LANGLEY
POLICY
DIRECTIVE

Directive: LAPD 7000.2
Effective Date: July 27, 2009
Expiration Date: July 27, 2014

Responsible Office: Center Operations Directorate

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

1. POLICY

a. General

(1) This Center will conduct the following sequential set of reviews for facility projects covered by this directive:

(a) Project Requirements Review (PRR).

(b) Conceptual Design Review (CoDR).

(c) Preliminary Design Review (PDR).

(d) Critical Design Review (CDR).

(e) Integrated Systems Review (ISR).

(f) Operational Readiness Review (ORR).

(2) Attachments A-F describes the detailed review objectives and provides sample agendas for each review.

(3) The process for implementing the reviews is described in LMS-CP-5621, "Facility Systems Project Review."

(4) The Chairperson of each review or the cognizant Directorate Director may also establish other special reviews to supplement the above reviews.

b. Review Objectives

(1) The primary objective of the above reviews is to enhance the probability of success of LaRC facility projects. This will be achieved using the cumulative knowledge of a team of engineers, scientists, technicians, and others who have been selected for their experience with the particular systems and functions involved. These reviews do not relieve the LaRC organization to which the project is assigned of the responsibility for the success of the project.

(2) The reviews will be comprehensive, covering the technical, cost, schedule, and safety aspects of the project.

c. Criteria

The criteria stated herein are minimum requirements for reviews of the technical and management aspects of LaRC's facility projects. The requirements of this directive do not supersede other reviews imposed by NASA Headquarters, or replace the scientific and technical reviews conducted by LaRC organizations or committees such as:

(1) The Executive Safety Council Reviews.

(2) Technical Merit and Feasibility Reviews.

(3) Routine Line Organization Reviews.

2. APPLICABILITY

a. Facility projects to be included in this review program are determined by the Deputy for Facilities Engineering and Maintenance, Center Operations Director (COD) in conjunction with the Directorate for whom the project is being executed and routinely include Major Discrete and Research Systems Projects, Repair and Environmental Compliance Projects, Rehabilitation and Modification Program, and Minor Construction Program projects. Additional projects can be added by the Director, Safety and Mission Assurance Office (SMAO) or the Director, COD. The reviews for facility projects not covered by this directive will be established by the Deputy Director for COD.

b. A determination of the applicability of this Policy Directive will be made at the initiation of the facility project or upon the receipt of funding for a Preliminary Engineering Report (PER) or requirements document. At that time, decisions relative to tailoring the review requirements of this directive will also be made.

3. AUTHORITY

a. NPD 7330.1, "Approval Authorities for Facility Projects"

b. NPD 8820.2, "Design and Construction of Facilities"

c. NPD 8831.1, "Maintenance and Operations of Institutional and Program Facilities and Related Equipment"

d. NPR 8820.2, "Facility Project Requirements"

4. APPLICABLE DOCUMENTS

a. NPR 7150.2, “NASA Software Engineering Requirements”

b. LAPD 1700.1, "Safety Program"

c. LAPD 1700.2, "Safety Assignments and Responsibilities"

d. LMS-CP-5621, “Facility Systems Engineering Project Review”

Verify the correct revision before use by checking the LMS Web site.

e. Langley Form 6, “Request for Action”

5. RESPONSIBILITY

a. Director, COD and Cognizant Directorate Director

Ensure the effective implementation of the design review process.

b. Deputy for Facilities Engineering and Maintenance, COD

(1) Select Chairperson for the Conceptual Design Review (CoDR), Preliminary Design Review (PDR), Critical Design Review (CDR), and Integrated Systems Review (ISR)

(2) Select Co-Chairpersons for the Project Requirements Review (PRR) and Operational Readiness Review (ORR) in consultation with the Cognizant Directorate Director.

c. Other Directorate, Assistant, or Associate Directors

(1) Support the design review process including closure of Requests for Action (RFAs) as required.

(2) Furnish senior personnel experienced in the required technical disciplines to support the reviews

d. Review Chairperson

(1) Appoint Review Panel members. Organize each panel and draw support from LaRC, NASA Headquarters, other Centers, industry, or other Federal agencies when applicable.

(2) Chair the review(s).

(3) Assign and close RFA’s.

e. Review Panel Members

(1) Review the materials provided prior to the design review.

(2) Originate and review RFA’s as appropriate.

f. Line Management

(1) Ensure that review material meets the requirements of this directive.

(2) Ensure Action Items are properly addressed.

g. Project Manager/Project Management Engineer

Verify the correct revision before use by checking the LMS Web site.

(1) In conjunction with the Review Chairperson, establish the review agenda, using the sample agenda as a guide.

(2) Develop or oversee development and distribution of review materials.

(3) Recommend Action Item assignee and a closure date to the Review Chairperson.

h. Review Secretary

(1) Schedule the review in consultation with the review Chairperson.

(2) Document the review proceedings.

