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## Subject: Review Program for Langley Research Center (LaRC) Facility Projects

Responsible Office: Center Operations Directorate (COD)

### 1. POLICY

#### a. Introduction

- (1) This Langley Policy Directive provides instruction on the necessary reviews for facility design and construction projects that are under the jurisdiction of the Center Operations Directorate. The primary purpose of the reviews is to enhance the probability of success of LaRC facility projects by validating requirements, mitigating risks, and ensuring the adherence to the established, codes, standards, budgets, and schedules.
- (2) The applicable reviews shall be determined during the project planning stage as the scope of work is being developed and refined. The level of rigor for each review should be commensurate to the complexity, risk, cost, and Center impact. Taking into consideration the subjectiveness of these factors and the uniqueness of each project, the final set of required reviews shall be determined through discussions between the COD Chief Engineer, the Project Manager, and a representative from the customer's Directorate as appropriate.
- (3) The audience for the reviews is the project stakeholders. These individuals will vary depending on the project and type of review. The stakeholders usually include the customer, the COD project team, the end users, Standard Practice Engineers, Subject Matter Experts, Authorities Having Jurisdiction, the Facility Safety Head, a representative from the Safety and Mission Assurance Office, the Facility Coordinator, operators, maintenance technicians, test engineers, researchers, Directorate representatives and Contracting Officer's Representatives.
- (4) These reviews are not Quality Assurance (QA) or Quality Control (QC) processes. All internal design quality procedures shall be complete prior to the distribution of the review materials.

#### b. Review Types and Descriptions

Refer to the Attachments for review objectives and sample agendas.

- (1) **Design Review Process:** See below for an overview of the design review process and activities required.

- a. **Kickoff meeting:** The Project Manager shall hold a formal kickoff meeting at the beginning of each design review cycle to provide an overview of the project, discuss the review objectives, provide the review schedule, and distribute the review material to the stakeholders. The kickoff meeting should occur as soon as possible after deliverables are submitted and prior to distribution to project team.

Prior to initiating a kickoff meeting and distributing review materials, the Project Manager shall review the design documents to ensure they are at the appropriate level of detail and completeness for the specified design deliverable. If not, the Project Manager shall return the package to the design team for corrections.

- b. **Technical Review Process:** A Technical Review is required for every design submittal. After the distribution of the project review documents, the required reviewers shall review and redline the document PDFs and summarize the comments on the formal Comment Review Sheet (provided by the Project Manager). The reviewer shall then return the comment sheets to the PM by the requested deadline.

The PM shall determine whether comments are applicable and in-scope and consolidate the comments. The PM shall send the consolidated comment sheet to the design team. The associated design team members shall review and provide a response to each comment and document whether they concur, do not concur, or take exceptions to the comment. This shall be followed by an explanation to resolve comment. The consolidated comment sheet with design team's responses is then distributed to the project team prior to the Technical Review meeting. Comments that are not agreed to by the project team or need clarification from the reviewer are adjudicated in discussions between the reviewer and the design team at the Technical Review meetings.

- i. **An In-depth Technical Review (ITR)** is warranted when the project has a high technical complexity or there are significant issues identified during the Technical Review that require further technical discussions. These are separate reviews that supplement the Summary Reviews and are technically focused. ITRs can be divided into discipline-specific focused discussions or a combined multidisciplined discussion between the applicable Subject Matter Experts, Standard Practice Engineers, Authority Having Jurisdiction, design engineers, customer's technical representatives, and the Project Managers. ITRs may be conducted at any stage of the design.

Each participant is provided the opportunity to present their most pertinent comments, technical issues, and insights. The reviewers then have an open discussion with the design team to answer questions, mitigate issues and concerns, develop actions, and acquire a consensus on the path forward. A summary of the ITR findings and any actions are presented at the

accompanying Summary Review.

c. **Design Reviews:** Every project will follow a defined design review process that is dependent on project complexity:

i. **Summary Reviews (SR)** are a series of reviews that cover the major phases of a typical design project. The purpose of the reviews is to verify to the stakeholders that the design meets the established requirements; adheres to NASA and Langley procedures, codes, and standards; properly addresses risks; and ensures that the work can be completed within the established budget and schedule. The Summary Reviews are structured and sequenced in a logical order that establish the bases for the succeeding reviews. These reviews cover a broad scope of the majority of the COD related designs and are the default when it is unclear which type of review to select. Summary Reviews for Design include:

- Project Requirements Review (PRR)
- Conceptual Design Review (CoDR)
- Preliminary Design Review (PDR)
- Critical Design Review (CDR)

Summary Reviews are typically a significant PowerPoint slide presentation detailing the agenda items. They are presented by the NASA Project Manager supported by the project design team members including both civil servants and contractor. The length, depth, and extent of the review shall be commensurate to the scope of the project with the agenda customized as appropriate.

Not all Summary Reviews are required for all design efforts. The applicability of the reviews shall be determined during the initial project planning stage and shall be based on the project scope, level of technical complexity, risk, and funding source. All NASA Facility Projects with an approved facility project cost estimate for construction of \$100,000 or greater (excluding maintenance work) shall require Summary Reviews. Construction of Facility (CoF) projects shall require Summary Reviews that adhere to NASA Procedural Requirements (NPR) 8820.2I.

Each of the subsequent Summary Reviews builds on the progress of the design and previous review. Therefore, a well-established set of requirements is imperative and the early design effort and the accompanying reviews shall be rigorous and thoroughly developed with as much detail as practical to verify that the design addressed the established requirements. As a rule, there should be no major design changes between the Preliminary Design Review (PDR) and the Critical Design Review (CDR).

ii. **A Basic Validation Review (BVR)** is a less rigorous and time intensive

design review than a Summary Review and is used to simply verify that the design addresses the requirements and it is safe to proceed to procurement or construction. It consists of a top-level PowerPoint presentation customized to fit the project scope.

A Basic Validation Review may be conducted, in lieu of the more detailed Summary Review, for a project that has low technical complexity, low risk, and an estimated construction cost below \$100,000 (excluding maintenance tasks). In most cases, one BVR is conducted when the design is at the 100% completion level prior to finalization of the deliverable. Additional BVR reviews may be added at earlier stages of the design if deemed appropriate by the customer and design team.

