurement.

d. Review Conferences. Review conferences shall be held at the stages of design and at the locations listed below.

Design Stage	Location
Design Charrette	BCE @ Cannon AFB, NM
Final CR/CCD Report	BCE @ Cannon AFB, NM

The designer will be required to make presentation of the general design concept and project features at the beginning of the review conference. Conference members may include representatives from reviewing, using, maintaining and regulatory agencies. The presentation is intended to provide the conference members with a clear understanding of the facility and how it will function. An elaborate, technical presentation, which might include engineering data, is not desired.

3. Additional On-Board Review Conferences. At the option of the Contracting Officer, the A-E and/or appropriate representative(s) may be required to attend and participate in other conferences (in addition to those included in the lump sum) to facilitate timely review of work under this Delivery Order. Labor costs for such visits will be based on the hourly rates listed on the original accepted fee proposal. Escalation of the hourly labor rates may be necessary depending on the timing of the additional conference(s). Travel costs will be paid in accordance with paragraph I.H.8.c. Any additional conferences must be authorized by modification to this Delivery Order.

H. Special Conditions.

1. Prosecution of the Work. (See Section C of the Basic Contract.)

2. Project Management.

a. (See Section C of the Basic Contract.)

b. The Government's Project Manager for this project is Dan Lenz, Military Programs & SFO Branch, Albuquerque District, telephone number 505-342-3612, fax number 505-342-3497. The Project Manager is the Government's representative responsible for the day-to-day management of the project. Questions regarding the technical issues under this contract should be directed to this individual. This individual does not have the authority to change the terms or conditions of this Delivery Order including time and cost. The A-E will be notified, in writing, of any changes in the Government Project Manager.

3. Verification and Return of Government Furnished Information.

a. Upon initial delivery of the contract and all Government furnished data, the A-E shall inspect them and inform the Contracting Officer if Exhibit I information is missing, no later than seven days after receipt (reference paragraph I.C.).

b. The A-E shall thoroughly review all Government furnished data concerning the project. Should the A-E find any conflict between the Government supplied data and applicable codes, Government regulations, minutes and/or communications, or if the cost estimate is determined to be in error such that it appears that the construction cost will exceed funds available, the A-E shall inform the Contracting Officer in writing within five days of the discovery.

c. All engineering manuals, guide specifications and other data furnished by the Government as designated by the Contracting Officer, shall be returned, if specifically requested, within 30 calendar days after the date of acceptance of the work to be accomplished.

4. Verification of Site Conditions.

a. The A-E shall review the existing documents pertaining to the site and buildings, and shall visit the site and its immediate vicinity to evaluate observable existing conditions. It is the responsibility of the A-E to evaluate existing conditions in the immediate proximity of the project to determine if such conditions may affect, or be affected by proposed construction. If there are site conditions that appear to affect the proposed construction the A-E shall inform the Contracting Officer in writing before proceeding with the project.

b. The A-E shall photograph the site and/or structures in connection with the development of the CR/CCD Report, as necessary, to portray the initial conditions. The A-E shall use digital photography and one copy of the digital files shall be furnished the Contracting Officer at the time of the draft report review of the project. The A-E must comply with regulations governing the use of photographic equipment on the military installation visited.

c. The A-E shall notify the Contracting Officer of any item encountered/discussed in accordance with the requirement for "Confirmation Notices." Work outside the original scope of work shall be accomplished only at the direction of the Contracting Officer.

5. Rights-of-Entry Fees. (See Section C of the Basic Contract.)

6. Project Criteria.

a. All work shall be in accordance with the project criteria, technical manuals, and other instructions furnished by the Contracting Officer. If criteria provided appear to be in conflict, the A-E shall consult the Government for clarification.

b. Standard or previous designs supplied for site-adaptation or modification for this project must be reviewed and updated to reflect current regulatory requirements, standards and criteria.

7. Architect-Engineer Request for Information (A-E RFI). (See Section C of the Basic Contract.)

8. Conferences and Meetings.

a. The A-E shall attend and participate in all design meetings and conferences pertinent to the services under this Delivery Order as directed by the Contracting Officer. Such meetings and conferences, when not included in the lump sum of this Delivery order, will be considered in accordance with paragraph I.G.3, "Additional On-Board Review Conferences".

b. Periodic meetings other than those stated in paragraph 8.a. above, may be held whenever requested by the Contracting Officer, or the A-E, for discussion of questions and problems relating to the services required under this Delivery Order.

c. If the A-E and/or its representative(s) are required to travel to locations not specifically covered in the lump sum-price of this Delivery Order, the Government will compensate the A-E for transportation, including rental car and commercial aircraft where necessary. Per Diem costs shall not exceed the then-current daily rates for Government employees, in lieu of all other expenses. Transportation by private automobile on such required travel shall be likewise reimbursed. All extraneous travel shall be accomplished by modification to this Delivery Order.

