PDRI

Project Definition Rating Index

Use on NASA Facilities

Produced under the guidance
of the NASA Pre-Project Planning
Team

April 2000

This page left intentionally blank.

EXECUTIVE SUMMARY

As demonstrated in research results published previously by CII, and new data presented in this document, greater front end planning efforts lead to improved performance on capital projects in the areas of cost, schedule, and operational characteristics. Unfortunately, until now, the building sector has lacked non-proprietary tools to assist in performing this critical stage of the project.

The Project Definition Rating Index (PDRI) for Building Projects is a powerful and simple tool that helps meet this need by offering a method to measure project scope definition for completeness. A PDRI score of 200 or less has been shown to greatly increase the probability of a successful project. This document will present usage of the PDRI in relation to NASA's capital budgeting process. Note that large portions of this document were adapted from CII Implementation Resource 155-2, *PDRI for Building Projects*, and edited to reflect NASA's unique project processes.

The PDRI offers a comprehensive checklist of 64 scope definition elements in an easy-to-use score sheet format. The PDRI score sheet is supported by detailed descriptions of these elements. Each element is also weighted based on its relative importance to the other elements. The PDRI element descriptions given in this manual are slightly modified to reflect usage by NASA personnel on NASA-specific building projects. An individual, or team, can therefore evaluate the status of their project definition effort during pre-project planning and determine their score, or level of effort. Furthermore, since the PDRI element score relates to its risk, high risk areas that need further work can easily be isolated.

It should be noted that there is a PDRI for industrial projects that can be used for NASA projects such as power plants, chillers, manufacturing facilities, wind tunnels, and so forth. Although not covered specifically in this document, it is almost identical in usage and similar in content. Individuals involved in pre-project planning these types of facilities should get CII Implementation Resource 113-2, *PDRI for Industrial Projects*, and use it as a planning tool.

The PDRI can benefit owners, designers and constructors and provides numerous benefits to the project team. These include: a detailed checklist for work planning, standardized scope definition terminology, facilitation of risk assessment, assistance in progress monitoring, aid in communication of requirements between participants, method of reconciling differences between project participants, a training tool, and a benchmarking basis.

This implementation guide contains chapters describing the PDRI for building projects, why it should be used, how it fits within NASA's project planning process, how to score a project, how to analyze a PDRI score and a path forward for the using this tool. Each of these chapters is supported by extensive background material in the Appendices.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1: WHAT IS THE PDRI?

The PDRI is a simple and easy-to-use tool for measuring the degree of scope development on building projects.

The Project Definition Rating Index (PDRI) for Building Projects is a powerful and simple tool that helps meet this need by offering a method to measure project scope definition for completeness. It is adapted from the PDRI for Industrial Projects (see Reference 6)

The PDRI offers a comprehensive checklist of 64 scope definition elements in an easy-to-use score sheet format. Each element is weighted based on its relative importance to the other elements. Since the PDRI score relates to risk, those areas that need further work can easily be isolated. (A PDRI score of 200 or less has been shown to greatly increase the probability of a successful project.)

The PDRI identifies and precisely describes each critical element in a scope definition package and allows a project team to quickly predict factors impacting project risk. It is intended to evaluate the completeness of scope definition at any point prior to the time a project is considered for development of construction documents and construction. Building type projects may include the following:

- Offices
- Banks
- Medical facilities
- Institutional buildings
- Dormitories
- Hotels and motels
- Warehouses
- Recreational and athletic facilities
- Industrial control buildings
- Schools (classrooms)
- Research and laboratory facilities
- Stores and shopping centers
- Apartments
- Parking structures
- Light assembly and manufacturing
- Airport terminals
- Public assembly and performance halls

The PDRI consists of three main sections, each of which are broken down into a series of categories which, in turn, are further broken down into elements, as pictorially shown in Figure 1.1. Details of how the PDRI for buildings was developed, as well as a summary of the overall research effort are given in References 1 and 2. A complete list of the PDRI's three sections, 11 categories, and 64 elements is given in Figure 1.2.

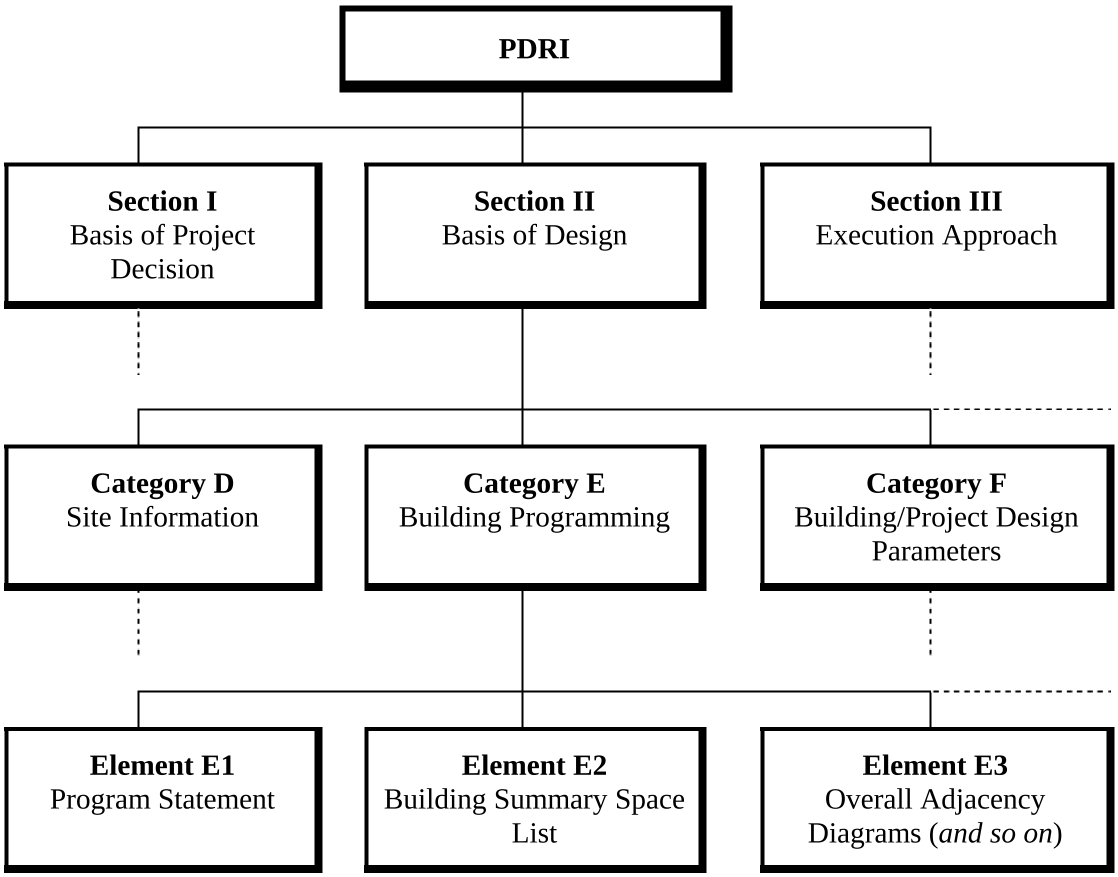

Figure 1.1. PDRI Partial Hierarchy

SECTION I. BASIS OF PROJECT DECISION

A. Business Strategy
- A1. Building Use Requirements
- A2. Business Justification
- A3. Business Plan
- A4. Economic Analysis
- A5. Facility Requirements
- A6. Future Expansion/Alteration
- A7. Site Selection Considerations
- A8. Project Objectives Statement

B. Owner Philosophies
- B1. Reliability Philosophy
- B2. Maintenance Philosophy
- B3. Operating Philosophy
- B4. Design Philosophy

C. Project Requirements
- C1. Value-Analysis Process
- C2. Project Design Criteria
- C3. Evaluation of Existing Facilities
- C4. Scope of Work Overview
- C5. Project Schedule
- C6. Project Cost Estimate

SECTION II. BASIS OF DESIGN

D. Site Information
- D1. Site Layout
- D2. Site Surveys
- D3. Civil/Geotechnical Information
- D4. Governing Regulatory Requirements
- D5. Environmental Assessment
- D6. Utility Sources with Supply Conditions
- D7. Site Life Safety Considerations
- D8. Special Water and Waste Treatment Requirements

E. Building Programming
- E1. Program Statement
- E2. Building Summary Space List
- E3. Overall Adjacency Diagrams
- E4. Stacking Diagrams
- E5. Growth and Phased Development
- E6. Circulation and Open Space Requirements
- E7. Functional Relationship Diagrams/Room by Room
- E8. Loading/Unloading/Storage Facilities Requirements
- E9. Transportation Requirements
- E10. Building Finishes
- E11. Room Data Sheets
- E12. Furnishings, Equipment, & Built-Ins
- E13. Window Treatment Considerations

F. Building/Project Design Parameters
- F1. Civil/Site Design
- F2. Architectural Design
- F3. Structural Design
- F4. Mechanical Design
- F5. Electrical Design
- F6. Building Life Safety Requirements
- F7. Constructability Analysis
- F8. Technological Sophistication

G. Equipment
- G1. Equipment List
- G2. Equipment Location Drawings
- G3. Equipment Utility Requirements

SECTION III. EXECUTION APPROACH

H. Procurement Strategy
- H1. Identify Long Lead/Critical Equipment and Materials
- H2. Procurement Procedures and Plans

J. Deliverables
- J1. CADD/Model Requirements
- J2. Documentation/Deliverables

K. Project Control
- K1. Project Quality Assurance and Control
- K2. Project Cost Control
- K3. Project Schedule Control Requirements
- K4. Risk Management
- K5. Safety Procedures

L. Project Execution Plan
- L1. Project Organization
- L2. Owner Approval Requirements
- L3. Project Delivery Method
- L4. Design/Construction Plan & Approach
- L5. Substantial Completion Requirements

Figure 1.2. PDRI SECTIONS, **Categories**, and Elements

In order to provide the most value to NASA, a team of NASA project professionals was formed to adapt the PDRI to Construction of Facilities (CoF) projects. (The list of team members is given in Appendix F.) This team met for two days in September 1999 and subsequently performed its work via electronic communications. Each of the PDRI elements was reviewed for applicability to NASA projects and their descriptions were modified slightly to include NASA-specific terminology and administrative requirements. All of the elements were found to be applicable to NASA projects, even in the context of minor construction projects. A discussion of PDRI adaptation to small and renovation projects is given in Chapter 4. In addition, the use of the PDRI in the context of the CoF capital budgeting and delivery cycle was developed and is given in Chapter 3.

It should be noted that there is a PDRI for industrial projects that can be used for NASA projects such as power plants, chillers, manufacturing facilities, wind tunnels, and so forth. Although not covered specifically in this document, it is almost identical in usage and similar in content. Individuals involved in pre-project planning these types of facilities should get CII IR 113-2, *PDRI for Industrial Projects* and use it as a planning tool. (Reference 6)

Use the PDRI score sheet most closely related to your project's use or type.

If your project is a hybrid of industrial and building types, which PDRI score sheet should be used (building version or industrial version)? In general, if the designers who are driving the project are architects, then the PDRI for Buildings should be used. If the primary designers are process (chemical) engineers or industrial (mechanical) engineers, then the PDRI for Industrial Projects should be used. Alternatively, the team can look at the composition of the project in terms of work (design or construction expenditures) to make the decision. In some circumstances, the team may decide to use both in concert. The PDRI for Industrial Projects is not included in this document, but is available from CII.

Structure of this Document

This implementation resource consists of six main chapters followed by five appendices of supporting information. Chapter 2 highlights how the benefits of the PDRI and how it can be used to improve project performance on building projects. Chapter 3 provides direction for using the PDRI within the NASA budgeting cycle. Chapter 4 provides detailed instructions for scoring a project using the PDRI. Chapter 5 describes the various ways in which PDRI scores can be analyzed to assess a project's potential for success. The final chapter summarizes the major uses and benefits of the PDRI and offers recommendations for implementing it on future projects.

This page left intentionally blank.

CHAPTER 2: BENEFITS OF THE PDRI

Effective early project planning improves project performance in terms of both cost and schedule. The majority of industry participants recognize the importance of scope definition during the early stages of a project and its potential impact on project success. Until now, however, the building industry has been lacking a practical, non-proprietary method for determining the degree of scope development on a project. The PDRI for buildings is the first publicly available tool of its kind in this sector. It allows a project planning team to quantify, rate, and assess the level of scope development on projects prior to beginning development of construction documents.

A significant feature of the PDRI is that it can be utilized to fit the needs of almost any individual project, small or large. Elements that are not applicable to a specific project can be zeroed out, thus eliminating them from the final scoring calculation.

The PDRI is quick and easy to use. It is a "best practice" tool that will provide numerous benefits to the building industry. A few of these include:

- A **checklist** that a project team can use for determining the necessary steps to follow in defining the project scope
- A listing of **standardized scope definition terminology** throughout the building industry
- An industry standard for rating the completeness of the project scope definition package to facilitate **risk assessment** and prediction of escalation, potential for disputes, etc.
- A means to **monitor progress** at various stages during the front end planning effort
- A tool that aids in **communication and promotes alignment** between owners and design contractors by highlighting poorly defined areas in a scope definition package
- A means for project team participants to **reconcile differences** using a common basis for project evaluation
- A **training tool** for organizations and individuals throughout the industry

- A **benchmarking tool** for organizations to use in evaluating completion of scope definition versus the performance of past projects, both within their organization and externally, in order to predict the probability of success on future projects

Who Should Use the PDRI?

Anyone wishing to improve the overall performance on their projects should use the PDRI.

The PDRI can benefit facility owners such as NASA, as well as designers and constructors. NASA planners can use it as an assessment tool for establishing a comfort level at which they are willing to move forward with projects. Designers and constructors working with NASA can use it as a method of identifying poorly defined project scope definition elements. The PDRI provides a means for all project participants to communicate and reconcile differences using an objective tool as a common basis for project scope evaluation.

CHAPTER 3: PRE-PROJECT PLANNING AT NASA

Introduction

The NASA-specific project planning timelines given in this Chapter, illustrate NASA's planning efforts in accordance with the NASA facility planning project cycle. These diagrams show optimal points in time for the utilization of the NASA-specific PDRI tool to maximize its benefit in relation to the major milestones and sequences of the NASA facility planning project cycle. These timelines with their associated milestones are outlined in Figures 3.1, 3.2, and 3.3. It should be noted that the process used to plan projects and the project mix varies at the different Centers. The discussion in this Chapter is meant to provide guidance and will have to be adapted depending on Center-specific requirements.