- iii. **A Functional Approval Review (FA)** is conducted when a design, construction task, or maintenance task is limited in scope but entails aspects that require the notification and approval of the appropriate Standard Practice Engineer (SPE), Subject Matter Expert (SME), Authority Having Jurisdiction (AHJ), or the Safety and Facilities Assurance Branch (SFAB) as applicable. These tasks cover the maintenance or replacement of material or equipment that do not require a full set of drawings and specifications or warrant more rigorous reviews covered in this directive.

Functional Approvals are not formal reviews that require a PowerPoint presentation. Further these projects do not require a kickoff meeting or a Technical Review meeting as required for most projects. However, a review package shall be compiled and provided to the reviewer(s). Refer to the Attachment for more information on the applicable work and approval requirements for a Functional Approval.

The need for an FA shall be determined prior to the initiation of the design, maintenance task, or construction task. If it has been determined that a FA is required, the Project Manager shall correspond with the appropriate SPEs, SMAs, AHJs, and SFAB representative notifying them of the work and requesting their guidance during the design development and the final review and approval of the completed design documentation.

- (2) **A Management Oversight Review (MOR)** is a top-level review conducted when the project has high visibility, is a high risk, has a high dollar value, or will have a major impact on the Center. This may include Construction of Facilities (CoF), mission-critical, or other high-cost projects. An MOR can be held at any of the corresponding Summary Review phases or conducted as a final review for Directorate management, Center leadership, or NASA Headquarters awareness or concurrence. The use of an MOR is determined during the planning stage of the project and includes a high-level summary of the project status, cost, risks, safety, environmental impact, and schedule.

Management Oversight Reviews are typically a significant PowerPoint slide

presentation detailing the agenda items. They are presented by the NASA Project Manager supported by the project design team members including both civil servants and contractor. The length, depth, and extent of the review shall be commensurate to the scope of the project with the agenda customized as appropriate.

- (3) An **Integrated Systems Review (ISR) and Operational Readiness Review (ORR)** shall be conducted in sequence near the completion of select construction projects. The terms and objectives generally follow established NASA Agency Procedure Requirements for reviews; however, these have been modified to adhere to Langley Center Operations Directorate's requirements.

The Project Manager, customer representative, and the COD Chief Engineer shall determine, at the project planning stage, if an ISR and ORR are required. Decision factors include the scope, safety of personnel, and risk to critical infrastructure or research assets. Typical projects that may require an ISR and ORR include modifications or new construction of wind tunnel systems or other research assets; major modifications to tunnel Facility Automation Systems (FAS) or Data Acquisition Systems (DAS); installation and start-up of new research facility systems; installation of new or major modifications to pressure systems such as steam, specialty gases or high-pressure air.

When the construction phase is approximately 90% complete, the Project Manager shall contact the COD Chief Engineer to schedule an Integrated Systems Review (ISR). Prior to the ISR, subsystem checkouts shall be conducted as specified in the project documents and the integrated test plan and the Acceptance Test Plans shall be developed. When practical, the Project Manager shall coordinate a walkthrough with the panel members in order to orient them to the project in preparation for the ISR.

After a successful ISR, the project team shall conduct the established integrated systems tests. After all construction work is complete and all Acceptance Test Plans are complete, the PM shall contact the COD Chief Engineer to schedule the Operations Readiness Review (ORR) to present the result of the tests and acquire the approval that the facility can then proceed to operate as intended.

The ISR and ORR typically include a significant PowerPoint slide presentation detailing the agenda items. They are presented by the NASA Project Manager supported by the project design team members including both civil servants and contractor. The length, depth, and extent of the review shall be commensurate to the scope of the project with the agenda customized as appropriate.

- (4) A **Return to Service (RTS)** review is conducted to confirm that all requirements are completed prior to a return to operational readiness of a facility or subsystem after a prolonged shutdown, a direct replacement of major equipment, or after completion of a corrective action conducted as a result of a safety incident. Langley Form (LF) 438 provides the Return to Service review requirements, a criteria checklist, and further instructions. The RTS consists of a top-level PowerPoint presentation customized for the RTS activities.

The COD Chief Engineer and the Customer Directorate representative shall evaluate the scope of work during the project planning stage to determine the applicability of an RTS review or if an ISR and ORR are more appropriate.

- c. Review Planning and Execution
- (1) The Project Manager, the Customer Directorate representative, and the COD Chief Engineer shall work together during the project planning stage to determine which reviews are required for the project.
  - (2) Review objectives and pertinent information are provided in Attachments A-I. Agendas for the associated reviews are provided to serve as an outline for the content of the presentation and should be modified to accommodate the specifics of the project.
  - (3) The reviews shall be incorporated in the project schedule with the appropriate amount of time allotted for the deliverable distribution, review period, comment disposition, development of any formal review materials, and review presentation.
  - (4) Attachment K provides a matrix of review panel members. The specific members are determined through a joint effort between the Project PM, the COD Chief Engineer, and the Review Chairperson. Participation is based upon:
    - Type of project
    - Technical complexity and risk
    - Technical expertise required
    - Scope of the project
  - (5) Prior to the review (excluding a Functional Approval), the Review Secretary shall send out a review notification email which shall include:
    - Type of review and objectives
    - Date, time, and location
    - Review panel members
    - Invitees, including project team and other stakeholders
    - Tentative agenda with allotted times (optional)
    - A statement such as “If you are a panel member and are unable to attend, please contact the review Chairperson prior to the review so that a suitable alternate can be arranged. The Project Team is expected to attend the review.”
  - (6) During a review, a stakeholder or panel member may ask the Review Chair to create a formal Action to address an issue that can’t be resolved during the review. The Action is warranted when it is critical for the success of the project and requires the assigned party to perform additional work outside of the review to resolve the specified issue.

Action items shall be recorded in the review minutes and include the following information:

- Action item identifier (e.g., CDR\_09apr2018\_1)
- Description of the action
- Reason/justification
- Requested by
- Assigned to
- Due date (or timeframe)

Summary action items may be used to group multiple open items for tracking.