9. Review Comment Annotations and Compliance.

a. The Governments' review will consist of quality assurance (QA) checks. It will focus primarily on the design's functional aspects with limited technical review. Comments will be provided in written form. The A-E shall annotate the review comments in the development of data for the next design level. If any review comment requires clarification and/or amplification to assure understanding, the A-E shall notify the Contracting Officer in writing.

(1) Written Comments:

(2) MS Word Comments: The A-E shall respond to technical review comments made on the A-E's submittals. All project design review comments will be transmitted electronically from the Albuquerque District to a comment file via Email. The A-E shall respond to the comments and then provide the responses back via an electronic file. The A-E shall provide all comments with annotations back to the Project Manager by an Email message. Annotations shall be: A-Concur; D-Do Not Concur; and E-Exception. Comments annotated with D or E shall be explained to justify noncompliance with the comment. Comments annotated with "A", will include a brief explanation as to what action was taken.

b. The A-E shall furnish all annotated comments to the Government no later than 7 calendar days after receipt of all comments associated with the particular submittal.

c. After each submittal, the A-E shall incorporate any corrections necessary that may be required as a result of comments.

d. A compliance check to insure all accepted review comments have been incorporated will be performed upon delivery of the Corrected Customer Concept Document submittal. Upon acceptance and approval, the A-E shall deliver the final Customer Concept Document per Exhibit II.

10. Cost and Scope Limitations. (See Section C of the Basic Contract.)

II. GENERAL PROVISIONS.

A. Performance. An evaluation of A-E performance will be prepared at completion of the work and be kept on file, in the Corps of Engineers Architect-Engineer Contract Administration Support System (ACASS), for six years. Various COE Districts, in the selection process for future contracts, will utilize it.

B. Project Location Considerations. (See Section C of the Basic Contract.)

C. Work Authorization. (See Section C of the Basic Contract.)

D. Subcontractors. (See Section C of the Basic Contract.)

E. Confidentiality. (See Section C of the Basic Contract.)

F. Inspection and Acceptance.

1. Inspection During Progress. During the progress of work, all work and all the A-E's or subcontractor's plant and equipment engaged in the work shall be subject to, and available for, inspection by the Contracting Officer during normal office hours.

2. Inspection of Delivered Work. As soon as practicable after delivery of work in any installment, the Contracting Officer will spot check for serious errors or an undue number of minor errors indicating mistakes, carelessness, or lack of adequate quality control on the part of the A-E. The Contracting Officer may forego a thorough inspection and return the entire submittal for rechecking and correction by the A-E.

3. Resubmittal. In the event that documents submitted for review are deemed to be deficient or incomplete for a particular stage of completion, the A-E will be required to correct the deficiencies and resubmit the documents in the quantities originally required and within a reasonable time as specified by the Contracting Officer. The cost of accomplishing the resubmittal data shall be borne by the A-E.

4. Acceptance. Tentative acceptance of work delivered in any installment will be the basis for estimating partial payments for completed work but shall not be construed as final acceptance. Work tentatively accepted but proven by subsequent inspection to be not acceptable shall be corrected by the A-E. Final acceptance of the work will not be made until all work under this Delivery Order has been delivered and found to be acceptable.

G. Certification of Computer Media. (See Section C of the Basic Contract.)

H. Progress Payments. The A-E may invoice monthly based on progress of the project. The invoice shall give the status of the project expressed on a percentage basis, of the total amount of work completed. All invoices shall be signed and submitted to the Albuquerque District, Attention: Don Luna, Military Programs and SFO Branch.

EXHIBIT I
GOVERNMENT FURNISHED ITEMS

1. Design Directive No. 1.

2. Southwestern Division Architectural and Engineering Instructions Manual (CESWD-AEIM), dated September 1998.

3. International Building Code, current edition, or latest version of the UBC.

4. HQ USAF Force Protection Guide.

5. Computer Aided Cost Estimating System (M-CACES) Gold Version v5.3 or M-CACES for Windows Program with template for Albuquerque District and instructions for the Tri-Service Automated Cost Engineering System, Work Breakdown Structure (WBS).

6. Military Handbook 1008C.

7. NFPA Life Safety Code 101, current edition.

8. Tri-Service CADD/GIS Systems Technology Center's Architectural, Engineering and Construction (A/E/C) CADD Standards Manual.