Background

The NASA Construction of Facilities planning process operates on a 5-year planning cycle. This planning cycle, and all its elements, is explicitly defined in the 1993 Facility Project Implementation Handbook (FPIH) (Reference 10). The 5-year planning process includes the identification of functional requirements that need to be satisfied to achieve mission objectives and the conversion of these requirements into facilities and equipment resources. This effort is a continuous updating process based on improved data from the progressive pre-project planning efforts.

Figure 3.1 illustrates the major events in a typical NASA project cycle. These project events are placed in a time sequence relative to the "budget year," or the year in which initial funds are expected to be made available for the execution of the proposed project. For illustration purposes, a timeline referencing the budget year 2002 is inserted. The events in the project cycle are planned around the congressional appropriations cycle.

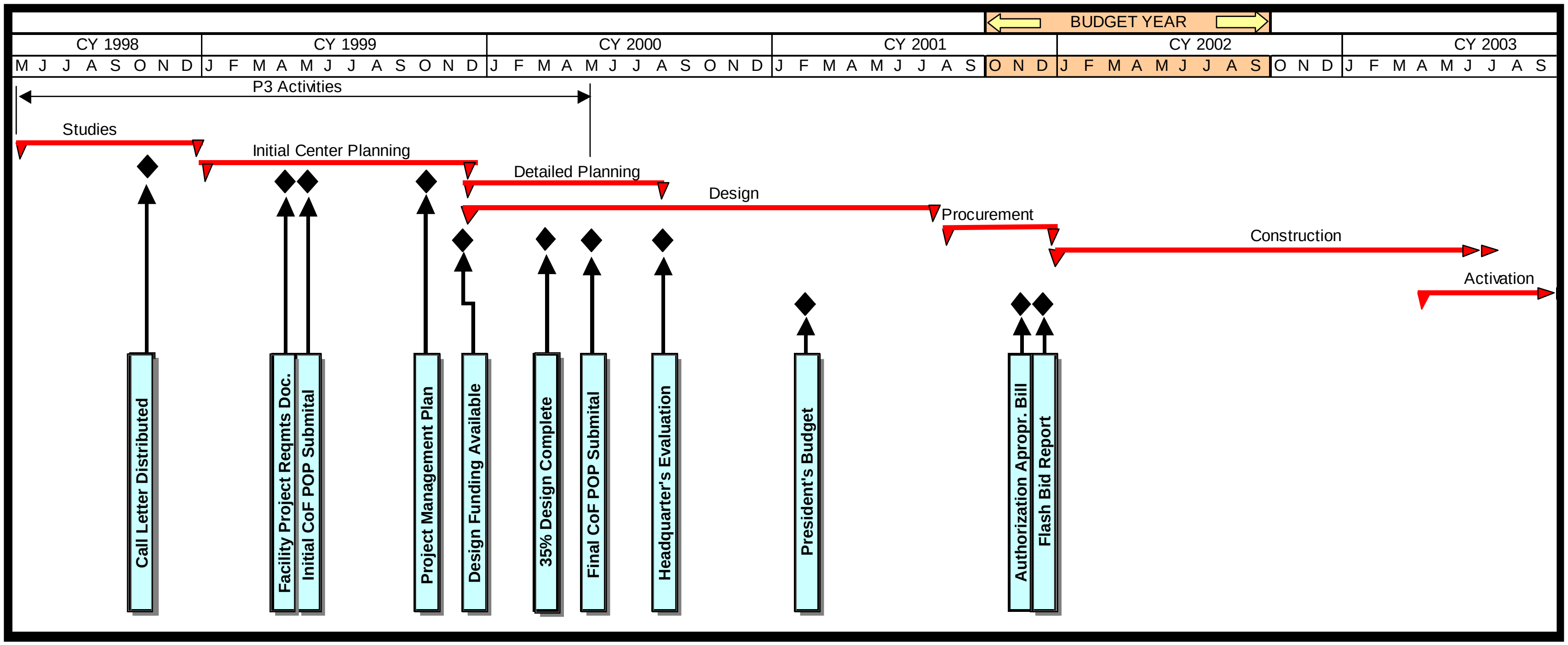

Figure 3.1 Typical NASA Construction of Facilities (CoF) Project Cycle

Pre-Project Planning Timeline Development

Figure 3.2 further breaks down the NASA pre-project planning steps. This illustration follows the same timeline as given in Figure 3.1 and is also referenced to the Budget Year of 2002. The major elements of this figure are explained in the FPIH. The FPIH requires the submittal of various documents, which detail the execution of critical planning steps. The elements of Figure 3.2 are described in the following paragraphs.

The identification and validation of functional requirements is the first step. This is accomplished through the completion of a Functional Requirements Statement. This statement defines the type of capability that is needed and evaluates various options that meet the stated need. The primary use of this statement is to support the center's decision-making process, which leads to the inclusion of the proposed project in the 5-year plan. In some cases, funds may be available from NASA Headquarters or from center programs to perform this work.

The initial project screening at the center level occurs next. This screening reveals projects that warrant future pre-project planning efforts from the center perspective. This process allows the center to "cull" projects that have little chance of funding or that fail to meet the center's mission. This screening in turn, allows the center to conserve resources and focus planning efforts. Actual screening procedures vary by Center.

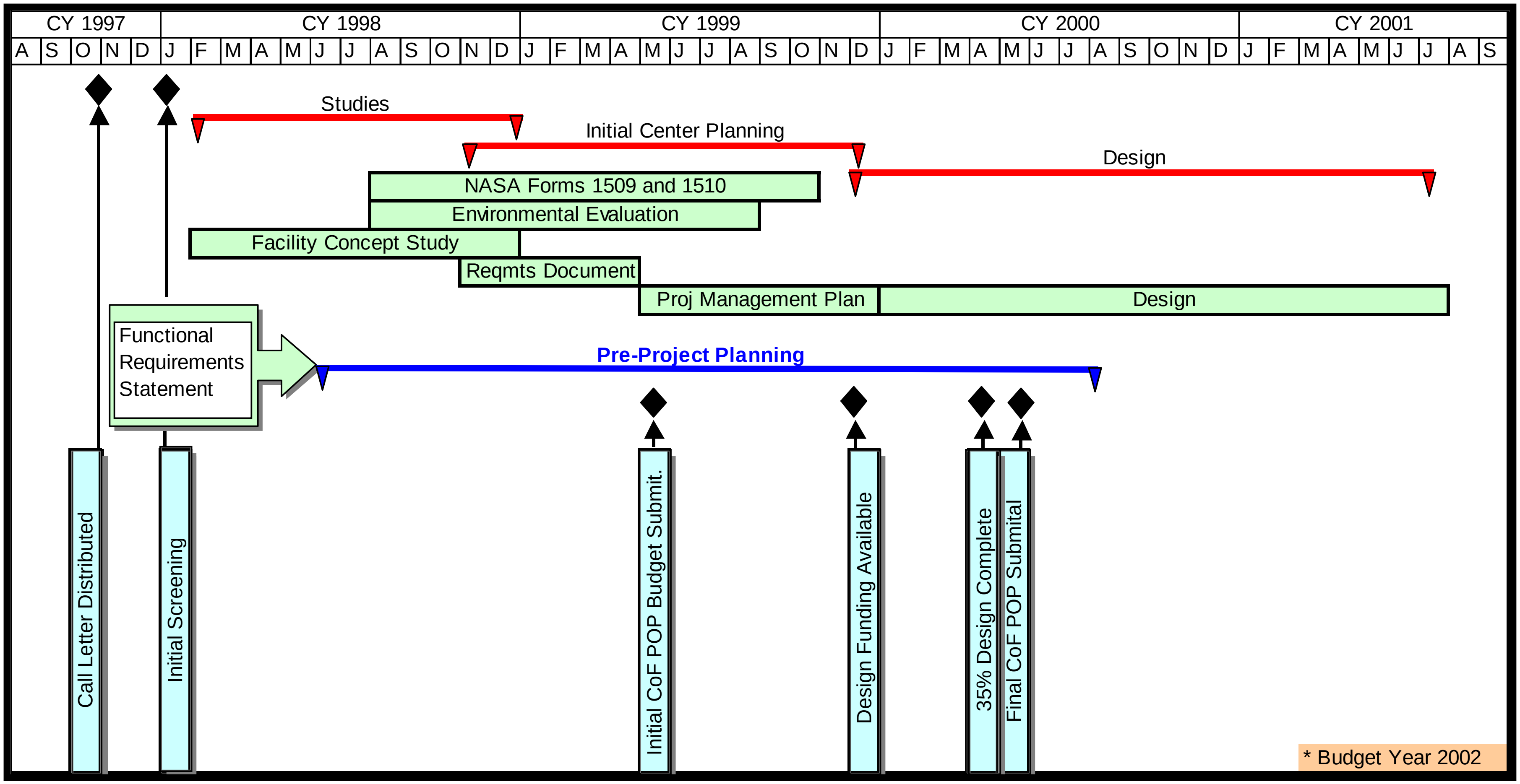

Figure 3.2: NASA Pre-Project Planning Time Line

Following a favorable assessment from the screening process, the following pre-project planning steps begin:

- Facility Concept Study. The basic elements of the concept study are an updated discussion of the mission, operations, or research and development tasks that generated the requirement for a new or modified facility, and an expanded description of the proposed facility. Included in the study are: evaluation of options, site description, structural, mechanical, electrical, energy and environmental considerations, fire protection, life safety, and schedule sensitivity.
- Brief Project Document (NASA Form 1509). This form should fully explain the proposed facility project including an accurate and concise description, scope and justification of need, and full disclosure of related resources. When approved, this form authorizes and directs design and implementation of the facility project described, contingent on funds being made available.
- Facility Project Cost Estimate (NASA form 1510). This form is a cost summary page for all cost estimate packages developed for facility projects. It includes a breakdown of total project costs into major cost elements.

The information necessary for the completion of the three previously mentioned documents is also relevant to the project Requirements Document. The development of the project Requirements Document is based on the Facility Concept Study with major emphasis on the project description. The Requirements Document is considered the most important pre-project deliverable, as it is the primary input to design. Once the development of the Requirements Document is completed, the Facility Project Management Plan is prepared. This plan establishes a realistic schedule for the implementation of a facility project and assigns responsibility and authority for various actions. The plan is approved prior to the start of the final design work.

Approximately eight percent of the CoF Program Operating Plan (POP) budget estimate is made available to the centers for project designs and related activities during the month of December after the initial POP submittal. The final pre-project planning step culminates in the development of the design to approximately the 35% level, which supports evaluation of project readiness and also supports program decisions for the final CoF POP submittal. This development effort is often called the PER (Preliminary Engineering Report) and is discussed in detail in Chapter 3 of the FPIH (1993).

PDRI Applied to the Pre-Project Planning Timeline

Based on the NASA pre-project planning events relative to the budget cycle, there are three specific points at which it is recommended to conduct NASA-specific PDRI evaluations. These three proposed evaluation points are identified in Figure 3.3,which is also referenced to a Budget Year of 2002.

The first NASA-specific PDRI evaluation is recommended at the completion of the initial screening process. At this initial stage in planning, the PDRI score will serve to show areas that require further definition. If used as a checklist to identify items requiring consideration, the PDRI will be valuable to the planning team (or individual). Action items and due dates developed from the checklist approach can be assigned. The process of identifying and defining the elements contained in the NASA-specific PDRI provides an excellent starting point for the completion of the documents leading to the Project Management Plan.

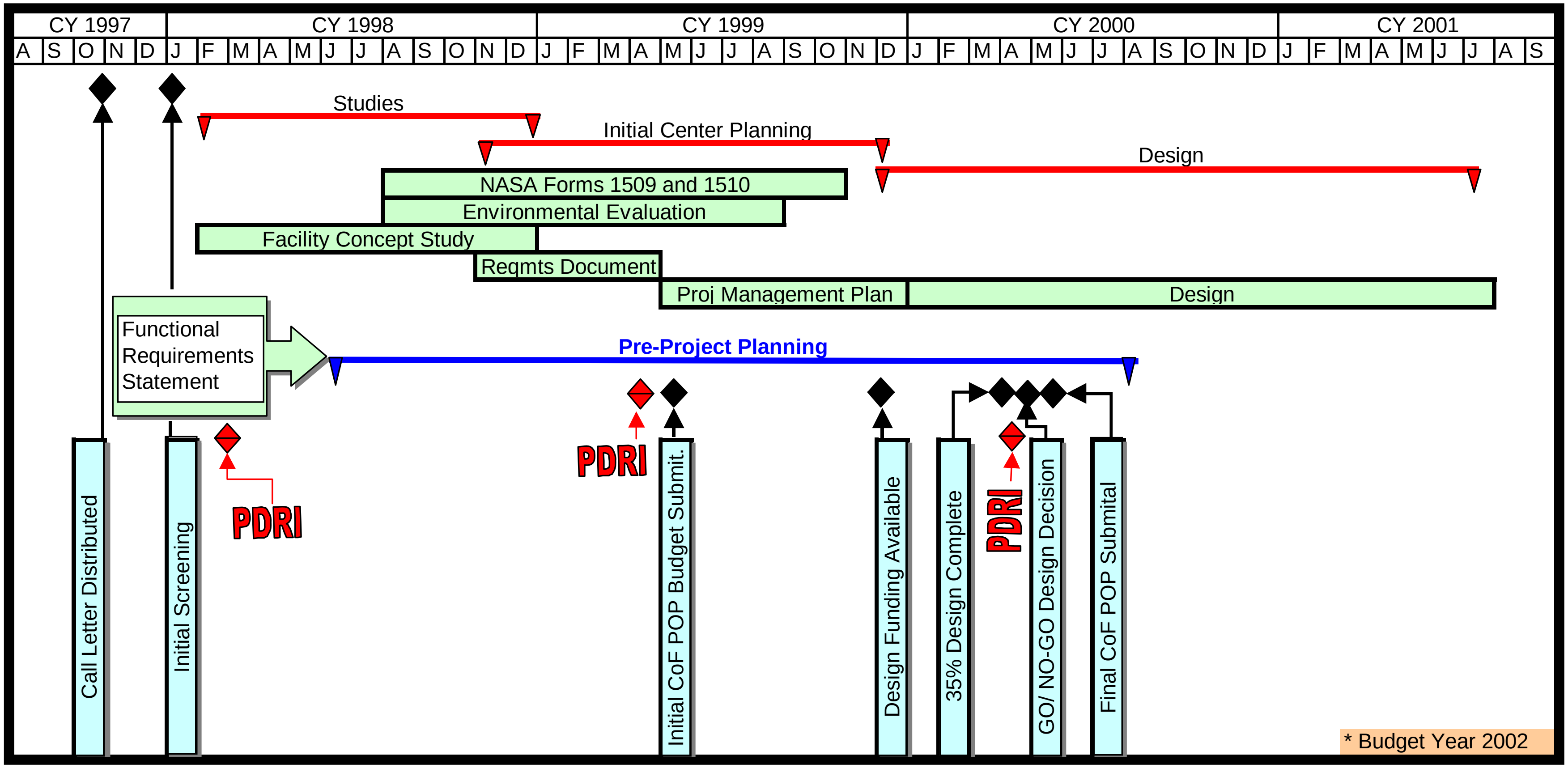

Figure 3.3: NASA Pre-Project Planning Time Line with PDRI Evaluation Points

The second NASA-specific PDRI evaluation should be performed at the completion of the Facility Concept Study and prior to the initial POP budget submittal. Based on the PDRI analysis at this point, a sense for the adequacy of the project estimate can be developed and appropriate adjustments can be made prior to the submission of the initial POP budget. Planning team members will be able to rate the completeness of the project scope definition at this point and redirect efforts to correct the inadequately defined areas prior to commencement of the design. Analyzing individual PDRI elements with scores indicating poor definition will reveal the amount of risk each individual element brings to the project relative to the maximum score. This provides an effective method of risk analysis since each element, category, and section is weighted relative to each other in terms of potential risk exposure. Addressing inadequately defined areas highlighted by the PDRI evaluation, a basis is formed for the realization of an accurate and complete Requirements Document.