- (7) During a review, a panel member may determine that there are major deficiencies with the design or presentation material and make a request to the Chair that a follow-on Delta review be conducted. The PM shall coordinate the scope and schedule for the Delta review with the COD Chief Engineer.
- (8) Review minutes shall include type of review, date and location, objective, identification of panel members and attendees, key discussion items and decisions, recommendation of the panel, and action items. Video of the review may be captured and stored in the project file to support the written minutes.

d. Criteria

- (1) The criteria stated herein are the minimum for reviews to cover the technical and management aspects of facility projects under the jurisdiction of the NASA Langley COD. This directive does not supersede other reviews imposed by NASA Headquarters or replace the scientific and technical reviews conducted by other LaRC organizations or committees.
- (2) Other reviews may be added as necessary by the applicable AHJs or Customer Directorates.

e. Records of Reviews

- (1) Records of all reviews shall be maintained in the master project file. The records shall include the documents submitted as part of the review, the review presentation, the video of the review (if captured), the written minutes of the review, and any action items along with the associated action item responses.

## 2. APPLICABILITY

- a. This directive covers all facility work within NASA Langley and includes work completed by any Directorate, contractor, or civil servant.
- b. For CoF projects and construction projects over \$100,000 (excluding maintenance work), this directive shall supplement but not supersede NPD 8820.2E “Design and Construction of Facilities” and requirements in NPR 8820.2I “Facility Project Requirements.”



- c. Program sponsored projects shall follow directive NPD 7120.4 “NASA Engineering and Program/ Project Management”. Any aspects of a Program sponsored project that require facility or infrastructure modifications shall follow this directive.
- d. Facility projects covered by this directive include:
  - (1) Discrete and Minor CoF projects as defined in NPR 8820.2I
  - (2) Demolition projects as defined in NPR 8820.2I
  - (3) Research Systems Projects making permanent modifications to a facility.
  - (4) Environmental Compliance and Restoration Projects as defined in NPR 8590.1
  - (5) Facility Maintenance and Repair projects
  - (6) Other projects making permanent modifications to a facility.
- e. Additional projects to be subject to this set of review requirements can be designated by the Director, Safety and Mission Assurance Office (SMAO), or the COD Director.
- f. The applicability of this directive to a facility project is determined by the COD Chief Engineer in conjunction with the Project Manager and the associated Directorate. The applicability of this directive, discrepancies between other NASA directives or procedural requirements shall be adjudicated during the project planning stage prior to the finalization of the project Statement of Work (SOW).

### **3. AUTHORITY**

- a. NPR 7123.1, “NASA Systems Engineering Processes and Requirements”
- b. NPD 7330.1, “Approval Authorities for Facility Projects”
- c. NPD 8820.2E, “Design and Construction of Facilities”
- d. NPD 8831.1, “Maintenance and Operations of Institutional and Program Facilities and Related Equipment”
- e. NPD 8500.1, “NASA Environmental Management”
- f. NPR 8820.2I, “Facility Project Requirements”
- g. NPR 8590.1, “Environmental Compliance and Restoration Program”



#### **4. APPLICABLE DOCUMENTS AND FORMS**

- a. NPR 7150.2, “NASA Software Engineering Requirements”
- b. LAPD 1700.1, “Safety Program”
- c. LAPD 1700.2, “Safety Assignments and Responsibilities”
- d. LAPD 8500.1, “LaRC Environmental and Energy Management”
- e. LPR 8500.1, “Environmental and Energy Program Manual”
- f. LPR 7123-2, “Facility Configuration Management”
- g. Langley Form 438, “Return to Service Checklist”
- h. Langley Form 461, “Environmental Project Planning Form”
- i. Langley Form 605 “Facility Change Request”

#### **5. RESPONSIBILITY**

The responsibilities assigned to the various Directorates may be delegated to other individuals at the Director’s discretion.

- a. COD Chief Engineer
  - (1) Works with the Project Manager and Customer Directorate during the project planning phase to determine the required reviews.
  - (2) Presides as chairperson for the Conceptual Design Review (CoDR), Preliminary Design Review (PDR), Critical Design Review (CDR), and Integrated Systems Review (ISR).
  - (3) Selects a co-chairperson for the Project Requirements Review (PRR) and Operational Readiness Review (ORR), in consultation with the Customer Directorate.
  - (4) Presides as co-chairperson for the Project Requirements Review (PRR) and Operational Readiness Review (ORR).
- b. Customer Directorate
  - (1) Ensures that the project requirements are well defined and valid.
  - (2) Supports the design review process including closure of action items as required.

- (3) Furnishes senior personnel experienced in the required technical disciplines to support the reviews.
- (5) Works with the PM and the COD Chief Engineer to select the co-chairperson for Project Requirements Review (PRR) and Operational Readiness Review (ORR). This can be the Customer Directorate Chief Engineer, Operations Manager, Facility Manager, Facility Safety Head or Safety Engineer.

c. Review Chairperson

- (1) Appoints Review Panel members. Organizes each panel and draws support from LaRC, NASA Headquarters, other Centers, industry, and other federal agencies as applicable.
- (2) Chairs the review.
- (3) Determines if a quorum of panel members is present at the time of the review and decides whether to proceed with the review or reschedule.
- (4) Approves and signs meeting minutes.
- (5) Recaps all action items at the end of the review to determine the specifics and responsible parties.
- (6) Ensures the review meets the intended objectives and follows the associated Directives and Procedures.
- (7) Assigns and closes action items.
- (8) Follows up with any formal memos or letters to management and the project team as required.

d. Review Panel Members

- (1) Review the materials provided prior to the review.
- (2) Suggest action items to resolve issues from the review.
- (3) Review and approve action items for closure.

e. Line Management

- (1) Ensures that review material meets the requirements of this directive.
- (2) Ensures the reviews are attended by the appropriate staff within their jurisdiction and that the participants fully understand their duties and responsibilities.

(3) Ensures action items are properly addressed.

f. Project Manager

(1) Works with the COD Chief Engineer to determine the necessary reviews for the projects.

(2) Manages the Technical Review process.

(3) Coordinates all civil servants and contractor project team members in the development, distribution, and presentation of the review material.

(4) Works in conjunction with the review chairperson to establish the review agenda using the appropriate sample agenda as a guide.

(5) Coordinates the review schedule and appropriate attendees.

(6) Identifies and coordinates the presenters including safety and environmental.

(7) Recommends action item assignee and a closure date to the review chairperson. Coordinates the adjudication of all action items.

(8) Obtains approval of action items from the requester.

g. Review Secretary

(1) Schedules the review in consultation with the review chairperson. Reserves the conference room, prepares/revises review notification (including letter and electronic calendar invite), and distributes review notification to Review Panel members.