(3) Serve as Action Item Coordinator, formally documenting, distributing, and tracking Requests for Action (RFAs)

6. DELEGATION OF AUTHORITY

None

7. MEASUREMENTS/VERIFICATION

None

8. CANCELLATION

LAPD 7000.2, dated 4 October 2004.

Original signed on file, July 27, 2009

Lesa B. Roe
Director

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

Attachments A - F

Verify the correct revision before use by checking the LMS Web site.

PROJECT REQUIREMENTS REVIEW (PRR)

a. Description

(1) Objective (PRR)

The purpose 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 the Preliminary Engineering Report (PER).

(2) Membership

(a) Chairperson: As designated by the Deputy for Facilities Engineering and Maintenance, COD

(b) Co-Chairperson: As designated by the Cognizant Directorate Director in consultation with the Deputy for Facilities Engineering and Maintenance, COD.

(c) Secretary: Appointed by the Chairperson

(d) Members: LaRC Safety Manager; Facility Manager; Facility Systems Engineer; Facility Safety Head; Facility Coordinator; Cognizant Organization Manager; Deputy for Facilities Engineering and Maintenance, COD; Directorate Chief Engineer, COD; technical experts as appropriate.

(e) Invitees: As designated by the Chairperson.

b. 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

Cultural Resources
Interfaces
Functional Requirement Changes since Publication of Requirements Document

Verify the correct revision before use by checking the LMS Web site.

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. SUMMARY

Verify the correct revision before use by checking the LMS Web site.

CONCEPTUAL DESIGN REVIEW (CoDR)

a. Description

(1) Objective (CoDR)

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 8820.2) or at 10 percent completion of final design.

(2) Membership

(a) Chairperson: As designated by the Deputy for Facilities Engineering and Maintenance, COD.

(b) Secretary: Appointed by the Chairperson

(c) Members: LaRC Safety Manager; Facility Manager; Facility Systems Engineer; Facility Safety Head; Facility Coordinator; Cognizant Organization Manager; Deputy for Facilities Engineering and Maintenance, COD; Directorate Chief Engineer, COD; technical experts as appropriate.

(d) Invitees: As designated by the Chairperson.

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
Acquisition Approach

III. DESIGN REQUIREMENTS/CONSTRAINTS

Cultural Resources
Interfaces
Functional Requirement Changes Since Publication of Requirements Document
Site Selection

Verify the correct revision before use by checking the LMS Web site.

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, and so forth)
Component and Subsystem Testing

VI. SAFETY AND QUALITY ASSURANCE

Facility Energy Source Checklist
Preliminary Hazards List
Preliminary Critical Items List (CIL)
Status of As-Built Reference Interface Drawings
Special Construction Inspection Requirements
Design Safety Considerations

VII. COST

Baseline Construction Estimate
Design/Construction Cost Estimates

Verify the correct revision before use by checking the LMS Web site.

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

VIII. SCHEDULE

Project Level (with rationale)
Major Element or Work Package Level
Schedule Uncertainties/Concerns

IX. DOCUMENTATION TREE AND STATUS

Project Management Plan
Requirements Document
Requirements Tracability Matrix
Preliminary Acquisition Plan

X. SUMMARY

Verify the correct revision before use by checking the LMS Web site.

PRELIMINARY DESIGN REVIEW (PDR)

a. Description

(1) Objective (PDR)

The objective of the PDR is to validate the adequacy of the intended final design approaches as related to the functional design requirements according to applicable policies, design criteria and National Codes. The PDR will normally be scheduled when the final design is approximately 35 percent complete.

(2) Membership

(a) Chairperson: As designated by the Deputy for Facilities Engineering and Maintenance, COD.

(b) Secretary: Appointed by the Chairperson

(c) Members: LaRC Safety Manager; Facility Manager; Facility Systems Engineer; Facility Safety Head; Facility Coordinator; Cognizant Organization Manager; Deputy for Facilities Engineering and Maintenance, COD; Directorate Chief Engineer, COD; technical experts as appropriate.

(d) Invitees: As designated by the Chairperson.

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

Verify the correct revision before use by checking the LMS Web site.

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 Document including:
- Software Requirements List
- Programmatic Requirements/Objectives List
- Engineering Requirements List
- Design Load/Environments List
- Interface Requirements

V. PRELIMINARY DESIGN

Preliminary Design Concept Drawings
Design Approach and Supporting Analyses
- Architectural
- Process Systems
- Structural
- Mechanical
- Electrical
- Controls and Instrumentation
- Software

Tradeoff Studies
Areas of Technical Uncertainty/Risk
Design Verification Results/Plans
Performance Analyses
Status Summary of Design Compliance with Design Criteria and Requirements Document
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, and so forth)
Implementation of SR&QA Plan
Field Verification Status of Interface Drawings to be Referenced in Acquisition Package
Potential Revisions and Additions to Existing Facility Baseline List (FBL)
Areas of Concern or Uncertainty

VII. COST

Baseline Cost Estimate (PER)
Current Cost Estimate and Rationale for any Cost Variations
Cost Concerns/Uncertainties (design or construction)

Verify the correct revision before use by checking the LMS Web site.