It is recommended that the third and final NASA-specific PDRI evaluation be performed at the 35% design completion level. The evaluation of the completeness of project scope definition at this point will help determine the decision to proceed with design or to hold off on the project due to the excessive risks involved. The PDRI may also be used as a "bridging" tool at the continuation of the design beyond the 35% level to communicate NASA's intent to the project design team. Use caution when proceeding with the design of projects with a 35% design level PDRI score greater than 200 since a correlation exists between high PDRI scores and poor project performance.

Summary

The timelines given in this Chapter present a pre-project planning sequence, which includes recommended points in time for the utilization of the PDRI to assess the level of completeness at major steps in the project planning process. The developed timeline offers a standardized methodology that can be embedded and institutionalized agency wide and is based on requirements of the FPIH.

CHAPTER 4: INSTRUCTIONS FOR SCORING A PROJECT

Scoring a project is as easy as 1-2-3.

Individuals involved in the front end planning effort should use the Project Score Sheet shown in Appendices A and B when scoring a project. Note that two score sheets are provided—the first is simply an unweighted checklist in Appendix A. The second (in Appendix B) contains the weighted values and allows a front end planning team to quantify the level of scope definition at any stage of the project on a 1000 point scale. The unweighted version should probably be used in the team scoring process to prevent bias in choosing level of definition and "targeting" a specific score. The team leader or facilitator can easily score the project as the weighting session is being held (using the score sheet in Appendix B).

The PDRI consists of three main sections that are broken down into 11 categories. The categories are further broken down into 64 elements. The elements are individually described in Appendix C, Element Descriptions. Elements should be rated numerically from 0 to 5. The scores range from 0 - *not applicable*, 1 - *complete definition* to 5 - *incomplete or poor definition* as indicated in the legend at the bottom of the score sheet. The elements that are as well defined as possible should receive a perfect definition level of "one." Elements that are not completely defined should receive a "two," "three," "four," or "five" depending on their levels of definition as determined by the team. Those elements deemed not applicable for the project under consideration should receive a "zero," thus not affecting the final score. The definition levels are defined as follows:

Definition Levels

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

To score an element, first refer to the Project Score Sheet in Appendix A**.** Next, read its corresponding description in Appendix C**.** Some elements contain a list of items to be considered when evaluating their levels of definition. These lists may be used as checklists. All elements have five pre-assigned scores, one for each of the five possible levels of definition. Choose only one definition level (0, 1, 2, 3, 4, or 5) for that element based on your perception of how well it has been addressed. Once you have chosen the appropriate definition level for the element, write the value of the score that corresponds to the level of definition chosen in the "Score" column. Do this for each of the 64 elements in the Project Score Sheet. Be sure to score each element.

Each of the element scores within a category should be added to produce a total score for that category. The scores for each of the categories within a section should then be added to arrive at a section score. Finally, the three section scores should be added to achieve a total PDRI score.

Scoring Example

Consider, for example, that you are a member of a planning team responsible for developing the scope of work for the renovation of an existing research building. Your team has identified major milestones throughout front end planning at which time you plan to use the PDRI to evaluate the current level of "completeness" of the scope definition package. Assume that at the time of this particular evaluation the scope development effort is underway, but it is not yet complete.

Your responsibility is to evaluate how well the project-specific equipment requirements have been identified and defined to date. This information is covered in Category G of the PDRI as shown below and consists of three elements: "G1. Equipment List," "G2. Equipment Location Drawings," and "G3. Equipment Utility Requirements."

CATEGORY Element	Definition Level						Score
	0	**1**	**2**	**3**	**4**	**5**	
G. EQUIPMENT (Maximum Score = 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							

Definition Levels

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

To fill out Category G, Equipment, follow these steps:

Step 1: **Read the description for each element in Appendix C.** Some elements contain a list of items to be considered when evaluating their levels of definition. These lists may be used as checklists.

Step 2: **Collect all data that you may need** to properly evaluate and select the definition level for each element in this category. This may require obtaining input from other individuals involved in the scope development effort.

Step 3: **Select the definition level for each element** as described below and shown below.

Element G1: Requirements for food service, trash disposal, and material handling have been well defined; however, process equipment for the laboratory has not been identified to your satisfaction. You feel that this element has *some deficiencies* that should be addressed prior to development of construction documents. **Definition Level = 3**.

Element G2: Your team decides that this element has been well done, including existing and new equipment rooms. You are a little concerned about the laboratory process equipment, but feel you have space available regardless of the requirements for your project; therefore, the team feels the element has *minor deficiencies*. **Definition Level = 2**.

Element G3: Although your team plans to clarify utility requirements for the equipment, it has not yet been done. This element is therefore *incomplete or poorly defined*. **Definition Level = 5**.

CATEGORY Element	Definition Level						Score
	0	**1**	**2**	**3**	**4**	**5**	
G. EQUIPMENT (Maximum Score = 36)							
G1. Equipment List	0	1	5	8	12	15	8
G2. Equipment Location Drawings	0	1	3	5	8	10	3
G3. Equipment Utility Requirements	0	1	4	6	9	11	11
CATEGORY G TOTAL							**22**

<u>Definition Levels</u>

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

<u>Step 4</u>: For each element, **write the score that corresponds to its level of definition** in the "Score" column. If the team feels that any or all of the elements were *not applicable* for this project they would have had a definition level of "0" and been zeroed out.

<u>Step 5</u>: **Add the element scores to obtain the category score**. Repeat this process for each element in the PDRI. Add element scores to obtain category scores. Add category scores to obtain section scores. Add section scores to obtain a total PDRI score. A completed PDRI score sheet for a medical research project is included in Appendix D for reference.

<u>Step 6</u>: **Take Action**. In this example, Category G has a total score of 22 (out of 36 total points) and probably needs more work.

Philosophy of Use

Ideally, the project team gets together to conduct a PDRI evaluation at various points in the project. Experience has shown that the scoring process works best in a team environment with a neutral facilitator who is familiar with the process. This facilitator provides objective feedback to the team and controls the pace of the meeting. Alternatively, the project manager can serve the role of facilitation for the project team. If these arrangements are not possible, another approach is to have key individuals evaluate the project separately, then meet and evaluate it together to reach a meeting of the minds. Even using the PDRI from an individual standpoint as a checklist provides a method for project evaluation.

The scoring session should be well organized and the facilitator should work in concert with the project manager to make sure the right participants and facilities are available. A checklist outlining facilitator and project manager preparation issues is given in Appendix E.

Experience has shown that the PDRI is best used as a tool to help project managers (project coordinators, project planners, etc.) organize and monitor progress of the front end planning effort. In many cases, a planner may score the project using the PDRI prior to the existence of a team in order to understand major risk areas. Using the PDRI early in the project lifecycle will usually lead to high PDRI scores. This is normal and the completed score sheet gives a road map of areas that are weak in terms of definition.

The PDRI provides an excellent tool to use in early project team meetings in that it provides a means for the team to align itself on the project and organize its work. Some PDRI users feel that the final PDRI score is less important than the process used to arrive at that score. The PDRI also can provide an effective means of "handing off" the project to other entities or helping maintain continuity as new project participants are added to the project.

If the Center has front-end planning procedures and building standards in place, many of the elements may be partially defined when the project begins front-end planning. It may want to standardize many of the PDRI elements as much as possible to improve cycle time of planning activities.

PDRI scores may change on a day-to-day or week-to-week basis (even scoring higher) as team members realize that some elements are not as well-defined as initially assumed. It is important to score the elements honestly. The planning process is inherently iterative in nature and any changes that occur in assumptions or planning parameters need to be resolved with earlier planning decisions. The target score (150 or 200 points) may not be as important as the team's progress over time in resolving issues that harbor risk.

The PDRI was developed as a "point in time" tool with elements that are as independent as possible. Most of the elements constitute deliverables to the planning process; however, a close review of the elements shows an imbedded logic relationship between many of the categories and elements--certain elements must first be defined well in order for others to be defined.

Figure 4.1 outlines the logic at a "section" level. In general, Section I elements must be well-defined prior to defining Section II and III elements (Reference 1). Note that this is not a CPM-type logic in that certain elements are completed prior to the point when the next elements can start. Many times elements can be pursued concurrently. As information is gained down stream, elements already defined have to be revisited.

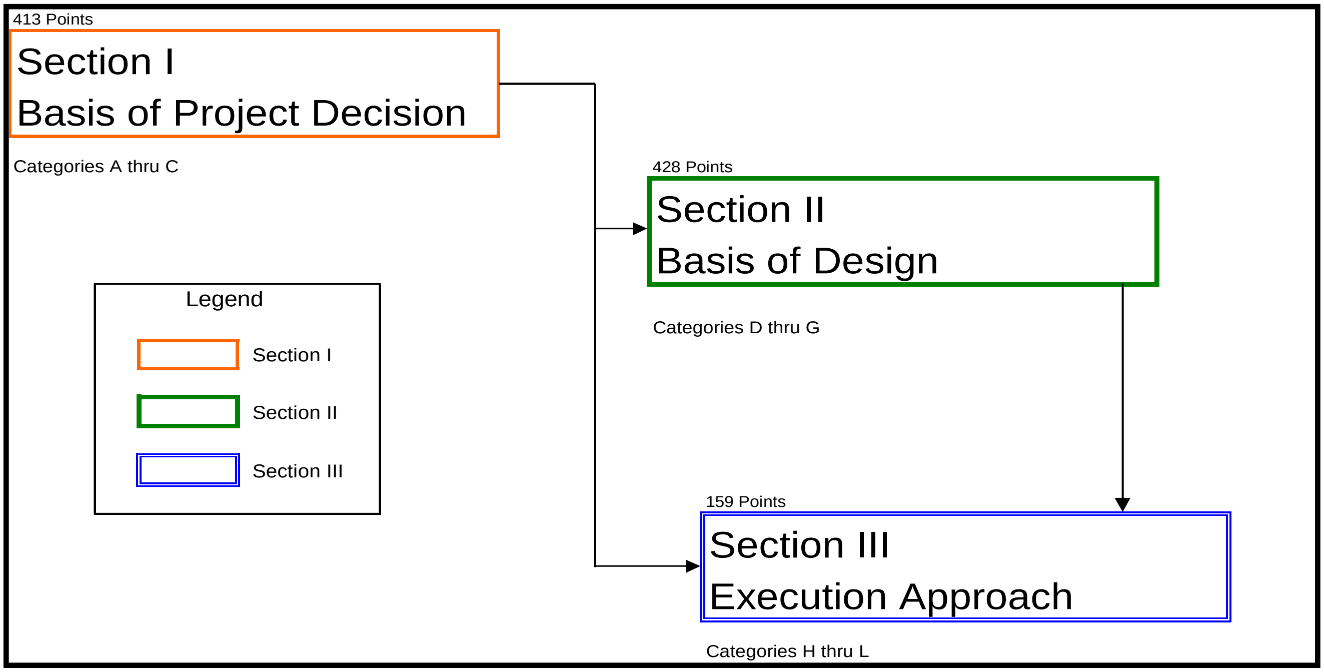

Figure 4.1. Section Logic Flow Diagram

Figure 4.2 outlines the general logic flow of the PDRI categories. (Note: the legend used in Figure 4.1 is carried forward to Figure 4.2) Again, the flow is not the traditional CPM logic paradigm. Indeed, there may be many ways to organize the work differently than the flow shown in this diagram. This logic flow diagram is provided as a guideline for planners to use in pursuing the planning process. For instance, if information gained in Category D, Site Information, is very different than expected (or initially assumed), then a planner should assess the impact of that difference on Categories A, B, and C.