(2) Documents the review proceedings, manages the video recording of the review proceedings, and finalizes and distributes review minutes.

(3) Serves as action item coordinator formally documenting, distributing, and tracking action items.

(4) Distributes review meeting minutes and action items to Review Panel members, team members, invitees, and other relevant stakeholders (e.g., affected organization heads).

(5) Distributes a copy of action item closures to Review Panel members.

**6. DELEGATION OF AUTHORITY**

None

**7. MEASUREMENTS/VERIFICATION**

None

**8. CANCELLATION**

LAPD 7000.2T, dated November 6, 2024.

*Original signed on file*

Trina M. Dyal  
Deputy Director

Distribution:

Approved for public release via the Langley Management System; distribution is unlimited.

Attachments A - K

## **PROJECT REQUIREMENTS REVIEW (PRR)**

### a. Description

#### (1) Objective

The intent of the PRR is to ensure that project objectives (especially research objectives) have been translated into definitive, verifiable, and unambiguous statements of requirements. The PRR will normally be scheduled prior to the initiation of a Preliminary Engineering Report (PER).

#### (2) Membership: See J for review panel members.

### a. Sample Agenda

#### I. INTRODUCTION

Scope of Review

Agenda

#### II. PROJECT OVERVIEW

Research/Programmatic Requirements and Project Justification

New Capability/Performance Desired

Project Scope – Construction of Facilities (CoF) Funded Portion

Project Scope – Research and Development (R&D) Funded Portion

Project Scope – Center or Other Funded Portion

#### III. DESIGN REQUIREMENTS/CONSTRAINTS

Environmental Project Planning Submittal (LF 461)

Interfaces

Functional Requirement Changes since Publication of Requirements Document

Site Selection

Special Systems or Equipment

Safety, Reliability, and Quality Assurance (SR&QA)

Security

Utilities

Design Codes/Criteria

Operations and Maintenance

Design Loads/Environment

Geometric Lines

Hardware/Software

Environmental Impact

Accommodation for Persons with Disabilities

Human Engineering

Project Definition Rating Index (PDRI) results

IV. RISKS

Requirements Risks and Mitigation Strategy

Technical

Cost

Schedule

V. SUMMARY



## CONCEPTUAL DESIGN REVIEW (CoDR)

### a. Description

#### (1) Objective

The objective of the CoDR is to review the functional design requirements, design options, and recommended conceptual design to ensure a sound basis for a final design. The CoDR will normally be scheduled at 90 percent completion of the PER (see NPR 8820.2I) or at 10 percent completion of final design.

(2) Membership: See Attachment K for review panel members.

### b. Sample Agenda

#### I. INTRODUCTION

Scope of Review

Status of Conceptual Design (percent complete, earlier studies, and so forth)

Status of Action Items

Agenda

#### II. PROJECT OVERVIEW

Research/Programmatic Requirements and Project Justification

New Capability/Performance Desired

Project Scope – CoF Funded Portion

Project Scope – R&D Funded Portion

Project Scope – Center or Other Funded Portion

Acquisition Approach

#### III. DESIGN REQUIREMENTS/CONSTRAINTS

Interfaces

Functional Requirement Changes Since Publication of Requirements Document

Site Selection

Special Systems or Equipment

Safety, Reliability, and Quality Assurance (SR&QA)

Security

Utilities

Design Codes/Criteria

Operations and Maintenance

Design Loads/Environment

Geometric Lines

Hardware/Software

Environmental Impact

Accommodation for Persons with Disabilities Human

## Engineering

### IV. CONCEPTUAL DESIGN

Evaluation of Options

Project Description (major elements/components) (preliminary Work Breakdown Structure)

Site Description

Architectural Concept Foundation/Structural/Mechanical/Electrical

Concepts and Analyses

Operations and Maintenance Considerations

Design of Special Systems or Equipment

Needed Additional Studies/Tests/Analyses

Summary of How Design Tentatively Meets Requirements

Areas of Design Concern/Uncertainty

Project Definition Rating Index (PDRI) results

### V. DESIGN VALIDATION APPROACH

Scope of Analyses (for example, thermal, controls, and so forth)

Methods of Analysis (for example, handbook/finite element/difference/controls simulation, etc.)

Component and Subsystem Testing

### VI. SAFETY AND QUALITY ASSURANCE

Preliminary Hazards List

Preliminary Critical Items List (CIL)

Special Construction Inspection Requirements

Design Safety Considerations

### VII. CONFIGURATION MANAGEMENT

Status of Existing Facility Baseline List

Status of As-Built Interface Drawings

### VIII. COST

Baseline Construction Estimate

Design/Construction Cost Estimates

Breakdown of Major Cost Elements, including:

- Element Cost Ranges/Uncertainties and Potential for Growth

- Significant Cost Drivers

- Potential Areas for Descoping or Bid Alternatives

- Potential Areas for Design, Furnish and Install Procurement

- Operations & Maintenance Cost

- Overall Cost Assessment and Uncertainties/Concerns

### IX. SCHEDULE

Project Level (with rationale)

Major Element or Work Package Level  
Schedule Uncertainties/Concerns

X. DOCUMENTATION TREE AND STATUS

Project Management Plan  
Requirements Document  
Requirements Traceability Matrix  
Preliminary Acquisition Plan  
Environmental Project Planning, LF 461 Update

XI. RISK

Risks and Mitigation Strategy  
    Technical  
    Cost  
    Schedule

XII. SUMMARY

## **PRELIMINARY DESIGN REVIEW (PDR)**

### a. Description

#### (1) Objective

The objective of the PDR is to validate the adequacy of the intended final design approach as related to the established requirements and that the work follows applicable procedures, policies, design criteria, codes, and standards. The PDR confirms that there is coordination between disciplines, the basis of design is fully established, and design decisions are supported by accompanying calculations when practical. The PDR will normally be scheduled when the design is approximately 30 percent complete.

(2) Membership: See Attachment K for review panel members.