9. Engineering Technical Letters:

10. Cannon AFB Architectural Standards/General Plan.

11. "Interim Department of Defense Antiterrorism/Force Protection Construction Standards", Dated December 16, 1999, with Erata Memorandum dated 15 Feb 00. http://wwwmil.acc.af.mil/ce/cep/cepc

12. Albuq. Dist. Structural Standard - ftp://ftp.spa.usace.army.mil/aeim

13. Albuquerque District Mechanical Requirements.

14. USAF Environmentally Responsible Facilities Guide - http://www.ccb.org/pdf/10/12/004/ERFGUIDE.PDF

15. Air Force Manuals

16. CAFB Site Map in MicroStation format.

EXHIBIT II
DISTRIBUTION SCHEDULE

	NUMBER OF COPIES PER ADDRESSEE			
SUBMITTAL	(A)	(B)	(C)	(D)
DQC PLAN	1	0	0	0
Charrette Documents	4	6	10	1
FINAL CR/CCD Report	4	6	10	1
CORRECTED FINAL CR/CCD REPORT [3]	4	6	10	1

NOTES FOR SUBMITTALS

(3) Includes indicated hard copies and three electronic copies on CD (electronic copies to addresses A, B and C).

ADDRESSEES

(A) Albuquerque District, Corps of Engineers
ATTN: CESPA-PM-M (Dan Lenz)
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435 (FAX: (505) 342-3497).

(B) HQ ACC/CECW
ATTN: Steve White
129 Andrews Street, Suite 326
Langley AFB, VA 23665-2769

(C) 27 CES/CECNE
ATTN: Pat Burns
111 Engineer's Way
Cannon AFB, NM 88103-5136

(D) Corps of Engineers
ATTN: Max Pastor
201 North Perimeter Rd
Cannon AFB, NM 88103-5146

EXHIBIT III
VERIFICATION AND NAMING OF CAD FILES

1. Naming of CAD Drawing Files. The Contractor shall name each drawing file using the project code assigned by the Contracting Officer. **File names shall be no longer than eight characters, with a three-character suffix, shall use no underscores or hyphens, and shall use leading zeros where applicable**. The standard drawing file name shall only use seven characters with the eighth character used in special cases to designate a specific design phase or to indicate modifications or superseded drawings. The assignment and use of the eighth character shall be coordinated with the Contracting Officer. The file-naming scheme is as follows:

NNNNDXXZ.SSS

Where:

NNNN = Albuquerque District assigned project code number is **CC83.**

D = the discipline or drawing category code,

Where:

A = Architectural
B = Interior Design
C = Civil
E = Electrical
F = Fire Protection
G = Geotechnical
I = Index Sheet(s)
K = Survey/Topography/Utilities
L = Landscape
M = Mechanical
P = Plumbing
S = Structural
T = Title or Cover Sheet(s)

XX = the drawing sheet,

Z = the eighth naming character

and,

SSS = the file-type suffix, where:

. DGN = MicroStation PC file
. JNL = MicroStation file checker journal file
. DWG = AutoCAD drawing file
. MSG = AutoCAD file checker message file
. DTM = Inroads digital terrain model
. TNN = Inroads triagulated topographic network
. RAN = Inroads ASCII random point file

. BRK = Inroads ACSII break point file
. PLT = Plot file

An example of a MicroStation PC file might be: **CC83A09.DGN**, where: HM49 is the 4-character project number assigned by the Contracting Officer; A09 represents architectural sheet A9; and DGN is the 3-character MicroStation PC suffix. Each drawing shall have a separate file name.

2. Verification of CAD Drawing Files. The Contractor shall verify CAD drawing files. Verification shall consist of the following:

a. Each drawing shall be brought up in CAD format specified by the Contracting Officer (MicroStation, AutoCAD, etc.). Custom or proprietary menus shall be replaced with the default CAD menu. If the drawing file requires special shapes, fonts, tables, etc. not common to the CAD software, the Contractor shall also submit a list of levels/layers previously unassigned. These files shall be included in the delivery to the Government.

b. All drawing files shall be provided with full drawing displayed and all extraneous information removed outside of the plot boundary. Drawing file size shall be minimized utilizing "COMPRESS" (MicroStation) or "WBLOCK" (AutoCAD) or other similar command. Drawing entities outside of the sheet boundary (except for plotting snap points) are not desired on the delivery files, and shall be deleted.

c. The Contractor shall verify the structure of CAD files submitted to the Government. CAD files shall be examined for errors or corruptions in drawing file structure using software expressly designed for such purposes. Such software shall be capable of saving a report on the condition of the files examined. Examples of such utilities producing acceptable results are EDG (for MicroStation) and Audit/Recover (for AutoCAD). The Contractor shall provide magnetic and hard copies of file checking software message files. CAD files will be accepted if their respective file checking message files indicate that no errors were found.

d. CAD drawing files shall be accompanied on the same compact disc by their respective report message files. A message file shall have the same name as the drawing file, except that the suffix shall be MSG. Special shapes, fonts, tables, etc., files shall be included as necessary to generate the drawing file(s).