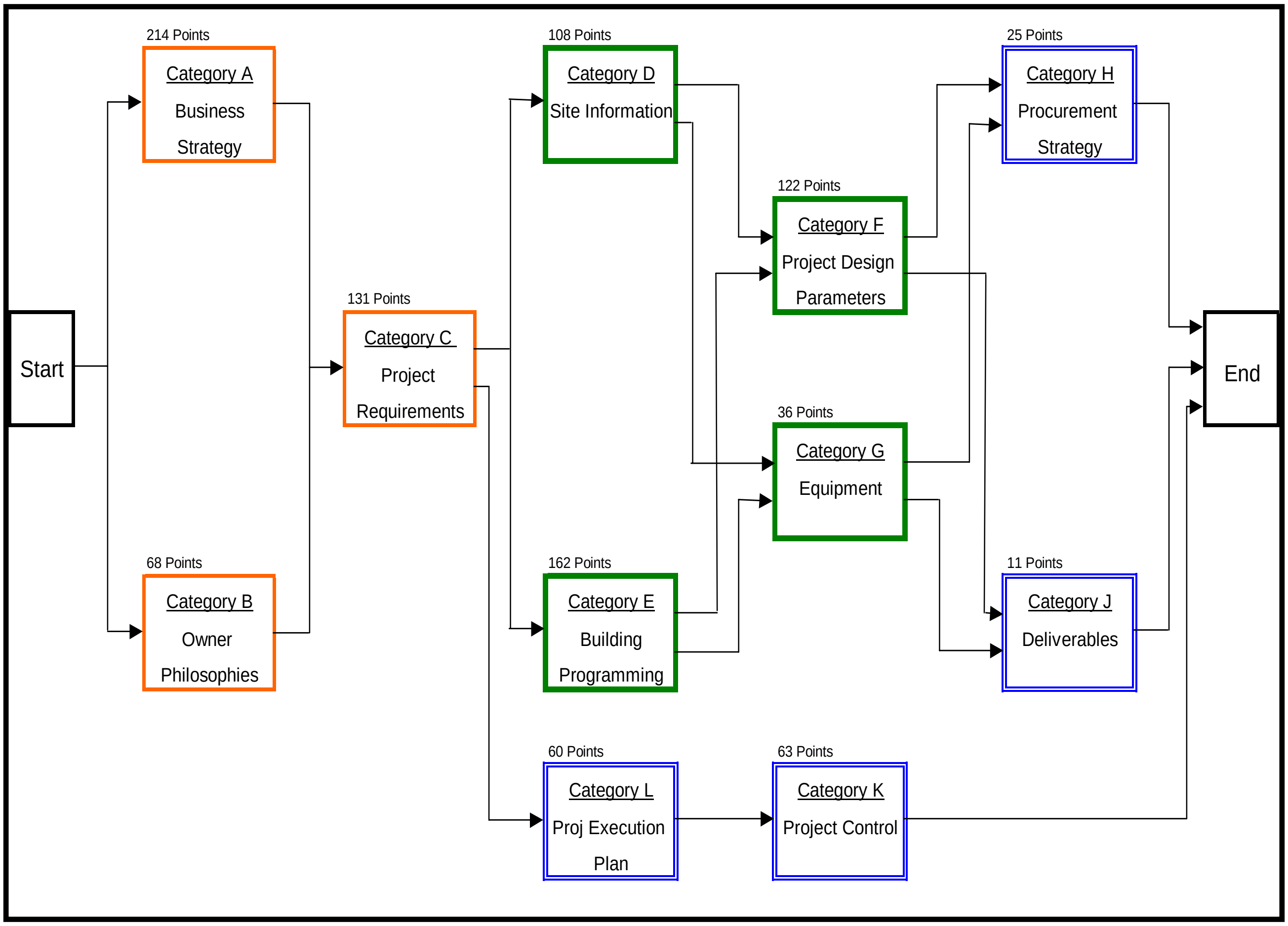

Figure 4.2. Category Logic Flow Diagram

These logic flow diagrams are provided to illustrate the interrelationship between various categories and elements of the PDRI. Your organization may want to standardize a front end planning process and the logic presented in these diagrams could provide the basis for that development.

Use of PDRI on Small or Renovation Projects

The PDRI can be customized to meet each Center's needs.

Revitalization projects are becoming increasingly necessary due to the age of NASA’s technical facilities and infrastructure. These projects are “small” and frequent in nature as well as short in duration. They are diverse in terms of type and requirements. On an individual basis, the scope of these projects may not encompass many of the elements contained in the PDRI. In particular, some of the Basis of Business Decision elements found in Section I of the PDRI may not be clearly defined on these projects. Although business planning is generally performed on an overall program of small projects, it may be difficult to determine if specific business decisions directly apply to one individual project. The NASA Pre-Project Planning Team specifically looked at usage of the PDRI on revitalization projects and came to the conclusion that it could be used, with slight modification, on these types of projects

In these situations an individual wishing to incorporate the PDRI into his/her front end planning program will need to customize it to fit the needs of smaller projects. Since the PDRI was purposely developed to be generic in nature, a user can delete any elements that specifically do not apply on certain types of projects.

If an individual decides to create a scaled-down version of the PDRI, he/she must be aware of the fact that this procedure will alter the maximum possible score from 1000 points to some lower number. Each time an element is deleted from the checklist, the maximum score for the project is reduced by that element's total weight. Further, not only will the maximum score be reduced, but the lowest possible score that can be achieved with complete definition also will drop from 70 points to some lower number.

Any individual choosing to create a scaled-down version of the PDRI must also determine a new target score at which they feel comfortable continuing with detailed design and construction. Although the research presented in this document suggests that a total score of 200 be reached in order to improve the chances for project success, Centers using a scaled-down version of the PDRI will have to collect internal data and determine its own threshold score. For example, if the scaled-down version has a maximum possible score of 752 (after certain elements are deleted from the score sheet), it may determine that a score of 120 must be reached before authorizing its small projects for design.

A word of caution should be given here. The PDRI was not specifically developed to address small or renovation projects with large numbers of not applicable elements. Using the PDRI score sheet for this purpose should be done carefully, or else elements that are relatively more important for small or renovation projects may be given less emphasis than needed. The operative phrase for using the PDRI in these situations is "common sense."

Another possible method to use the PDRI on these types of projects is as a simple checklist. For example, if the project is to change out an existing compressor, the planner may want to peruse the list of PDRI elements and choose the specific elements that are applicable. In this case, Category G, Equipment, will provide the most important reference to equipment scope issues and the element descriptions in Category G can be used as checklists to address key scope questions. In addition, some of the elements in Category B, Owner Philosophies, Category C, Project Requirements, Category D, Site Information, Category F, Building/Project Design Parameters, Category H, Procurement Strategy, and so on may apply as well. The planning effort will correspondingly be fairly small in comparison to a major capital facility, but should provide the basis to make sure that critical issues are not missed. Remember, the purpose of performing planning activities is the identify and answer key questions in order to get a good cost/schedule estimate and overcome unforeseen future problems during design, construction, and operations.

CHAPTER 5: WHAT DOES A PDRI SCORE MEAN?

A low PDRI score represents a project definition package that is well defined and, in general, corresponds to an increased probability for project success. Higher scores signify that certain elements within the project definition package lack adequate definition.

To validate the quality of the PDRI, the CII PDRI for Building Projects Research Team tested it on 32 building projects representing approximately $890 million. For each of these projects, PDRI scores and project success criteria were computed. (Note: these projects were scored after the fact) An analysis of these data yielded a strong correlation between low (good) PDRI scores and high project success. For more information on the validation sample and methodology, please see Reference 1.

The analysis revealed that a significant difference in performance between the projects scoring above 200 and the projects scoring below 200 prior to development of construction documents.

The validation projects scoring below 200 outperformed those scoring above 200 in three important design/construction outcome areas: cost performance, schedule performance, and the relative value of change orders compared to the authorized cost, as shown in Figure 5.1. In addition to cost and schedule differences, the projects scoring less than 200 performed better financially, had fewer numbers of change orders, had less turbulence related to design size changes during development of construction documents and the construction phase, and were generally rated more successful on average than projects scoring higher than 200.

Performance	PDRI Score < 200	PDRI Score > 200	Difference
Cost	1% above budget	6% above budget	5 %
Schedule	2% behind schedule	11% behind schedule	9%
Change Orders	7% of budget	11% of budget	4%
	(N= 16)	(N = 16)	

Figure 5.1. Summary of Cost, Schedule, and Change Order Performance for the PDRI Validation Projects Using a 200 Point Cutoff

The PDRI was also used in on-going projects to observe its effectiveness in helping teams complete project planning activities. Organizations represented on the research team participated in this effort and the PDRI was used on a total of 12 building projects totaling over $400 million at different stages of planning. In each case, the PDRI gave project planners a viable platform to discuss project specific issues and helped identify critical planning problems. Specific lessons learned include:

- The PDRI should be used at a minimum of two times during project planning.
- A facilitator provides a neutral party to help maintain consistency when scoring projects.
- Using the tool is an excellent way to align a project team.
- Because of project pressures, it is often difficult to get the right project participants together to score a project, but the results are worthwhile.
- The tool provides an excellent mechanism to identify specific problems and assign actions.
- The team or individual scoring the project should focus on the scoring process, rather than the final score, in order to honestly identify deficiencies.
- Use the PDRI initially on pre-selected pilot projects in order to gain proficiency with using the tool.
- Train individuals in the use and background of the tool in order to improve consistency.
- The PDRI is effective even when used very early in the planning process. Individual planners can use the tool at this point to identify potential problems and to organize their work effort.
- Care should be taken when determining level of definition of *elements* such as maintenance philosophy or operating philosophy to maintain (within company) consistency of scoring due to the existence of internal standards in many organizations.

It is hard to compare the level of definition of one *project* to another if there is no consistency.

Analyzing PDRI Scores – What to Look For?

The PDRI is of little value unless the user takes action based on the analysis and uses the score in managing the project. Among the potential uses when analyzing the PDRI score are the following:

- Track project progress during front end planning using the PDRI score as a macro-evaluation tool. Individual elements, categories, and sections can be tracked as well. Remember that the method of scoring the project over time (whether individual or team-based) should be consistent because it is a subjective rating.
- Compare project-to-project scores over time in order to look at trends in developing scope definition within your organization.
- Compare different types of projects (e.g., R&D vs. medical vs. office; or new vs. renovation) and determine your acceptable PDRI score for those projects and identify critical success factors from that analysis.
- Determine a comfort level (PDRI score) at which you are willing to authorize projects.

> Depending on the nature of your mission, your internal scope definition practices and requirements, etc., you may wish to use a score other than 200 as a benchmark for beginning of construction document development.

- Look at weak areas for your project on a section, category, or element level for each project over time. For instance, if 16 of the 64 elements rate 5 (no definition), 25 percent of the elements are not defined at all. By adding these element's scores, one can see how much risk they bring to the project relative to 1000 points. This provides an effective method of risk analysis since each element, category and section is weighted relative to each other in terms of potential risk exposure. Use the PDRI score to redirect effort by the project team.

- The individual element scores can be used to highlight the “critical few” elements for team focus--either through segregating by element score or definition level. Remember that the weights given in the score sheet were developed for a generic project. *Your project may have unique requirements that must be met, therefore examine the level of definition in some amount of detail because the score may not be reflective of the project’s complexity or makeup.*

Market/program demand or other pressures to reduce project cycle times may force a team to begin design and construction of projects with underdeveloped definition. In these instances, the amount of time available for defining the scope of the project decreases. Thus, the ability to predict factors that may impact project risk becomes more critical. To minimize the possibility of problems during the detailed design, construction, and commissioning phases of a project, the front end planning effort should focus on the critical few elements that, if poorly defined, could have the greatest potential to negatively impact project performance. Figure 5.2 summarizes the 10 highest ranking PDRI elements based on Category 5, incomplete or poor definition. (Remember, the higher the element weight, the more risk to the project.) Descriptions for these elements are given in Appendix C.

1. Building Use (A1)
2. Facility Requirements (A5)
3. Site Selection Considerations (A7)
4. Business Justification (A2)
5. Project Cost Estimate (C6)
6. Business Plan (A3)
7. Project Design Criteria (C2)
8. Evaluation of Existing Facilities (C3)
9. Future Expansion/Alteration Considerations (A6)
10. Architectural Design (F2)

TOTAL POINTS = 275 / 1000

Figure 5.2. Ten Highest Ranking PDRI Elements
(with corresponding element number in parentheses)

Potential PDRI Score Applications

You may wish to keep your own database of PDRI scores for various project sizes and types. As more projects are completed and scored using the PDRI, your ability to accurately predict the probability of success on future projects should improve. The PDRI may serve as a gauge for the Center in deciding whether or not to move forward with design and construction of a project. You may also wish to use it as an external benchmark for measurement against the practices of other industry leaders or Centers.

Once a PDRI score is obtained, it is important to correlate the score to a measurement of project success. The measurement of project success used by the CII PDRI for Building Projects Research Team are critical performance factors in the execution and operation of the capital facility. In general, lower PDRI scores represent scope definition packages that are well-defined and correspond to higher project success. Higher PDRI scores, on the other hand, signify that certain elements in the scope definition package lack adequate definition and, if the project moves forward with development of construction documents, could result in poorer project performance and lower success.

You will probably want to track your project estimates minus contingency when plotting them versus the PDRI scores. The original estimates are then compared to the final outcome of the project to evaluate its success versus these goals. Plot these estimates to develop a curve for determining contingency allowance on future projects. An explanation of how to develop these curves is given in Reference 6, Appendix E.

CHAPTER 6: RECOMMENDATIONS

The PDRI provides a forum for all project participants to communicate and reconcile differences using an objective tool as a common basis for project scope evaluation. It also provides excellent input into the detailed design process and a solid baseline for design management. The NASA-specific PDRI contained in this book and the instructions given for its usage can provide an effective means of improving planning efforts. If your project is more industrial-oriented than building-oriented, you will want to use the PDRI for Industrial Projects. (Reference 6)

Anyone who wishes to improve the overall performance on their building projects should use the PDRI.

How to Improve Performance on Future Projects

The following suggestions are offered to individuals who adopt the PDRI with the desire to improve performance on their building projects:

- **Commit to early project planning.** Effective planning in the early stages of building projects can greatly enhance cost, schedule, and operational performance while minimizing the possibility of financial failures and disasters.
- **Gain and maintain project team alignment** during front-end planning. Scope definition checklists are effective in helping with team alignment.
- **Adjust the PDRI as necessary to meet the specific needs of your project.** The PDRI was designed so that certain elements considered not applicable on a particular project can be "zeroed out," thus eliminating them from the final scoring calculation.
- **Use the PDRI to improve project performance.** Build your own internal database of projects that are scored using the PDRI. Compute PDRI scores at the various times during scope development along with success ratings once projects are completed. Based upon the relationship between PDRI scores and project success, establish your own basis for the level of scope definition that you feel is acceptable for moving forward on future projects.

- **Use caution when beginning detailed design of projects with PDRI scores greater than 200.** A correlation exists between high PDRI scores and poor project performance.