### b. Sample Agenda

#### I. INTRODUCTION

Scope of Review  
 Status of Design  
 Status of Action Items  
 Agenda

#### II. PROJECT OVERVIEW

Research/Programmatic Requirements  
 New Capability/Performance Desired  
 Project Scope – CoF Funded Portion  
 Project Scope – R&D Funded Portion  
 Project Scope – Center or Other Funded Portion

#### III. PROJECT MANAGEMENT

Work Breakdown Structure  
 Management Structure/Organization  
 Roles and Responsibilities  
 Project Controls and Status Reporting  
 Configuration/Change Control, Requirements, Cost, Schedule  
 Contingency Plans (regarding cost and schedule)

#### IV. DESIGN REQUIREMENTS/CONSTRAINTS

System Interfaces between Work Packages  
 System Interfaces with Existing Facility  
 Requirements, including:  
     Software Requirements

Programmatic Requirements/Objectives  
Engineering Requirements  
Design Load/Environments  
Interface Requirements

Other Requirements (e.g., environmental, energy, historical)

## V. PRELIMINARY DESIGN

Preliminary Design Concept Drawings

Basis of Design

Architectural

Process Systems

Structural

Mechanical

Electrical

Controls and Instrumentation Software

Completed Calculations (when practical)

Tradeoff Studies

List of Major Equipment Selection

Design Verification Results/Plans

Performance Analyses

Status Summary of Design Compliance with Design Criteria and Requirements

Project Definition Rating Index (PDRI) results

## VI. SAFETY, RELIABILITY, AND QUALITY ASSURANCE

Overview of SR&QA Approach During Design/Acquisition/Construction/ Checkout

Hazard Analyses Results and Preliminary Critical Items List (CIL)

Systems Safety Features Included in Design (interlocks, stops, etc.)

Implementation of SR&QA Plan

Areas of Concern or Uncertainty

## VII. CONFIGURATION MANAGEMENT

Field Verification Status of Interface Drawings to be referenced in Acquisition Package Potential

Revisions and Additions to Existing Facility Baseline List (FBL)

## VIII. COST

Baseline Cost Estimate (PER)

Current Cost Estimate and Rationale for any Cost Variations

Cost Concerns/Uncertainties/Unfunded Environmental Liabilities (design or construction)

## IX. SCHEDULE

Project Level

Work Package Level

Status of Design Tasks Against Plan

Schedule Concerns/Uncertainties (design or construction)

## X. DOCUMENTATION TREE AND STATUS

Note: The following list includes examples of documentation items. The complete list of documentation items is included in the Project Management Plan for the specific project.

- Management Plan
- Requirements Document
- Cost and Schedule Reporting
- Standard Operating Procedures (SOPs)
- SR&QA Plan
- Inspection Plan
- Maintenance and In-Service Inspection Plan/Procedures
- Design Criteria Document
- Environmental Project Planning, LF 461 Update
- Interface Requirements
- Configuration Control Plan
- Hazard Analyses and Critical Items List (CIL)
- Installation Procedures
- Operational Checkout Plan/Procedures
- Software Management Plan
- Software Assurance Plan
- Design Analyses

## XI.RISK

- Top Risks and Mitigation Strategies
  - Technical
  - Cost
  - Schedule

## XII. SUMMARY

## **CRITICAL DESIGN REVIEW (CDR)**

### a. Description

#### (1) Objective

The objective of the CDR is to ensure that the design is complete, and the project is ready to proceed to the acquisition and construction phase. The CDR shall confirm that the final design is valid, fulfills the design requirements, utilizes good engineering practices, and adheres to applicable LaRC/NASA policies, procedures, standards, and codes. The CDR shall be scheduled after the design has been completed and reviewed by the project team, but prior to the initiation of the acquisition/construction phase.

(2) Membership: See Attachment K for review panel members.

### b. Sample Agenda

#### I. INTRODUCTION

Scope of Review  
 Status of Design  
 Status of Action Items  
 Agenda

#### II. PROJECT OVERVIEW

Research/Programmatic Requirements  
 New Capability/Performance Desired  
 Roles and Responsibilities  
 Project Scope – CoF Funded Portion  
 Project Scope – R&D Funded Portion  
 Project Scope – Center or Other Funded Portion

#### III. PROJECT MANAGEMENT

Work Breakdown Structure  
 Management Structure/Organization  
 Overview of Acquisition Plan  
 Acquisition Package(s) Status

#### IV. DESIGN REQUIREMENTS/CONSTRAINTS

System Interfaces between Work Packages  
 System Interfaces with Existing Facility Elements of Interface  
 Requirements Document Elements of Design Criteria Document  
 (includes Functional Requirements)



Software Requirements List  
Programmatic Requirements/Objectives List  
Engineering Requirements List  
Design Load/Environment List  
Interface Requirements  
Other Requirements (e.g., environmental, energy, historical)

## V. FINAL DESIGN

Basis of Design  
Final Design Drawings and Specifications  
Block Diagrams and Schematics  
Design Details, Supporting Calculations, and Analyses including:  
    Architectural  
    Structural  
    Mechanical  
    Electrical Process Systems Controls and Instrumentation  
    Software  
Sequence of Operations  
Performance Analyses  
Maintainability, Repairability, and Operability  
Producibility and Manufacturing Readiness  
Human Engineering/Accessibility  
Mock-ups, Breadboards, and/or Prototype Hardware  
List of equipment to be added or removed from facility  
Design Verification Results  
Summary of Design Compliance with Design Criteria and Interface Requirements  
Areas of Technical Uncertainty/Risk

## VI. SAFETY, RELIABILITY, AND QUALITY ASSURANCE

Status of Safety, Reliability, and Quality Assurance (SR&QA) Activities  
Independent Reviews of Drawings and Analyses  
Hazard Analyses and Updated Critical Items List (CIL)  
Quality Assurance Plan  
Systems Safety Features included in Design  
Software Classification and Software Safety Criticality  
Overall SR&QA Assessment and Area of Concern/Uncertainty

## VII. CONFIGURATION MANAGEMENT

Verification Status of Interface Reference Drawings  
Status of Facility Baseline List Drawings

## VIII. COST

Baseline Cost Estimate (PER)  
Current Cost Estimate and Rationale for any Cost Variations

Cost Concerns/Uncertainties

## IX. SCHEDULE

Project Level, including Construction Work Package Level  
Design Completion and Preparation of Procurement Package  
Procurement Cycle  
Schedule Concerns/Uncertainties

## X. DOCUMENTATION TREE AND STATUS

Note: The following list includes examples of documentation items. The complete list of documentation items is included in the Project Management Plan for the specific project.