3. Deliverables.

a. The Contractor shall submit all plates as CAD files (.dgn, .dwg, etc.) on recordable compact disc, 650MB/74 minute, DOS compatible, ISO standard. If there are any questions regarding the format for the submittal, contact Sherry Thompson of the Albuquerque District, at telephone (505) 342-3310.

The Contractor shall check for surface errors and computer viruses using a competent virus-checking program shall check b. Deliverable media type and data. The Contractor shall provide certification that this virus checking has taken place. The name and release date of the virus-checking software shall be furnished to the Government. Virus-checking software shall be the current version, which has detected the latest known viruses at the time of delivery of the diskettes. For Contractors using virus-checking programs that attach validation files to diskettes, such as the VIRUSCAN program from McAfee and Associates, the validation files on the diskettes shall be sufficient proof of virus checking. If analysis of delivery media by the Government finds evidence of virus infection, the media will be returned to the Contractor. The Contractor shall re-submit the media at no cost to the Government.

c. The Contractor shall label each compact disc with standard compact disc labels. Each compact disc shall be labeled with the following information:

—The name of the project;
—The project location;
—The CAD project number (first four characters of the file name); and
—The date of the submittal.

d. The Contractor shall furnish CAD shape, font, tables, etc. files necessary for display or editing of drawing files furnished under this contract.

e. Compact discs furnished by the Contractor shall be delivered in hinged, rigid plastic compact disc boxes.

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Biographies of Authors

G. Edward Gibson, Jr., is a professor of civil engineering and the Austin Industries endowed faculty fellow in the construction engineering and project management program at the University of Texas, Austin. He received his Ph.D. in civil engineering from Auburn University in 1990 and an M.B.A. from the University of Dallas in 1987. His research interests include organizational change, preproject planning, construction productivity, electronic data management, and automation and robotics. In 1996 he received the Construction Industry Institute's Outstanding Researcher Award for his pioneering work in preproject planning. He is an author or a coauthor of numerous articles and reports on this subject. Among these documents are CII's *Pre-Project Planning Handbook, Project Definition Rating Index (PDRI)—Industrial Projects,* and *Project Definition Rating Index (PDRI)—Building Projects*. In 2002 he received the Engineering Education Excellence Award from the National Society of Professional Engineers for his leadership in education, research, and service.

Dr. Gibson currently serves as associate chairman of the Department of Civil Engineering in charge of the architectural engineering program at the University of Texas. He has developed several CII education modules for continuing education and has taught over 130 short courses to industry on such topics as setting objectives, team alignment, continuous improvement, preproject planning, and materials management. Dr. Gibson has consulted with many organizations such as NASA, the Smithsonian Institution, the General Services Administration, Department of State, the Texas Department of Transportation, 3M, Broadwing, BECK Group, DuPont, Ontario Power Generation, Hensel Phelps, and Union Carbide. He also served on a National Research Council committee investigating project management practices at the U.S. Department of Energy. Dr. Gibson has several years of industry experience and is a licensed professional engineer in Texas.

Michael P. Pappas is a project management consultant and a Ph.D. candidate in civil engineering at the University of Texas, Austin. He has 10 years of industry experience managing domestic and international construction projects and facilities programs as a U. S. Navy Civil Engineer Corps officer and with an *Engineering News Record* Top 300 design firm. Over the past four years he has worked as a project management consultant, analyzing planning, cost, schedule, and delay data for process improvement programs and construction dispute resolution. Mr. Pappas has a B.S. in civil engineering from the University of Missouri, Rolla, and an M.S.E. in civil engineering from the University of Texas, Austin. He is a member of the National Society of Professional Engineers and the American Society of Civil Engineers and is a licensed professional engineer in the state of Missouri.

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Acronyms

A/E	architect/engineer
ACC	U.S. Air Force Air Combat Command
AIA	American Institute of Architects
CCD	Customer Concept Document
CII	Construction Industry Institute
DBIA	Design-Build Institute of America
DOD	Department of Defense
DOE	Department of Energy
DOS	Department of State
EJCDC	Engineers Joint Contract Documents Committee
FFC	Federal Facilities Council
GSA	General Services Administration
IBB	International Broadcasting Bureau
IHS	Indian Health Service
IPT	Integrated Project Team
JSC	Johnson Space Center
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Command
NNSA	National Nuclear Security Administration
NRC	National Research Council

OMB	Office of Management and Budget
PDRI	Project Definition Rating Index
POR	Program of Requirements
RFP	Request for Proposal
SFCAM	Shore Facilities Capital Asset Management
SI	Smithsonian Institution
SOUTHDIV	Southern Division, Naval Facilities Engineering Command
SPiRiT	Sustainable Project Rating Tool
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
VA	Department of Veterans Affairs