CII research has shown that the PDRI can effectively be used to improve the predictability of building project performance. However, the PDRI alone will not ensure successful projects. When combined with sound mission planning, alignment, and good project execution, it can greatly improve the probability of meeting or exceeding project objectives.

APPENDIX A: PROJECT SCORE SHEET (UNWEIGHTED)

SECTION I - BASIS OF PROJECT DECISION							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
A. BUSINESS STRATEGY							
A1. Building Use							
A2. Business Justification							
A3. Business Plan							
A4. Economic Analysis							
A5. Facility Requirements							
A6. Future Expansion/Alteration Considerations							
A7. Site Selection Considerations							
A8. Project Objectives Statement							
CATEGORY A TOTAL							
B. OWNER PHILOSOPHIES							
B1. Reliability Philosophy							
B2. Maintenance Philosophy							
B3. Operating Philosophy							
B4. Design Philosophy							
CATEGORY B TOTAL							
C. PROJECT REQUIREMENTS							
C1. Value-Analysis Process							
C2. Project Design Criteria							
C3. Evaluation of Existing Facilities							
C4. Scope of Work Overview							
C5. Project Schedule							
C6. Project Cost Estimate							
CATEGORY C TOTAL							
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						Score
	0	1	2	3	4	5	
D. SITE INFORMATION							
D1. Site Layout							
D2. Site Surveys							
D3. Civil/Geotechnical Information							
D4. Governing Regulatory Requirements							
D5. Environmental Assessment							
D6. Utility Sources with Supply Conditions							
D7. Site Life Safety Considerations							
D8. Special Water and Waste Treatment Req'mts							
						CATEGORY D TOTAL	
E. BUILDING PROGRAMMING							
E1. Program Statement							
E2. Building Summary Space List							
E3. Overall Adjacency Diagrams							
E4. Stacking Diagrams							
E5. Growth & Phased Development							
E6. Circulation and Open Space Requirements							
E7. Functional Relationship Diagrams/Room by Room							
E8. Loading/Unloading/Storage Facilities Req'mts							
E9. Transportation Requirements							
E10. Building Finishes							
E11. Room Data Sheets							
E12. Furnishings, Equipment, & Built-Ins							
E13. Window Treatment							
						CATEGORY E TOTAL	
F. BUILDING/PROJECT DESIGN PARAMETERS							
F1. Civil/Site Design							
F2. Architectural Design							
F3. Structural Design							
F4. Mechanical Design							
F5. Electrical Design							
F6. Building Life Safety Requirements							
F7. Constructability Analysis							
F8. Technological Sophistication							
						CATEGORY F TOTAL	

Definition Levels

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

SECTION II - BASIS OF DESIGN							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
G. EQUIPMENT							
G1. Equipment List							
G2. Equipment Location Drawings							
G3. Equipment Utility Requirements							
CATEGORY G TOTAL							
SECTION II TOTAL							

Definition Levels

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

SECTION III - EXECUTION APPROACH							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
H. PROCUREMENT STRATEGY							
H1. Identify Long Lead/Critical Equip. & Materials							
H2. Procurement Procedures and Plans							
CATEGORY H TOTAL							
J. DELIVERABLES							
J1. CADD/Model Requirements							
J2. Documentation/Deliverables							
CATEGORY J TOTAL							
K. PROJECT CONTROL							
K1. Project Quality Assurance and Control							
K2. Project Cost Control							
K3. Project Schedule Control							
K4. Risk Management							
K5. Safety Procedures							
CATEGORY K TOTAL							
L. PROJECT EXECUTION PLAN							
L1. Project Organization							
L2. Owner Approval Requirements							
L3. Project Delivery Method							
L4. Design/Construction Plan & Approach							
L5. Substantial Completion Requirements							
CATEGORY L TOTAL							
SECTION III TOTAL							
PDRI TOTAL SCORE							

Definition Levels

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

APPENDIX B: PROJECT SCORE SHEET (WEIGHTED)

SECTION I - BASIS OF PROJECT DECISION							
CATEGORY Element	**Definition Level**						**Score**
	0	**1**	**2**	**3**	**4**	**5**	
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 **2 = Minor Deficiencies** **4 = Major Deficiencies**
1 = Complete Definition **3 = Some Deficiencies** **5 = Incomplete or Poor Definition**

SECTION II - BASIS OF DESIGN							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
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 Req'mts	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 Req'mts	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 **2 = Minor Deficiencies** **4 = Major Deficiencies**
1 = Complete Definition **3 = Some Deficiencies** **5 = Incomplete or Poor Definition**

SECTION II - BASIS OF DESIGN							
	Definition Level						Score
CATEGORY Element	0	1	2	3	4	5	
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	

Definition Levels

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

SECTION III - EXECUTION APPROACH							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
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 Maximum Score = 1000 — PDRI TOTAL SCORE							

Definition Levels

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

APPENDIX C: ELEMENT DESCRIPTIONS

The following descriptions have been developed to help generate a clear understanding of the terms used in the Project Score Sheets located in Appendices A and B. Some descriptions include checklists to clarify concepts and facilitate ideas when scoring each element. *NASA-specific descriptions are annotated in bold text. Commentary referencing NASA-specific processes is placed in parenthesis.* Note that these checklists are not all-inclusive and the user may supplement these lists when necessary.

The descriptions are listed in the same order as they appear in the Project Score Sheet. They are organized in a hierarchy by section, category, and element. The Project Score Sheet consists of three main sections, each of which is broken down into a series of categories which, in turn, are further broken down into elements. Scoring is performed by evaluating the levels of definition of the elements, which are described in this attachment. The sections and categories are organized as follows:

SECTION I BASIS OF PROJECT DECISION

This section consists of information necessary for understanding the project objectives. The completeness of this section determines the degree to which the project team will be able to achieve alignment in meeting the project's business objectives.

Categories:

A -Business Strategy

B -Owner Philosophies

C -Project Requirements

SECTION II BASIS OF DESIGN

This section consists of space, site, and technical design elements that should be evaluated to fully understand the basis for design of the project.

Categories:

D -Site Information

E -Building Programming

F -Building/Project Design Parameters

G -Equipment

SECTION III EXECUTION APPROACH

This section consists of elements that should be evaluated to fully understand the requirements of the owner's execution strategy.

Categories:

H -Procurement Strategy

J -Deliverables

K -Project Control

L -Project Execution Plan

The following pages contain detailed descriptions for each element in the PDRI.

SECTION I - BASIS OF PROJECT DECISION

A. BUSINESS STRATEGY

A1. Building Use

Identify and list building uses or functions. These may include uses such as:

❑ Retail	❑ Research	❑ Storage
❑ Institutional	❑ Multimedia	❑ Food service
❑ Instructional	❑ Office	❑ Recreational
❑ Medical	❑ Light manufacturing	❑ **Aircraft Operations**
❑ Other		

(A description of other options which could also meet the facility need should be defined. (As an example, did we consider renovating existing space rather than building new space?) A listing of current facilities that will be vacated due to the new project should be produced.)

A2. Business Justification

Identify driving forces for the project and specify what is most important from the viewpoint of the owner including both needs and expectations. Address items such as:

❑ Possible competitors	❑ Need date
❑ Level of amenities	❑ Target consumers
❑ Location	❑ Building utilization justification
❑ Sales or rental levels	❑ Number of lessors/occupant types
❑ Market capacity	❑ Support new business initiatives
❑ Use flexibility	❑ Facility replacement/consolidation

❑ **Alignment with NASA Strategic Plan and Center of Excellence guidelines**

❑ **Core Capability**	❑ Other

A3. Business Plan

A project strategy should be developed that supports the business justification in relation to the following items:

- ❑ Funding availability
- ❑ Cost and financing
- ❑ Schedule milestones (including known deadlines)
- ❑ Types and sources of project funds
- ❑ Related/resulting projects
- ❑ Other

(Parts of this element may be applicable to NASA Form 1509)

Note: If NASA 3rd party agreement, additional steps required

A4. Economic Analysis

An economic model should be developed to determine the viability of the venture. The model should acknowledge uncertainty and outline the boundaries of the analysis. It should acknowledge items such as:

- ❑ Design life
- ❑ Building Ownership
- ❑ Long-term operating and maintenance costs
- ❑ Resale/lease potential or in the case of institutional buildings, long term use plans
- ❑ Analysis of capital and operating cost versus sales or occupancy and profitability
- ❑ Other

(Parts of this element may be applicable to NASA Form 1510)

A5. Facility Requirements

Facility size requirements are many times determined by applicable code and are often driven by occupancy. Note that this analysis is at the macro level. Some considerations are listed below:

- ❑ Number of occupants
- ❑ Volume
- ❑ Net and gross space requirements by area uses

- Support infrastructure
- Classroom size
- Linear meters of display space
- Number of laboratory stations
- Occupant accommodation requirements (i.e., number of hospital beds, number of desks, number of workstations, on-site child care, on-site medical care, cot space, etc.)
- Other

A6. Future Expansion/Alteration Considerations

The possibility of expansion and/or alteration of the site and building should be considered for facility design. These considerations consist of a list of items that will facilitate the expansion or evolution of building use including adaptability/flexibility. Evaluation criteria may include:

- Provisions for site space in case of possible future expansion up or out
- Technologically advanced facility requirements
- Are departments or functional areas intended to “grow in place” during the future phase?
- If there will not be a future expansion of the building, how will departments or areas expand?
- Are any functional areas more likely than others to move out of the building in the future to allow others to expand or move in?
- Who will occupy the building in 5, 10, 15, 20 years?
- Flexibility or adaptability for future uses.
- Future phasing plan
- Other

A7. Site Selection Considerations

Evaluation of sites should address issues relative to different locations (i.e., global, country, or local). This evaluation may take into consideration existing buildings or properties, as well as new locations. The selection criteria include items such as:

- General geographic location
    - Access to the targeted market area
    - Local availability and cost of skilled labor (e.g., construction, operations)
    - Available utilities

- Existing facilities
    - Economic incentive zones
    - Tax
- Land availability and developed costs
- Legal constraints
- Unusual financing requirements in region/locality
- Domestic culture vs. international culture
- Community relations
- Labor relations
- Government relations
- Political issues/constraints
- Education/training
- Safety and health considerations
- Environmental issues
- Symbolic and aesthetic
- Historic preservation
- Weather/climate
- Permitting Schedule
- **Master Plan Considerations**
- Other

A8. Project Objectives Statement

This statement defines the project objectives and priorities for meeting the business strategy. It should be clear, concise, measurable, and specific to the project. It is desirable to obtain total agreement from the entire project team regarding these objectives and priorities to ensure alignment. Specifically, the priorities among cost, schedule, and value-added quality features should be clear. The objectives also should comply with any master plans if applicable.

(Parts of this element may be applicable to NASA Form 1509 and/or the Management Plan)

B. OWNER PHILOSOPHIES

B1. Reliability Philosophy

A brief description of the project intent in terms of reliability should be defined. A list of the general design principles to be considered to achieve optimum/ideal operating performance from the facility/building should be addressed. Considerations may include:

- ❑ Critical systems redundancy
- ❑ Architectural/structural/civil durability
- ❑ Mechanical/electrical/plumbing reliability
- ❑ Other

B2. Maintenance Philosophy

A list of the general design principles to be considered to meet building maintenance requirements should be identified. This evaluation should include life cycle cost analysis of major facilities. Considerations may include:

- ❑ Daily occupancy loads
- ❑ Maximum building occupancy requirements
- ❑ Equipment monitoring requirements
- ❑ Energy conservation programs
- ❑ Selection of materials & finishes
- ❑ Requirements for building finishes
- ❑ **Reliability Centered Maintenance Program requirements**
- ❑ Other

(Refer to Center specific maintenance requirements)

B3. Operating Philosophy

A list of the general design issues that need to be considered to support routine operations should be developed. Issues may include:

- ❑ Operating schedule/hours
- ❑ Provisions for building rental or occupancy assignments (i.e., by room, floor, suite) including flexibility of partitioning
- ❑ Future renovation schedule
- ❑ User finish out philosophy
- ❑ Flexibility to change layout
- ❑ Other

B4. Design Philosophy

A listing of design philosophy issues should be developed. These issues should be directed at concerns such as the following:

- ❑ Design life
- ❑ Aesthetic requirements
- ❑ Compatibility with master plan
- ❑ Theme
- ❑ Image
- ❑ Environmentally sustainable design (internal/external)
- ❑ Quality of life
- ❑ **Design for maintainability**
- ❑ Other

C. PROJECT REQUIREMENTS

C1. Value-Analysis Process

A structured value analysis approach should be in place to consider design and material alternatives in terms of their cost effectiveness. Items that impact the economic viability of the project should be considered. Items to evaluate include issues such as:

- ❑ Discretionary scope issues

- ❑ Expensive materials of construction
- ❑ Life-cycle analysis of construction methods and structure
- ❑ Other

C2. Project Design Criteria

Project design criteria are the requirements and guidelines which govern the design of the project. Any design review board or design review process should be clearly articulated. Evaluation criteria may include:

- ❑ Level of design detail required
- ❑ Climatic data
- ❑ Codes & standards
  - ❑ National ❑ Local ❑ **Randolph-Sheppard Act**
  - ❑ **Govm't & NASA specific** ❑ International
- ❑ Utilization of design standards
  - ❑ **Govm't & NASA** ❑ Contractor's
  - ❑ Designer's ❑ Mixed
  - ❑ Level of design detail required
- ❑ **3rd Party requirements**
- ❑ Sole source requirements for equipment or systems
- ❑ Insurance underwriter requirements
- ❑ Cultural preferences
- ❑ Other

C3. Evaluation of Existing Facilities

If existing facilities are available, then a condition assessment must be performed to determine if they will meet facility requirements. Evaluation criteria may include:

- ❑ Capacity
  - ❑ Power ❑ Utilities (i.e., potable water, gas, oil, etc.)
  - ❑ Fire water ❑ Waste treatment/disposal
  - ❑ Sanitary sewer ❑ Telecommunications
  - ❑ Security ❑ Storm water containment system/filtration
- ❑ Access
  - ❑ Rail ❑ ADA or local standards

- Roads
- Parking areas
- Type and size of buildings/structures
- Amenities
  - Food service
  - Ambulatory access
  - Medical facilities
  - Recreation facilities including public outdoor spaces
  - Change rooms
- Condition assessment of existing facilities and infrastructure **(Includes existing safety and occupational health conditions that need correction.)**
- **Assess availability and condition of As-Built drawings**
- Other

C4. Scope of Work Overview

This work statement overview is a complete narrative description of the project that is discipline-oriented and supports development of the project schedule and project cost estimate. It sets the limits of work by each involved party and generally articulates their financial, task, and contractual responsibilities. It clearly states both assumptions and exclusions used to define the scope of work.