VIII. SCHEDULE

Project Level
Work Package Level
Status of Design Tasks Against Plan
Schedule Concerns/Uncertainties (design or construction)

IX. 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
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

X. SUMMARY

Verify the correct revision before use by checking the LMS Web site.

CRITICAL DESIGN REVIEW (CDR)

a. Description

(1) Objective (CDR)

The objective of the CDR is to assure that the design is complete and the project is ready to proceed to the acquisition and construction phase. The CDR will confirm that the final design fulfills the design requirements, utilizes good engineering practices, and adheres to applicable LaRC/NASA policies and National Codes. The CDR will 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

(a) Chairperson: As designated by the Deputy for Facilities Engineering and Maintenance, COD.

(b) Secretary: Appointed by the Chairperson

(c) Members: LaRC Safety Manager; Facility Manager; Facility Systems Engineer; Facility Safety Head; Facility Coordinator; Cognizant Organization Manager; Deputy for Facilities Engineering and Maintenance, COD; Directorate Chief Engineer, COD; technical experts as appropriate.

(d) Invitees: As designated by the Chairperson.

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

Verify the correct revision before use by checking the LMS Web site.

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

V. FINAL DESIGN

Final Design Drawings and Specifications
Block Diagrams and Schematics
Design Details and Supporting 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 Elements of Design Criteria and Interface Requirements Documents
Areas of Technical Uncertainty/Risk

VI. SAFETY, RELIABILITY, AND QUALITY ASSURANCE

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

Verify the correct revision before use by checking the LMS Web site.

VII. COST

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

VIII. SCHEDULE

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

IX. 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
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

X. SUMMARY

Verify the correct revision before use by checking the LMS Web site.

INTEGRATED SYSTEMS REVIEW (ISR)

a. Description

(1) Objective (ISR)

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 will normally be scheduled when the construction and systems level acceptance testing is approximately complete, but prior to initiation of integrated systems testing.

(2) Membership

(a) Chairperson: As designated by the Director,

(b) Secretary: Appointed by the Chairperson

(c) Members: Cognizant Organization Manager; Deputy for Facilities Engineering and Maintenance, COD; LaRC Safety Manager; Facility Manager; Facility Systems Engineer; Directorate Chief Engineer, COD; Lead Operator; Facility Safety Head; Facility Coordinator; Chairperson, Systems Operations Committee (see LAPD 1150.2); technical experts as appropriate.

(3) Action

The Chairperson is to provide a written statement to the cognizant Directorate Director certifying it is acceptable to initiate system level checkout and test programs. All board members will receive a copy of this written statement.

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

Verify the correct revision before use by checking the LMS Web site.

III. CONSTRUCTION

Overview and Overall 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

Status Summary

V. FACILITY SHAKEDOWN

Overview of Objectives
Management Structure/Organization, Roles, and Responsibilities
Operating Personnel Readiness (includes training and certification)
Field Verification Status of Facility Baseline List (FBL) As-Built Drawings
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 and any 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

Verify the correct revision before use by checking the LMS Web site.

VII. SUMMARY ASSESSMENT OF READINESS FOR INTEGRATED SYSTEMS TESTING

Hardware
Software
Personnel
Open Items
Concerns

Verify the correct revision before use by checking the LMS Web site.

OPERATIONAL READINESS REVIEW (ORR)

a. Description

(1) Objective (ORR)

(a) 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.

(b) The ORR will normally be scheduled when the integrated system level test program is completed, but prior to initial research operation of the facility.

(2) Membership

(a) Chairperson: As designated by the Directorate Director responsible for facility in consultation with the Deputy for Facilities Engineering and Maintenance, COD.

(b) Co-Chairperson: As designated by the Deputy for Facilities Engineering and Maintenance, COD, in consultation with the Directorate Director responsible for facility.

(c) Secretary: Appointed by the Chairperson

(d) Members: Chairperson, Systems Operations Committee (see LAPD 1150.2); LaRC Safety Manager; Facility Manager; Facility Systems Engineer; Directorate Chief Engineer, COD; Facility Safety Head; Facility Coordinator; technical experts as appropriate.

(3) Action

(a) 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.

(b) 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.

Verify the correct revision before use by checking the LMS Web site.

b. Sample Agenda

I. INTRODUCTION

Objective and Scope of Review
Agenda

II. PROJECT OVERVIEW

Research/Program Requirements
Project Scope and Status Summary
Top Level Schedule and Summary
Status of Open Action Items from Prior Formal 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

IV. DOCUMENTATION

Status of Overall Project Documentation Against Requirements
Archival Responsibilities and Status

V. OPERATIONS PROCEDURES

Roles and Responsibilities
Typical Sequence of Events and Verification of Standard Operating Procedures (SOP's)
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
Configuration Management
Open Items

Verify the correct revision before use by checking the LMS Web site.

VII. SUMMARY ASSESSMENT OF OPERATIONAL READINESS

Hardware
Software
Personnel
Procedures/Documentation

Verify the correct revision before use by checking the LMS Web site.