Management Plan  
Requirements Document  
Cost and Schedule Reporting  
Standard Operating Procedures (SOP's)  
SR&QA Plan  
Inspection Plan  
Maintenance and In-Service Inspection Plan/Procedures  
Design Criteria Document  
Environmental Project Planning, LF 461 Update  
Interface Requirements  
Configuration Control Plan  
Hazard Analyses and Critical Items List (CIL)  
Installation Procedures  
Operational Checkout Plan/Procedures  
Software Management Plan  
Software Assurance Plan  
Design Analyses

## XI. RISK

Risks and Mitigation Strategy  
    Technical  
    Cost  
    Schedule

## XII. SUMMARY

## MANAGEMENT OVERSIGHT REVIEW (MOR)

### a. Description

#### (1) Objective

The Management Oversight Review (MOR) is intended to provide Directorate or Center management a top-level status and assessment of the project. It is utilized when the cost, technical risk, complexity, or mission impact warrants a review to those above the basic project stakeholders. It is also used to acquire approval to proceed and concurrence that the project aligns with the strategic direction of the customer Directorate and the Center.

#### (2) Membership: See Attachment K for review panel members.

### b. Sample Agenda

Use applicable sections of the Sample Agendas from the respective Summary Reviews in Attachments A-D.

## I. INTRODUCTION

Review Objectives  
Agenda

## II. PROJECT OVERVIEW

Project Scope  
Project Team  
Requirements  
Open Issues  
Concerns

## III. SUMMARY OF PRIOR REVIEWS

Status of Action Items or Key Findings  
Open Issues  
Areas of Concern or Uncertainty

## IV. SAFETY

## V. ENVIRONMENTAL

Status of LF 461  
Open Issues  
Areas of Concern or Uncertainty

- VI. PROCUREMENT PLAN
- VII. PROJECT COST ESTIMATE
- VIII. PROJECT SCHEDULE
- IX. RISK

Top Risks and Mitigation Strategies

- Technical
- Cost
- Schedule

- X. SUMMARY

## **IN-DEPTH TECHNICAL (TR)**

### a. Description

#### (1) Objective

The objective of the In-depth Technical Review is to perform an in-depth, discipline specific, technical review of the design documents to ensure that the design is valid, meets the requirements of the project; and follows the applicable processes, procedural requirements, standards, codes, and good engineering practices. This review is tailored to the technical requirements of the project, consistent with project size, complexity, criticality, and risk.

(2) Membership: See Attachment K for review panel members.

### b. Sample Agenda

#### I. INTRODUCTION

Review Objectives

#### II. PROJECT OVERVIEW

Research/Programmatic/Customer Requirements

Project Scope

Schedule

Top Technical Risks and Mitigation Strategies

#### III. CONTENT OF REVIEW PACKAGE (Specific to the discipline in review)

Design Analysis and Calculations

Drawings

Specifications

#### IV. SUMMARY

## **BASIC VALIDATION REVIEW (BVR)**

### c. Description

#### (1) Objective

The objective of the Basic Validation Review (BVR) is to ensure that the design meets the established requirements, utilizes good engineering practices, and adheres to applicable standards, codes, and procedures. It serves as a much less rigorous review than a Summary Review while providing a means for the project team and customer to achieve concurrence that the project is ready to proceed to the acquisition and construction phase.

(2) The BVR shall be scheduled after the design deliverables have been completed and reviewed by the project design team, but prior to the initiation of the acquisition/construction phase.

(3) Membership: See Attachment K for review panel members.

### d. Sample Agenda

#### I. OVERVIEW

Objective of the Review

Summary of Project Scope

List of Functional Requirements

#### II. PROJECT MANAGEMENT

Acquisition Plan

Cost Summary

Top Level Schedule

Top Risks

Technical

Safety

Cost

Schedule

#### III. DESIGN

Review of Drawing and Sketches

Review of Calculations and Analysis

Review of Specifications package or on Drawing

Validation Summary

The Design Addresses the Requirements

The Design is Safe

The Design Adheres to Applicable Procedures, Codes, and Standards

The Design Addresses Maintainability, Repairability, and Operability

The Project is Ready Proceed to Acquisition or Construction.

## **FUNCTIONAL APPROVAL REVIEW (FA)**

### a. Description

#### (1) Objective

The objective of the Functional Approval Review (FA) is to make sure that designs and construction tasks of small scope are reviewed and approved by the appropriate Standard Practice Engineers (SPE), Subject Matter Experts (SME), Authorities Having Jurisdiction (AHJ) and Safety and Facilities and Assurance Branch (SFAB).

(2) The Functional Approval is not a formal Review and does not require any presentations.

(3) Refer to the table below for a list of the type of work that needs an FA and the approving Authority.

### b. Actions

#### (1) Compile Review Documents

The Technical Point of Contact or Project Manager shall compile the necessary documents in PDF format for the authority to review and approve. This may include calculations, sketches, description of the scope of work, equipment vendor information. A separate package shall be distributed to each authority that needs to provide approval. The review package shall be compiled on a shared server site and the link provided to each reviewer by email. The email shall provide instruction to the reviewer and the following information:

- Name of the reviewer
- Title of the project or task
- Name of the TPOC or PM
- List of review documents included
- Date the package was submitted for review
- Date the review comments are due
- Instructions on providing comments
- Instructions for the reviewer to provide an email with the review comments and whether the reviewer has approved or not approved the Project to proceed.

#### (2) Review Documents

The reviewing authority shall access the documentation through the link provided. They shall review the documents and provide their comments as electronic comments or markups on the PDFs or a list of comments compiled in a single document.

The reviewer shall send an email to the TPOC / PM with their comments list and any marked PDFs with a statement that they approved or not approved the project to proceed.



(3) Finalize The Functional Approval

The TPOC or the PM shall save the reviewer response in the project records, review and disposition comments, and proceed with the project if all required approvals are received.

If any of the reviewers did not approve the documents, then the comments and issues must be resolved until the reviewer approves the documents and allows the project to proceed.

The COD Chief Engineer shall adjudicate all unresolved disputes.