(Parts of this element may be applicable to NASA Form 1509 and the Project Management Plan)

C5. Project Schedule

Ideally, the project schedule should be developed by the project team (owner, A/E, and construction contractor). It should include milestones, unusual schedule considerations and appropriate master schedule “contingency” time (float), procurement of long lead or critical pacing equipment, and required submissions and approvals.

C6. Project Cost Estimate

The project cost estimate should address all costs necessary for completion of the project. This cost estimate may include the following:

- Construction contract estimate
- Professional fees
- Land cost
- Furnishings
- Administrative costs
- Contingencies
- Cost escalation for elements outside the project cost estimate
- Startup costs including installation
- Miscellaneous expenses including but not limited to:
  - Specialty consultants
  - Inspection & testing services
  - Bidding costs
  - Site clearance
  - Bringing utilities to the site
  - Environmental impact mitigation measures
  - Local authority permit fees
  - Occupant moving & staging costs
  - Utility costs during construction (if paid by owner)
  - Interest on borrowed funds (cost of money)
  - Site surveys, soils tests
  - Availability of construction laydown & storage at site or in remote or rented facilities
- Other

(NASA Form 1510 is a summary of the detailed cost estimate; Portions of the cost estimate also apply to NASA Form 1509; Note that some costs in the list above should not be included in the current cost estimate (CCE)—these costs are referred to as "related costs" in Section 4.6.1 of the FPIH; In any case, they will need to be identified and controlled at some point in the project.)

SECTION II - BASIS OF DESIGN

D. SITE INFORMATION

D1. Site Layout

The facility should be sited on the selected property. Layout criteria may include items such as:

- Access (e.g., road, rail, marine, air, etc.)
- Construction access
- Historical/cultural
- Trees, vegetation and **wildlife**
- Site massing and context constraints or guidelines (i.e., how a building will look in 3-dimensions at the site)
- Access transportation parking, delivery/service, & pedestrian circulation considerations
- Open space, street amenities, “urban context concerns”
- Climate, wind, and sun orientation for natural lighting views, heat loss/gain, energy conservation, and aesthetic concerns
- **Safety and occupational health issues**
- **Blast area and quantity distance considerations**
- Other

D2. Site Surveys

The site should be surveyed for the exact property boundaries, including limits of construction. A topography map with the overall plot and site plan is also needed. Evaluation criteria may include:

- Legal property descriptions with property lines
- Easements
- Rights-of-way
- Drainage patterns
- Deeds
- Definition of final site elevation
- Benchmark control systems
- Setbacks

- ❑ Access & curb cuts
- ❑ Proximity to drainage ways and flood plains
- ❑ Known below grade structures and utilities (both active and inactive)
- ❑ Trees, vegetation and **wildlife**
- ❑ Existing facility locations and conditions
- ❑ Solar/shadows
- ❑ Other

D3. Civil/Geotechnical Information

The civil/geotechnical site evaluation provides a basis for foundation, structural, and hydrological design. Evaluations of the proposed site should include items such as:

- ❑ Depth to bedrock
- ❑ General site description (e.g., terrain, soils type, existing structures, spoil removal, areas of hazardous waste, etc.)
- ❑ Expansive or collapse potential of soils
- ❑ Fault line locations
- ❑ Spoil area for excess soil (i.e., location of on-site area or off-site instructions)
- ❑ Seismic requirements
- ❑ Water table elevation
- ❑ Flood plain analysis
- ❑ Soil percolation rate & conductivity
- ❑ Ground water flow rates and directions
- ❑ Need for soil treatment or replacement
- ❑ Description of foundation design options
- ❑ Allowable bearing capacities
- ❑ Pier/pile capacities
- ❑ Paving design options
- ❑ Overall site analysis
- ❑ **Demolition requirements**
- ❑ Other

D4. Governing Regulatory Requirements

The local, state, and federal government permits necessary to construct and operate the facility should be identified. A work plan should be in place to prepare, submit, and track permit, regulatory, re-zoning, and code compliance for the project. It should include items such as:

- ❑ Construction
- ❑ Unique requirements
- ❑ Environmental
- ❑ Structural calculations
- ❑ Building height limits
- ❑ Setback requirements
- ❑ Fire
- ❑ Building
- ❑ Occupancy
- ❑ Special
- ❑ Signage
- ❑ Historical issues
- ❑ Accessibility
- ❑ Demolition
- ❑ Solar
- ❑ Platting
- ❑ Air/water
- ❑ Transportation
- ❑ **National Resource Protection Act**
- ❑ Other

The codes that will have a significant impact on the scope of the project should also be investigated and explained in detail. Particular attention should be paid to local requirements. Regulatory and code requirements may affect the defined physical characteristics and project cost estimate. The project schedule may be affected by regulatory approval processes. For some technically complex buildings, regulations change fairly often.

D5. Environmental Assessment

An environmental assessment should be performed for the site to evaluate issues that can impact the cost estimate or delay the project. These issues may include:

- ❑ Archeological
- ❑ Location in an EPA air quality non-compliance zone
- ❑ Location in a wet lands area
- ❑ Environmental permits now in force
- ❑ Existing contamination
- ❑ Location of nearest residential area

- ❑ Ground water monitoring in place
- ❑ Downstream uses of ground water
- ❑ Existing environmental problems with the site
- ❑ Past/present use of site
- ❑ Noise/vibration requirements
- ❑ Air/water discharge requirements and options evaluated
- ❑ Discharge limits of sanitary and storm sewers identified
- ❑ Detention requirements
- ❑ Endangered species
- ❑ Erosion/sediment control
- ❑ **Neighborhood concerns**
- ❑ **HAZMAT mitigation (asbestos, lead paint, mercury…etc.)**
- ❑ **National Environmental Policy Act requirements**
- ❑ Other

D6. Utility Sources with Supply Conditions

The availability/non-availability of site utilities needed to operate the facility with supply conditions of quantity, temperature, pressure, and quality should be evaluated. This may include items such as:

- ❑ Potable water
- ❑ Drinking water
- ❑ Cooling water
- ❑ Fire water
- ❑ Sewers
- ❑ Instrument air
- ❑ Facility air
- ❑ Heating water
- ❑ Gases
- ❑ Steam
- ❑ Electricity (voltage levels)
- ❑ Communications (e.g., data, cable television, telephones)
- ❑ Special requirement (e.g., deionized water or oxygen)
- ❑ **Central air and Vacuum systems**
- ❑ **Cryogenics**
- ❑ Other

(Refer to element G3 for specific equipment requirements)

D7. Site Life Safety Considerations

Fire and life safety related items should be taken into account for the selected site. These items should include fire protection practices at the site, available firewater supply (amounts and conditions), special safety requirements unique to the site, etc. Evaluation criteria may include:

- ❑ Wind direction indicator devices (e.g., wind socks)
- ❑ Fire monitors & hydrants
- ❑ Flow testing
- ❑ Access and evacuation plan
- ❑ Available emergency medical facilities
- ❑ Security considerations (site illumination, access control, etc.)
- ❑ Other

D8. Special Water and Waste Treatment Requirements

On-site or pretreatment of water and waste should be evaluated. Items for consideration may include:

- ❑ Wastewater treatment
  - ❑ Process waste
  - ❑ Sanitary waste
- ❑ Waste disposal
- ❑ Storm water containment & treatment
- ❑ Other

E. BUILDING PROGRAMMING

E1. Program Statement (Refer to Requirements Document)

The program statement identifies the levels of performance for the facility in terms of space planning and functional relationships. It should address the human, physical, and external aspects to be considered in the design. Each performance criteria should include these issues:

- ❑ A performance statement outlining what goals are to be attained (e.g., providing sufficient lighting levels to accomplish the specified task safely and efficiently)

- A measure that must be achieved (e.g., 200 foot-candles at surface of surgical table)
- A test which is an accepted approach to establish that the criterion has been met (e.g., using a standard light meter to do the job)
- Other

E2. Building Summary Space List

The *summary* space list includes *all* space requirements for the entire project. This list should address specific types and areas. Possible space listings include:

- Building population
- Administrative offices
- Lounges
- Food Service Cafeteria
- Conference rooms
- Vending alcoves
- Janitorial closets
- Elevators
- Stairs
- Loading docks
- **Fabrication areas**
- Dwelling units
- Special technology considerations
- Classrooms
- Laboratories
- Corridors
- Storage facilities
- Mechanical rooms
- Electrical rooms
- Parking space
- Entry lobby
- Restrooms
- Data/computer areas
- **Hangar Space**
- **Clean rooms**
- Other considerations

A room data sheet should correspond to each entry on the summary space list. Room data sheets are discussed in element E11. The room data sheet contains information that is necessary for the summary space list. This list is used to determine assignable (usable) and non-assignable (gross) areas.

E3. Overall Adjacency Diagrams

The overall adjacency diagrams depict the layout of each department or division of the entire building. They show the relationship of specific rooms, offices, and sections. The adjacency diagrams must adequately convey the overall relationships between functional areas within the facility. Note that these diagrams are sometimes known as “bubble diagrams” or “balloon diagrams.” They are also commonly expressed in an adjacency matrix.

E4. Stacking Diagrams

A stacking diagram portrays each department or functional unit vertically in a multi-story building. Stacking diagrams are drawn to scale, and they can help establish key design elements for the building. These diagrams are easily created with space lists and adjacency (or bubble) diagrams. Critical vertical relationships may relate to circulatory (stairs, elevators), structural elements, and mechanical or utility shafts. Stacking diagrams can establish building elements such as floor size. This type of diagram often combines functional adjacencies and space requirements and also shows how the project is sited.

(Conduct safety evaluations to determine operational issues)

E5. Growth and Phased Development

Provisions for future phases or anticipated use change must be considered during project programming. A successful initial phase necessitates a plan for the long term phases. The following phasing issues may be addressed.

- ❑ Guidelines to allow for additions (i.e., over-design of structural systems, joist layout, column spacing, etc.)
- ❑ Technology needs as facility grows and expands or changes (e.g., mechanical systems, water demands, etc.)
- ❑ Compare the additional costs involved with making the building “expandable” versus the probability of the future expansion occurring as envisioned.

- ❑ Provisions for infrastructure that allow for future expansion
- ❑ Other

E6. Circulation and Open Space Requirements

An important component of space programming is common-area open spaces, both interior and exterior. These areas include the items listed and considerations such as:

- ❑ Exterior
  - ❑ Service dock areas and access
  - ❑ Circulation to parking areas
  - ❑ Passenger drop-off areas
  - ❑ Pedestrian walkways
  - ❑ Courtyards, plazas, or parks
  - ❑ Landscape buffer areas
  - ❑ Unbuildable areas (e.g., wetlands or slopes)
  - ❑ Sidewalks or other pedestrian routes
  - ❑ Bicycle facilities
  - ❑ Lobbies and entries
  - ❑ Security considerations (e.g., card access or transmitters)
  - ❑ Snow removal plan
  - ❑ Postal and newspaper delivery
  - ❑ Waste removal
  - ❑ Fire and life-safety circulation considerations
- ❑ Interior
  - ❑ Interior aisle ways and corridors
  - ❑ Vertical circulation (i.e., personnel & material transport including elevators and escalators)
  - ❑ Directional and location signage
  - ❑ **Fire and life-safety circulation considerations**
  - ❑ Other

E7. Functional Relationship Diagrams/Room by Room

Room by room functional relationship diagrams show the structure of adjacencies of a group of rooms. With these adjacency diagrams (also known as bubble diagrams), the architect can convert them into a floor plan with all the relationships. Each space detail sheet should have a minimum of one functional relationship diagram. Rooms are often represented by circles, bubbles, squares, or rectangles. Larger rooms are represented with bigger symbols. They are also commonly expressed in an adjacency matrix.

E8. Loading/Unloading/Storage Facilities Requirements

A list of requirements identifying materials to be unloaded and stored and products to be loaded along with their specifications. This list should include items such as:

- ❑ Storage facilities to be provided and/or utilized
- ❑ Refrigeration requirements and capabilities
- ❑ Mail/small package delivery
- ❑ Recycling requirements
- ❑ **Material handling (including staging between lab facilities)**
- ❑ **Research and operational requirements**
- ❑ Other

E9. Transportation Requirements

Specifications for implementation of facility transportation (e.g., roadways, conveyers, elevators, etc.) as well as methods for receiving and shipping of materials (e.g., air, rail, truck, marine, etc.) should be identified. Provisions should be included for items such as:

- ❑ Facility access requirements based on transportation
- ❑ Drive-in doors
- ❑ Extended ramps for low clearance trailers
- ❑ Rail car access doors

- ❑ Service elevators
- ❑ Loading docks
- ❑ Temporary parking
- ❑ Other

E10. Building Finishes

Levels of interior and exterior finishes should be defined for the project. For example, the finishes may include categories such as:

<u>Interior Schedule:</u>

- ❑ Type A
  - ❑ Floor: vinyl composition tile
  - ❑ Walls: painted
- ❑ Type B
  - ❑ Floor: direct glue carpet
  - ❑ Walls: vinyl wall covering
- ❑ Type C
  - ❑ Floor: carpet over pad
  - ❑ Walls: wood paneling

<u>Exterior Schedule:</u>

- ❑ Type 1
  - ❑ Walls: brick
  - ❑ Trim: brick
- ❑ Type 2
  - ❑ Walls: overlapping masonry
  - ❑ Trim: cedar

Finishes and local design standards are further defined in category F.

(Check Center specific standards)

E11. Room Data Sheets

Room data sheets contain the specific requirements for each room considering its functional needs. A room data sheet should correspond to each room on the building summary space list. The format of the room data sheet should be consistent. Possible issues to include on room data sheets are:

- ❑ Critical dimensions
- ❑ Technical requirements (e.g., fireproof, explosion resistance, X-ray, etc.)
- ❑ Furnishing requirements
- ❑ Equipment requirements
- ❑ Audio/visual (A/V) data and communication provisions
- ❑ Lighting requirements
- ❑ Utility requirements
- ❑ Security needs including access/hours of operation
- ❑ Finish type
- ❑ Environmental issues
- ❑ Acoustics/vibration requirements
- ❑ Life-safety
- ❑ **High Bay area requirements**
- ❑ **Special Equipment (Cranes, tooling and rigging requirements)**
- ❑ Other

E12. Furnishings, Equipment, and Built-Ins

All moveable furnishings, equipment, and built-ins should be listed on the room data sheets. Moveable and fixed in place equipment should be distinguished. Building modifications, such as wide access doors or high ceilings, necessary for any equipment also need to be listed. Long delivery time items should be identified and ordered early. It is critical to identify the utility impact of equipment (e.g., electrical, cooling, special water or drains, venting, radio frequency shielding, etc.). Examples may include:

- ❑ Furniture
- ❑ Kitchen equipment
- ❑ Material handling
- ❑ Partitions

- Medical equipment
- Other

New items and relocated existing items must be distinguished in the program. The items can be classified in the following categories.

(“Owner” is typically the Government but could be a 3rd party supplier)

New Items:

- Contractor furnished and contractor installed
- Owner furnished and contractor installed
- Owner furnished and owner installed
- Other

Existing Items:

- Relocated as is and contractor installed
- Refurbished and installed by contractor
- Relocated as is and owner installed
- Refurbished and installed by owner
- Other

E13. Window Treatment

Any special fenestration window treatments for energy and/or light control should be noted in order to have proper use of natural light. Some examples include:

- Blocking of natural light
- Glare reducing windows
- Exterior louvers
- Interior blinds
- Other

F. BUILDING/PROJECT DESIGN PARAMETERS

F1. Civil/Site Design

Civil/site design issues should be addressed to provide a basis for facility design. Issues to address may include:

- ❑ Service and storage requirements
- ❑ Elevation and profile views
- ❑ High point elevations for grade, paving, and foundations
- ❑ Location of equipment
- ❑ Minimum overhead clearances
- ❑ Storm drainage system
- ❑ Location and route of underground utilities
- ❑ Site utilities
- ❑ Earth work
- ❑ Subsurface work
- ❑ Paving/curbs
- ❑ Landscape/xeriscape
- ❑ Fencing/site security
- ❑ **Exterior furnishings (Bus stops, benches, traffic lights, shade structures…etc.)**
- ❑ Other

F2. Architectural Design

Architectural design issue should be addressed to provide a basis for facility design. These issues may include the following:

- ❑ Determination of metric (hard/soft) versus Imperial (English) units
  (Note: The term "hard" metric means that materials and equipment are identified on the drawings and have to be delivered in metric-sized unit dimensions such as 200mm by 400mm. "Soft" metric means that materials and equipment can be delivered using sizes that approximate the metric dimensions given on the drawings, such as 3 inch length instead of 8 cm. It is important to set these dimensions and not "mix and match.")
- ❑ Requirements for building location/orientation horizontal & vertical
- ❑ Access requirements

- ❑ Nature/character of building design (e.g., aesthetics, etc.)
- ❑ Construction materials
- ❑ Acoustical considerations
- ❑ American with Disabilities Act requirements or other local access requirements
- ❑ Architectural Review Boards
- ❑ Planning & zoning review boards
- ❑ Circulation considerations
- ❑ Seismic design considerations
- ❑ Color/material standards
- ❑ Hardware standards
- ❑ Furniture, furnishings, and accessories criteria
- ❑ Design grid
- ❑ Floor to floor height
- ❑ Other

F3. Structural Design

Structural design considerations should be addressed to provide a basis for the facility design. These considerations may include the following:

- ❑ Structural system (e.g., construction materials, constraints, etc.)
- ❑ Seismic requirements
- ❑ Foundation system
- ❑ Corrosion control requirements/required protective coatings
- ❑ Client specifications (e.g., basis for design loads, vibration, deflection, etc.)
- ❑ Future expansion/flexibility considerations
- ❑ Design loading parameter (e.g., live/dead loads, design loads, collateral load capacity, equipment/material loads, wind/snow loads, uplift)
- ❑ Functional spatial constraints
- ❑ **Check hook height and tooling requirements**
- ❑ Other

F4. Mechanical Design

Mechanical design parameters should be developed to provide a basis for facility design. Items to consider include:

- ❑ Special ventilation or exhaust requirements
- ❑ Equipment/space special requirements with respect to environmental conditions (e.g., air quality, special temperatures)
- ❑ Energy conservation and life cycle costs
- ❑ Acoustical requirements
- ❑ Zoning and controls
- ❑ Air circulation requirements
- ❑ Outdoor design conditions (e.g., minimum and maximum yearly temperatures)
- ❑ Indoor design conditions (e.g., temperature, humidity, pressure, air quality, etc.)
- ❑ Building emissions control
- ❑ Utility support requirements
- ❑ System redundancy requirements
- ❑ Plumbing requirements
- ❑ Special piping requirements
- ❑ Seismic requirements
- ❑ Other

F5. Electrical Design

Electrical design parameters provide the basis for facility design. Consider items such as:

- ❑ Power sources with available voltage & amperage
- ❑ Special lighting considerations (e.g., lighting levels, color rendition)
- ❑ Voice, data, and video communications requirements
- ❑ Uninterruptable power source (UPS) and/or emergency power requirements
- ❑ Energy consumption/conservation and life cycle cost
- ❑ Ability to use daylight in lighting
- ❑ Seismic requirements
- ❑ Lightning/grounding requirements
- ❑ Other

F6. Building Life Safety Requirements

Building life safety requirements are a necessity for building operations. They should be identified at this stage of the project. Possible safety requirements are listed below:

- Fire resistant requirements
- Explosion resistant requirements
- Area of refuge requirements in case of catastrophe
- Safety and alarm requirements
- Fire detection and/or suppression requirements
- Eye wash stations
- Safety showers
- Deluge requirements and foam
- Fume hoods
- Handling of hazardous materials
- Isolation facilities
- Sterile environments
- Emergency equipment access
- Personnel shelters
- Egress
- Public address requirements
- Data or communications protection in case of disaster or emergency
- Fall hazard protection
- Gas hazard detection
- **Laser protection**
- **Planetary contamination protection**
- **Noise level requirements**
- **Ventilation requirements for restrooms, offices, and industrial areas**
- Other

F7. Constructability Analysis

CII defines constructability as, "the optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives. Maximum benefits occur when people with construction knowledge and experience become involved at the very beginning of a project." Is there a structured approach for constructability analysis in place? Have provisions been made to provide this on an ongoing basis? This would include examining design options and details of construction that minimize construction costs while maintaining standards of safety, quality, and schedule. Elements of constructability during pre-project planning include:

- ❑ Constructability program in existence
- ❑ Construction knowledge/experience used in project planning
- ❑ Early construction involvement in contracting strategy development
- ❑ Developing a construction-sensitive project schedule
- ❑ Considering major construction methods in basic design approaches
- ❑ Developing site layouts for efficient construction
- ❑ Early identification of project team participants for constructability analysis
- ❑ Usage of advanced information technologies
- ❑ Other

F8. Technological Sophistication

The requirements for "intelligent" or special building systems should be evaluated. Examples of these systems may include:

- ❑ Video conferencing
- ❑ Internet connections
- ❑ Advanced audio/visual (A/V) connections
- ❑ Personnel sensing
- ❑ Computer docking stations
- ❑ "Smart" heating or air-conditioning
- ❑ Intercommunication systems
- ❑ Security systems
- ❑ Communication systems
- ❑ Conveyance systems
- ❑ **Remote systems operations**
- ❑ Other

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/**Laboratory**
- ❑ 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
- ❑ **Trash chutes**
- ❑ **Equipment data sheet developed for each piece of equipment (Vendor data, utility requirements, special requirements)**
- ❑ 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

SECTION III - EXECUTION APPROACH

H. PROCUREMENT STRATEGY

H1. Identify Long Lead/Critical Equipment and Materials

Identify engineered equipment and material items with lead times that will impact the design for receipt of vendor information or impact the construction schedule with long delivery times.

(Parts of this element are applicable to Management Plan)

H2. Procurement Procedures and Plans

Procurement procedures and plans include specific guidelines, special requirements, or methodologies for accomplishing the purchasing, expediting, and delivery of equipment and materials required for the project. Evaluation criteria include:

- ❑ Who will perform procurement?
- ❑ Listing of approved vendors, if applicable
- ❑ Client or contractor purchase orders
- ❑ Reimbursement terms and conditions
- ❑ Guidelines for supplier alliances, single source, **Davis-Bacon**, and competitive bids
- ❑ Guidelines for engineering/construction contracts
- ❑ Who assumes responsibility for owner-**furnished** items?
  - ❑ Financial ❑ **Refurbishment**
  - ❑ Shop inspection
  - ❑ Expediting
- ❑ Tax strategy
  - ❑ Depreciation capture
  - ❑ Local sales and use tax treatment
  - ❑ Investment tax credits
- ❑ Definition of source inspection requirements and responsibilities
- ❑ Definition of traffic/insurance responsibilities
- ❑ Definition of procurement status reporting requirements
- ❑ Additional/special owner accounting requirements
- ❑ Definition of spare parts requirements
- ❑ Local regulations (e.g., tax restrictions, tax advantages, etc.)
- ❑ Incentive/penalty strategy for contracts
- ❑ Storage
- ❑ **Procedures in accordance with NASA FAR**
- ❑ **Definition of acceptance/commissioning criteria**
- ❑ Other

(Parts of this element are applicable to Management Plan)

J. DELIVERABLES

J1. CADD/Model Requirements

Computer Aided Drafting and Design (CADD) requirements should be defined. Evaluation criteria may include:

- ❑ Software system required by client (e.g., AutoCAD, Intergraph, etc.)

- ❑ Will the project be required to be designed using 2D or 3D CADD? Will rendering be required?
- ❑ If 3D CADD is to be used, will a walk-through simulation be required?
- ❑ Owner/contractor standard symbols and details
- ❑ How will data be received and returned to/from the owner?
    - ❑ Disk
    - ❑ Electronic transfer
    - ❑ Tape
    - ❑ Reproducibles
    - ❑ Full size mock-ups

Physical model requirements depend upon the type needed for analysis, such as study models or design checks.

J2. Documentation/Deliverables

Documentation and deliverables required during project execution should be identified. If electronic media are to be used, format and application packages should be outlined. The following items may be included in a list of deliverables:

- ❑ Drawings & specifications
- ❑ Project correspondence
- ❑ Permits
- ❑ Maintenance and operating information/startup procedures
- ❑ Facility keys, keying schedules, and access codes
- ❑ Project data books (quantity, format, contents, and completion date)
- ❑ Equipment folders (quantity, format, contents, and completion date)
- ❑ Design calculations (quantity, format, contents, and completion date)
- ❑ Spare parts and maintenance stock (special forms)
- ❑ Procuring documents/contract documents
- ❑ Record (as-built) documents
- ❑ Quality assurance documents
- ❑ Project signage
- ❑ Guarantees/warranties
- ❑ Inspection documents
- ❑ Certificates of inspection

- ❑ Shop drawings and samples
- ❑ Bonds
- ❑ Distribution matrix
- ❑ Other

K. PROJECT CONTROL

(Note: Elements in this category identify special considerations not necessarily identified in FPIH guidance.)

K1. Project Quality Assurance and Control

Quality assurance and quality control procedures need to be established. Responsibility for approvals needs to be developed. Electronic media requirements should be outlined. These issues may include:

- ❑ Responsibility during design and construction
- ❑ Testing of materials and workmanship
- ❑ ISO 9000 requirements
- ❑ Submittals and shop drawing approach
- ❑ Inspection reporting requirements
- ❑ Progress photos
- ❑ Reviewing changes and modifications
- ❑ Communication documents (e.g., RFI's, RFQ's, etc.)
- ❑ Commissioning tests
- ❑ Lessons-learned feedback
- ❑ Other

K2. Project Cost Control

Procedures for controlling project cost need to be outlined and responsibility assigned. Electronic media requirements should be identified. These may include cost control requirements such as:

- ❑ Financial (client/regulatory)
- ❑ Phasing or area sub-accounting
- ❑ Capital vs. non-capital expenditures

- ❑ Report requirements
- ❑ Payment schedules and procedures
- ❑ Cash flow projections/draw down analysis
- ❑ Cost code scheme/strategy
- ❑ Costs for each project phase
- ❑ Periodic control check estimates
- ❑ Change order management procedure, including scope control
- ❑ Other

(Refer to appropriate NASA Quality Control documentation)

K3. Project Schedule Control

The project schedule is created to show progress and ensure that the project is completed on time. The schedule is necessary for design and construction of the building. A schedule format should be decided on at the beginning of the project. Typical items included in a project schedule are listed below:

- ❑ Milestones
- ❑ Unusual schedule considerations
- ❑ Required submissions and/or approvals
- ❑ Required documentation and responsible party
- ❑ Baseline vs. progress to date
- ❑ Long lead or critical pacing equipment delivery
- ❑ Critical path activities
- ❑ Contingency or "float time"
- ❑ Permitting or regulatory approvals
- ❑ Activation and commissioning
- ❑ Liquidated damages/incentives
- ❑ Other

The owner must also identify how special project issues will be scheduled. These items may include:

- ❑ Selection, procurement, and installation of equipment
- ❑ Design of interior spaces (including furniture and accessory selection)
- ❑ Stages of the project that must be handled differently than the rest of the project
- ❑ Tie-ins, service interruptions, and road closures

- [ ] Other

K4. Risk Management

Major project risks need to be identified, quantified, and management actions taken to mitigate problems developed. Pertinent elements may include:

- [ ] Design risks
  - [ ] Expertise
  - [ ] Experience
  - [ ] Work load
  - [ ] Teamwork orientation
  - [ ] Communication
  - [ ] Integration and coordination
  - [ ] Other

- [ ] Construction risks
  - [ ] Availability of craft labor and construction materials
  - [ ] Weather
  - [ ] Differing/unforeseen/difficult site conditions
  - [ ] Long lead item delays
  - [ ] Strikes
  - [ ] Inflation
  - [ ] Scope growth
  - [ ] **Worker Safety**
  - [ ] **Expertise**
  - [ ] **Experience**
  - [ ] Other