**Functional Approval Review Requirements and Associated Approving Authority**

<b>APPROVING AUTHORITY</b>	<b>REQUIREMENTS</b>
Facility Coordinator or Alternate	Required for any type of repairs/modifications to facility.
Safety Office	Required for either of two general classifications: 1. Correction of a safety deficiency, or 2. Safety regulations, which govern a proposed work effort. See attached Safety and Fire Checklist.
Environmental Management	Required for all work that involves systems or equipment that contains material that has the potential to damage the environment. See form LF 461. Ref. LPR 8500.1
NASA Fire Chief	Required for any work that involves modification or alteration of fire protection system at LaRC. See attached Safety and Fire Checklist.
Lifting Device and Equipment Manager	Required for any work involving lifting hardware, lifting equipment, load testing or critical lifts.
Standard Practice Engineer - Pressure Systems	The Pressure Systems SPE reviews all new designs and all plans for modifications or repairs to LaRC pressure systems.
Standard Practice Engineer - Mechanical	The Mechanical SPE reviews new designs, modifications, and repairs of high-energy mechanisms with respect to compliance with national consensus codes, NASA policy and procedural requirements, and standard practices.
Standard Practice Engineer - Electrical Systems	The Electrical Systems SPE reviews project activities affecting new and existing systems for compliance with consensus codes, NASA policy and procedural requirements, and standard practices. The SPE is also the center point of contact for electrical safety and policy at the agency level and to the local electrical power utility for engineering matters related to the Center’s power distribution system.
Standard Practice Engineer - Welding/Construction	The Welding SPE reviews any project that requires welding. The review will consist of welding procedure and qualification documentation sign off.

<b>APPROVING AUTHORITY</b>	<b>REQUIREMENTS</b>
Standard Practice Engineer – Civil/Structural Systems	Serves as the Center expert and final authority on the application of Agency and Industry consensus standards and LaRC requirements concerning civil/structural systems. Responsible for reviewing all new designs and all plans for construction and modifications or repairs to LaRC facilities/structural systems.
Standard Practice Engineer - Facility Automation Systems (FAS)	The Facility Automation Systems SPE reviews project activities affecting new and existing systems for compliance with consensus codes, NASA policy and procedural requirements, and standard practices.
Standard Practice Engineer - Data Acquisition Systems (DAS)	The Data Acquisition Systems SPE reviews project activities affecting new and existing systems for compliance with consensus codes, NASA policy and procedural requirements, and standard practices.
Standard Practice Engineer - Wind Tunnel Model Systems	The SPE for Wind Tunnel Models serves as the resident expert for the review of wind tunnel model systems design and analysis.

## INTEGRATED SYSTEMS REVIEW (ISR)

### a. Description

#### (1) Objective

The objective of the ISR is to confirm that the construction has been successfully completed and that appropriate plans and preparations for shakedown have been developed. The ISR shall be scheduled when the construction and subsystems level acceptance testing is approximately complete, but prior to initiation of integrated systems testing.

(2) Membership: See Attachment K for review panel members.

### b. Sample Agenda

#### I. INTRODUCTION

Objective and Scope of Review  
Agenda

#### II. PROJECT OVERVIEW

Research/Programmatic Requirements  
Description of Construction Project and Functional Operation of Facility  
Top Level Schedule and Status  
Summary of Prior Reviews of All Types  
Status of Open Action Items from Design Reviews

#### III. CONSTRUCTION

Overview Status of Construction  
Detailed Discussion of Facility Components/Systems/Controls  
Brief Descriptions of Specifications by Which Item was Procured/Constructed  
Changes in the CDR Design and the Independent Reviewing Body for Each  
Summary of all Qualification, Proof, and/or Acceptance Testing Performed and Results  
Summary of As-Built Compliance with Contractual Requirements  
Status of Construction Contract(s) and Contract Submittals (including as-built drawings)  
Concern, Limitations, and Potential Problem Areas

#### IV. DOCUMENTATION

Overall Documentation Required (documentation tree):

- Design Related
- Safety, Reliability, and Quality Assurance (SR&QA) Related
- Construction Related

- Test Related
- Management Related
- Environmental close-out submittals – refer to requirements in LF461
- Field Verification Status of Facility Baseline List (FBL)
- As-Built Drawings Status Summary (CCIs and Non-CCIs)

## V. FACILITY SHAKEDOWN

- Overview of Objectives
- Management/Staffing Structure/Organization, Roles, and Responsibilities
- Operating Personnel Readiness (includes training and certification)
- Details of Shakedown Plan
  - Tasks
  - Operating Procedures (Standard and Test Unique)
  - Configuration Management Procedures
  - Test Instrumentation and Data Reduction
  - Schedule
- Areas of Concern/Uncertainty

## VI. SAFETY, RELIABILITY, AND QUALITY ASSURANCE

- Overview of Facility Safety Program, Special Studies, and Safety Reviews
- Safety Analysis Report/Operational Hazard Analyses (including Software and Shakedown Unique Configurations and Operations)
- Critical Items List (CIL)
- Critical Interlocks
- Quality Assurance/Inspection Utilized
  - Deviations Accepted (general items, critical items, and critical interlocks)
- Status of Open Items from Safety/Hazard Analysis Reviews
- Overall SR&QA Assessment and Areas of Concern/Uncertainty
- Status of Operator Training Certifications
- Status of Standard Operating Procedures

## VII. SUMMARY ASSESSMENT OF READINESS FOR INTEGRATED SYSTEMS TESTING

- Hardware
- Software
- Personnel
- Open Items
- Risk and Mitigation
- Concerns

## **OPERATIONAL READINESS REVIEW (ORR)**

### c. Description

#### (4) Objective

The objective of the ORR is to verify that shakedown has been satisfactorily completed and that the facility is ready to begin normal operations. The ORR will determine whether the shakedown tests demonstrated that the facility meets its performance requirements, all applicable documentation has been completed, and that the facility is adequately staffed and prepared for normal operations. The ORR shall be scheduled when the integrated system level test program is completed, but prior to initial research operation of the facility.

(5) Membership: See Attachment K for review panel members.

### d. Actions

#### (4) Walk-Through

Prior to the ORR, the Chairperson, and an appointed committee composed of at least three ORR members will conduct a final “walk-through” of the new/modified facility to:

- (i) Certify that the facility is operational.
- (ii) List all observed safety and quality assurance deficiencies.
- (iii) Verify that all prior corrective actions have been incorporated.

#### (5) Certification Statement

The Co-Chairperson representing the facility is to provide a written statement to the LaRC Deputy Director certifying that the facility is acceptable and recommending that the facility be declared operational. All panel members will receive a copy of this written statement.