- [ ] Management risks
  - [ ] Availability of designers
  - [ ] Critical quality issues
  - [ ] Bidders
  - [ ] Human error
  - [ ] Cost & schedule estimates

- Timely decisions
- Team chemistry
- Other

- Insurance considerations

K5. Safety Procedures

Safety procedures and responsibilities must be identified for design consideration and construction. Safety issues to be addressed may include:

- Hazardous material handling
- Interaction with the public
- Working at elevations/fall hazards
- Evacuation plans & procedures
- Drug testing
- First aid stations
- Accident reporting & investigation
- Pre-task planning
- Safety orientation & planning
- Safety incentives
- **Personal protective equipment**
- Other special or unusual safety issues

(Must perform Facility Safety Analysis prior to completion of design)

L. PROJECT EXECUTION PLAN

(Note: Many of the items in these elements are contained in the Management Plan)

L1. Project Organization

The project team should be identified including roles, responsibilities, and authority. Items to consider include:

- Core team members
- Project manager assigned
- Project sponsor assigned
- Working relationships between participants
- Communication channels

- ❑ Organizational chart
- ❑ Approval responsibilities/responsibility matrix
- ❑ Other

L2. Owner Approval Requirements

All documents that require owner approval should be clearly defined. These may include:

- ❑ Milestones for drawing approval by phase
  - ❑ Comment
  - ❑ Approval
  - ❑ Bid issues (public or private)
  - ❑ Construction
- ❑ Durations of approval cycle compatible with schedule
- ❑ Individual(s) responsible for reconciling comments before return
- ❑ Types of drawings/specifications
- ❑ Purchase documents/general conditions & contract documents
  - ❑ Data sheets
  - ❑ Inquiries
  - ❑ Bid tabulations
  - ❑ Purchase orders
- ❑ Vendor information
- ❑ Other

L3. Project Delivery Method

The methods of project design and construction delivery, including fee structure should be identified. Issues to consider include:

- ❑ Owner self-performed
- ❑ Designer and constructor qualification selection process
- ❑ Selected methods (e.g., design/build, CM at risk, competitive sealed proposal, bridging, design-bid-build, etc.)
- ❑ Contracting strategies (e.g., lump sum, cost-plus, etc.)
- ❑ Design/build scope package considerations
- ❑ Other

L4. Design/Construction Plan and Approach

This is a documented plan identifying the specific approach to be used in designing and constructing the project. It should include items such as:

- ❑ Responsibility matrix
- ❑ Subcontracting strategy
- ❑ Work week plan/schedule
- ❑ Organizational structure
- ❑ Work Breakdown Structure (WBS)
- ❑ Construction sequencing of events
- ❑ Site logistics plan
- ❑ Safety requirements/program
- ❑ Identification of critical activities that have potential impact on facilities (i.e., existing facilities, crane usage, utility shut downs and tie-ins, testing, etc.)
- ❑ Quality assurance/quality control (QA/QC) plan
- ❑ Design and approvals sequencing of events
- ❑ Equipment procurement and staging
- ❑ Contractor meeting/reporting schedule
- ❑ Partnering or strategic alliances
- ❑ Alternative dispute resolution
- ❑ Furnishings, equipment, and built-ins responsibility
- ❑ Other

L5. Substantial Completion Requirements

Substantial Completion (SC) is defined as the point in time when the building is ready to be occupied. The following may need to be addressed:

- ❑ Have specific requirements for SC responsibilities been developed?
- ❑ Have warranty, permitting, insurance, tax implications, etc., been considered?
- ❑ Commissioning
  - ❑ Equipment/systems startup and testing
  - ❑ Occupancy phasing
  - ❑ Final code inspection
  - ❑ Calibration

- ❑ Verification
- ❑ Documentation
- ❑ Training
- ❑ Acceptance
- ❑ **Lessons Learned documentation**

❑ Landscape requirements

❑ Punchlist completion plan and schedule

❑ Substantial completion certificate

❑ Other

This page left intentionally blank

APPENDIX D: EXAMPLE PROJECT

Project Type: NASA Bioastronautical Facility at Johnson Space Center

Facility Uses: Pre- and post- mission medical research on astronauts

Budget: Approximately $37 million

Scheduled Completion: December 31, 2001

Date Scored: December 14, 1999, 2:00 p.m. – 4:30 p.m.

Objectives of the Meeting: Assess current status of scope definition

Define potential problems using the PDRI

Align project team members on path forward and evaluate use of NASA-specific PDRI

Methodology: Discussed each element as a group.

Reached a common (consensus) definition level for each element through use of a facilitator.

Project Status: Approximately 50% PER stage development

Major Findings/Areas for Further Study:

Budget and funding sources not well defined (elements A3, A4, B2, C6); Scheduling issues which may heavily influence the contracting strategy require quick resolution in order to meet completion date (elements C5 and K3); Equipment requirements and responsibilities not well defined (elements G1 through G3, E12, H1)

Project Definition Rating Index for Buildings
Project Score Sheet

SECTION I - BASIS OF PROJECT DECISION							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
A. BUSINESS STRATEGY (Maximum = 214)							
A1. Building Use	0	1	12	23	33	44	12
A2. Business Justification	0	1	8	14	21	27	1
A3. Business Plan	0	2	8	14	20	26	20
A4. Economic Analysis	0	2	6	11	16	21	11
A5. Facility Requirements	0	2	9	16	23	31	2
A6. Future Expansion/Alteration Considerations	0	1	7	12	17	22	1
A7. Site Selection Considerations	0	1	8	15	21	28	1
A8. Project Objectives Statement	0	1	4	8	11	15	4
						CATEGORY A TOTAL	52
B. OWNER PHILOSOPHIES (Maximum = 68)							
B1. Reliability Philosophy	0	1	5	10	14	18	1
B2. Maintenance Philosophy	0	1	5	9	12	16	9
B3. Operating Philosophy	0	1	5	8	12	15	1
B4. Design Philosophy	0	1	6	10	14	19	1
						CATEGORY B TOTAL	12
C. PROJECT REQUIREMENTS (Maximum = 131)							
C1. Value-Analysis Process	0	1	6	10	14	19	10
C2. Project Design Criteria	0	1	7	13	18	24	1
C3. Evaluation of Existing Facilities	0	2	7	13	19	24	7
C4. Scope of Work Overview	0	1	5	9	13	17	5
C5. Project Schedule	0	2	6	11	15	20	15
C6. Project Cost Estimate	0	2	8	15	21	27	15
						CATEGORY C TOTAL	53
Section I Maximum Score = 413						**SECTION I TOTAL**	**117**

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						Score
	0	1	2	3	4	5	
D. SITE INFORMATION (Maximum = 108)							
D1. Site Layout	0	1	4	7	10	14	1
D2. Site Surveys	0	1	4	8	11	14	1
D3. Civil/Geotechnical Information	0	2	6	10	14	19	6
D4. Governing Regulatory Requirements	0	1	4	8	11	14	1
D5. Environmental Assessment	0	1	5	9	12	16	9
D6. Utility Sources with Supply Conditions	0	1	4	7	10	13	4
D7. Site Life Safety Considerations	0	1	2	4	6	8	2
D8. Special Water and Waste Treatment Req'mts	0	1	3	6	8	11	3
CATEGORY D TOTAL							**27**
E. BUILDING PROGRAMMING (Maximum = 162)							
E1. Program Statement	0	1	5	9	12	16	1
E2. Building Summary Space List	0	1	6	11	16	21	6
E3. Overall Adjacency Diagrams	0	1	3	6	8	10	1
E4. Stacking Diagrams	0	1	4	7	10	13	1
E5. Growth & Phased Development	0	1	5	8	12	15	1
E6. Circulation and Open Space Requirements	0	1	4	7	10	13	1
E7. Functional Relationship Diagrams/Room by Room	0	1	3	5	8	10	3
E8. Loading/Unloading/Storage Facilities Req'mts	0	1	2	4	6	8	1
E9. Transportation Requirements	0	1	3	5	7	9	1
E10. Building Finishes	0	1	5	8	12	15	5
E11. Room Data Sheets	0	1	4	7	10	13	7
E12. Furnishings, Equipment, & Built-Ins	0	1	4	8	11	14	11
E13. Window Treatment	0	0	2	3	4	5	0
CATEGORY E TOTAL							**39**
F. BUILDING/PROJECT DESIGN PARAMETERS (Maximum = 122)							
F1. Civil/Site Design	0	1	4	7	11	14	4
F2. Architectural Design	0	1	7	12	17	22	12
F3. Structural Design	0	1	5	9	14	18	1
F4. Mechanical Design	0	2	6	11	15	20	6
F5. Electrical Design	0	1	5	8	12	15	5
F6. Building Life Safety Requirements	0	1	3	5	8	10	3
F7. Constructability Analysis	0	1	4	8	11	14	11
F8. Technological Sophistication	0	1	3	5	7	9	5
CATEGORY F TOTAL							**47**

Definition Levels

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

SECTION II - BASIS OF DESIGN							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
G. EQUIPMENT (Maximum = 36)							
G1. Equipment List	0	1	5	8	12	15	12
G2. Equipment Location Drawings	0	1	3	5	8	10	8
G3. Equipment Utility Requirements	0	1	4	6	9	11	9
						CATEGORY G TOTAL	29
Section II Maximum Score = 428						**SECTION II TOTAL**	**142**

Definition Levels

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

SECTION III - EXECUTION APPROACH							
CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
H. PROCUREMENT STRATEGY (Maximum = 25)							
H1. Identify Long Lead/Critical Equip. & Materials	0	1	4	7	10	14	10
H2. Procurement Procedures and Plans	0	1	3	6	9	11	9
CATEGORY H TOTAL							**19**
J. DELIVERABLES (Maximum = 11)							
J1. CADD/Model Requirements	0	0	1	2	3	4	0
J2. Documentation/Deliverables	0	1	2	4	6	7	4
CATEGORY J TOTAL							**4**
K. PROJECT CONTROL (Maximum = 63)							
K1. Project Quality Assurance and Control	0	1	3	4	6	8	4
K2. Project Cost Control	0	1	4	7	10	13	7
K3. Project Schedule Control	0	1	4	8	11	14	8
K4. Risk Management	0	1	6	10	14	18	14
K5. Safety Procedures	0	1	3	5	7	9	1
CATEGORY K TOTAL							**34**
L. PROJECT EXECUTION PLAN (Maximum = 60)							
L1. Project Organization	0	1	3	5	8	10	5
L2. Owner Approval Requirements	0	1	4	6	9	11	6
L3. Project Delivery Method	0	1	5	8	12	15	12
L4. Design/Construction Plan & Approach	0	1	4	8	11	15	11
L5. Substantial Completion Requirements	0	1	3	5	7	9	1
CATEGORY L TOTAL							**35**
Section III Maximum Score = 159				**SECTION III TOTAL**			**92**
PDRI TOTAL SCORE				**(Maximum Score1000)**			**351**

Definition Levels

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

This page left intentionally blank.

APPENDIX E: PDRI Scoring Session Checklist

Logistics:

- ❑ Room reserved (adequate seating/work space for participants)
- ❑ Invitation letter to key stakeholders
- ❑ Transparency projector
- ❑ Refreshments (water, coffee, etc.)
- ❑ Name tags / placards (if applicable)
- ❑ Sign in sheet
- ❑ Flipchart and markers
- ❑ Copy of element descriptions and unweighted score sheet for each participant

Facilitator Preparation:

- ❑ Copy of weighted score sheet for facilitator
- ❑ Transparencies for PDRI introduction
- ❑ Review PDRI format and familiarization with method
- ❑ Prepare project manager on his/her role

Project Manager Preparation:

- ❑ Help with logistics
- ❑ Become familiar with the score sheet and descriptions
- ❑ Ensure proper stakeholders are at meeting
- ❑ Bring conceptual project documents/sketches/objectives, etc.
- ❑ Provide support to facilitator; (i.e., keeper of score and action list)

After Action:

- ❑ Develop after action report and distribute
- ❑ Capture data for lessons learned and future benchmarking usage

This page left intentionally blank.

APPENDIX F: NASA PRE-PROJECT PLANNING TEAM

Tam Antoine	JPL
Steve Campbell	JSC
Lou Desalvo	KSC
Ron Dilustro	HQ-JX
Edd Gibson*	Consultant
Bela Gutman	JPL
Ernest Jennings	ARC
Charles Kilgore	MSFC
Roz McCreery	LARC
G.R. Rupnarain	MAF/LM
Terry Spagnuolo	GSFC
Mark Warren	SSC
Chris Wolf	WSTF

* Principal Author

Todd Graham, PE and Ben Barrow, USN, formerly graduate students at the University of Texas, also assisted in writing this document.

This page left intentionally blank.

REFERENCES

1. C. S. Cho, J. Furman, and G. E. Gibson, *Project Definition Rating Index (PDRI) for Buildings*, A report to the Construction Industry Institute, The University of Texas at Austin, Research Report 155-11, December 1999.

2. *Pre-Project Planning Tool: PDRI for Buildings*, Research Summary 155-1, Construction Industry Institute, Austin, TX, December 1999.

3. G. E. Gibson and P. R. Dumont, *Project Definition Rating Index (PDRI)*, A report to the Construction Industry Institute, The University of Texas at Austin, Research Report 113-11, June 1996.

4. *Pre-Project Planning Tools: PDRI and Alignment,* Research Summary 113-1, Construction Industry Institute, Austin, TX, August 1997.

5. *Alignment Handbook*, Implementation Resource 113-3, Construction Industry Institute, Austin, TX, December 1997.

6. *Project Definition Rating Index, Industrial Projects*, Implementation Resource 113-2, Construction Industry Institute, Austin, TX, July 1996.

7. *Pre-Project Planning Handbook*, Special Publication 39-2, Construction Industry Institute, Austin, TX, April 1995.

8. *Pre-Project Planning: Beginning a Project the Right Way*, Publication 39-1, Construction Industry Institute, Austin, TX, December 1994.

9. *Project Definition Rating Index*, *Building Projects*, Implementation Resource 155-2, Construction Industry Institute, Austin, TX, July 1999.

10. *Facility Project Implementation Handbook*, NASA Document HB 8820.2A, July 1, 1993.

11. Barrow, Benjamin, "*Pre-Project Planning at NASA*," thesis, University of Texas at Austin, in partial fulfillment of the degree of Master of Science, December 1999.

This page left intentionally blank.