### e. Sample Agenda

#### I. INTRODUCTION

Objective and Scope of Review  
Agenda

#### II. PROJECT OVERVIEW

Research/Program Requirements  
Operational Scenario Summary  
Project Scope and Status Summary  
Top Level Schedule and Summary

Status of Open Action Items from Prior Reviews

### III. INTEGRATED SYSTEMS TESTING

Test Results Against Plan

Verification of Critical Interlocks

Resolution of Problems/Failures

Configuration Changes

Documentation

Hardware

Software

Summary of Overall Project Compliance with Requirements

Resolution of Risks

### IV. DOCUMENTATION

Status of Overall Project Documentation Against Requirements

Archival Responsibilities and Status

Lessons Learned

### V. OPERATIONS PROCEDURES

Roles and Responsibilities

Verification of Standard Operating Procedures (SOPs)

Emergency Procedures

### VI. SAFETY, RELIABILITY, AND QUALITY ASSURANCE

Safety Analysis Changes Since ISR

Safety Compliance Verification

Personnel Training and Certification

Quality Assurance and Compliance with Specifications

### VII. CONFIGURATION MANAGEMENT

Status of Facility Configuration Management System Document

### VIII. OPERATIONS AND MAINTENANCE

Status of Maintenance Plans

### IX. SUMMARY ASSESSMENT OF OPERATIONAL READINESS

Hardware

Software

Personnel

Procedures/Documentation

Open Items

## REVIEW PANEL MEMBERS

Note G1: Review participants are identified using this matrix (non-blank row-column entry).

Note G2: Summary Reviews and Management Oversight Reviews have panel members who are selected from the participants. A panel member is a required participant.

Note G3: In-Depth Technical Reviews do not have panel members; those invited are reviewers.

Recommended Review Panel Members	PRR	CoDR	PDR	CDR	MOR	ISR	ORR	BVR
Chairperson: COD Chief Engineer	X	X	X	X	X	X	X	X
Co-Chairperson: Customer Organization Director Appointed	X						X	
Secretary: Appointed by Chief Engineer	X	X	X	X	X	X	X	X
Safety and Facility Assurance Branch (SFAB) Head	X	X	X	X	X	X	X	
Facility Chief	X	X	X	X	X	X	X	X
COD Senior Safety Engineer	X	X	X	X	X	X	X	
Facility Manager	X	X	X	X	X	X	X	X
Facility Systems Engineer	X	X	X	X	X	X	X	
Facility Safety Head	X	X	X	X	X	X	X	X
Facility Coordinator	X	X	X	X	X	X	X	
Customer	X	X	X	X	X	X	X	X
Customer's Organizational Manager	X	X	X	X	X	X	X	
Standard Practice Engineer(s) and Technical Expert(s)	X	X	X	X	X	X	X	X
•Pressure Systems	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
•Mechanical Systems	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
•Electrical Systems	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
•Model Systems	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
•Facility Automation Systems	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
•Welding	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)
•Structures/Civil SPE – Technical Expert	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)
•Lifting Manager – Technical Expert	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
•Data Acquisition Systems – Technical Expert	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)
•Fire Chief /Authority Having Jurisdiction	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)
•IT Manager - Technical Expert	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Facility Lead Operator						X	X	
Projects & Engineering Branch Head	X	X	X	X	X	X	X	X
Environmental Management Office	X	X	X	X	X	X	X	X
Maintenance & Operations Branch Head	X	X	X	X	X	X	X	X
DCOR for Engr. for CMOE -or- COR (non CMOE)	X	X	X	X	X	X	X	
CO (for >\$2M procurements/legal review)				(12)	(12)			
SFAB Safety Engineer	X	X	X	X	X	X	X	X
Construction Manager					X	X	X	
Chief Engineer, Customer Organization - AHJ	X	X	X	X	X	X	X	X
<b>Additional Review Panel Members (not already listed above)</b>	<b>PRR</b>	<b>CoDR</b>	<b>PDR</b>	<b>CDR</b>	<b>MOR</b>	<b>ISR</b>	<b>ORR</b>	<b>BVR</b>
Security Chief	(13)	(13)	(13)	(13)	(13)	(13)	(13)	(13)
American Disability Act Coordinator	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)
Master Planner	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(15)
Energy Manager	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)
Real Property Officer	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)
Geographic Information Systems			(18)	(18)	(18)		(18)	(18)
Underground Utilities Coordinator			(19)	(19)	(19)	(19)	(19)	(19)
CoF Program Manager	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)
Associate Director of Strategic Infrastructure Transformation	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)
Deputy Director, COD	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)
Deputy Director, Customer Organization	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)

Note 1:Work involved with pressurized system (>125 psig), Vacuum Systems, Cryogenic systems, Structural Glass

Note 2:Work involved with machine design components and research mechanical systems

Note 3:Work with power distribution systems and industrial power and control systems

Note 4:Work on test articles and wind tunnel models or interface systems

Note 5:Work on research and industrial automation and control systems

Note 6:Welding SPE for Facilities when work involves ASME or AWS welding requirements. (Welding SPE if welding on flight systems or models involved).

Note 7:Work involving civil/structural engineering

Note 8:Work involving lifting operations, critical lifts, and or lifting equipment

Note 9:Work involving research Data Acquisition Systems

Note 10:Work involving fire/hazard code questions including fire suppression/detection, building ingress/egress, electrical hazard zones

Note 11:Work involving equipment interfaces, wireless technology, IT security requirements

Note 12:Contracting Officer is required for CDR level reviews on projects >\$2Million so that he/she can obtain legal review of Specifications

Note 13:Work involving new building, additions, perimeter fence, building access/locks, center traffic rerouting/disruption, center gates, badge & pass, security offices

Note 14:Work involving ADA compliance, disruption to ADA access points to building, relocation of personnel

Note 15:New buildings/additions/major rehabs, road/parking lot changes, ADA changes, projects involving the transfer, easement, leasing of land, land use changes

Note 16:Energy projects, water projects, metering, new buildings, building additions

Note 17:Demolition, new buildings, building additions, east side changes, leasing arrangements, projects involving the transfer, easement, or leasing of land

Note 18:Projects developing a Building Information Model or requiring a GIS deliverable.

Note 19:Work involves digging, utility connections, traversing utilities with a heavy load, any drawings showing underground utilities

Note 20:For Construction of Facilities or Revitalization projects

Note 21:Expected participant at Summary Reviews per the discretion of the COD Chief Engineer.