



Langley Research Center

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Flight Projects Directorate Space Flight Configuration Management Requirements

National Aeronautics and Space Administration

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Office of Primary Responsibility: Flight Projects Directorate

PREFACE

P.1 Purpose

- a. Configuration Management (CM) is a discipline for ensuring that hardware, software and documentation products meet carefully defined characteristics and that any changes in those products are tightly controlled, carefully identified, and accurately recorded.
- b. This procedure establishes CM requirements used by the Flight Projects Directorate (FPD) and the projects managed by FPD personnel. This procedural requirements document describes the objectives, requirements and responsibilities for implementing and maintaining a CM process.
- c. Configuration Management within NASA consists of five elements:
 - (1) Configuration Management Planning
 - (2) Configuration Identification
 - (3) Configuration Change Management
 - (4) Configuration Status Accounting
 - (5) Configuration Verification and Audit

P.2 Applicability

This requirements document applies to the NASA Langley Research Center Flight Projects Directorate and the projects it supports.

P.3 Authority

The National Aeronautics and Space Act of 1958 , As Amended, Section 203 (c)(1), 42 U.S.C. 2473(c)(1) and NASA Procedural Requirement (NPR) 7120.1.

P.4 Applicable Documents

The following documents form a part of this plan to the extent specified in the text. Unless a version is specified, the latest revision is applicable.

- a. NPD 1440.6, "NASA Records Management"
- b. NPD 2200.1, "Management of NASA Scientific and Technical Information"

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- c. NPD 2200.2B, "Requirements for Documentation, Approval and Dissemination of NASA Scientific and Technical Information"
- d. NPR 1441.1, "NASA Records Retention Schedules"
- e. NPR 7120.5D, "NASA Space Flight Program and Project Management Requirements"
- f. NPR 7123.1, "NASA Systems Engineering Processes and Requirements"
- g. NPR 7150.2, "NASA Software Engineering Requirements"
- h. LPR 1440.7, "LaRC Records Management Procedural Requirement"
- i. LPR 5300.1, "Product Assurance Plan"
- j. LPR 7120.5, "Space Flight Project Practices Handbook"
- k. LPR 7120.6, "Project And Task Review Procedures Requirements"
- l. LPR 7120.7, "Space Flight Independent Life Cycle Review Procedural Requirements"
- m. LPR 7320.1, "Engineering Drawing System"
- n. NASA/SP-2007-6105, "NASA Systems Engineering Handbook"
- o. NASA-STD-0005, "NASA Configuration Management Standard"
- p. LMS-CP-5510, "Aerospace Systems Change Control within Systems Engineering"
- q. LMS-CP-5526, "Product Requirements Development and Management Procedure"
- r. LMS-CP-5528, "Software Planning, Development, Acquisition, Maintenance, and Operations"
- s. LMS-CP-5529, "Software Configuration Management Planning for Low-, High-, and Critical-Control Software"
- t. LF 181, "Configuration Change Request" (CCR)
- u. ANSI/EIA-649, "National Consensus Standard for Configuration Management"
- v. IEEE 828, "IEEE Standard for Software Configuration Management Plans"
- w. GEIA/859, "Standard Data Management"
- x. ISO 10007, "Quality Management Systems – Guidelines for Configuration Management"
- y. MIL-HDBK-61A, "Configuration Management Guidance"
- z. "PMI Practice Standard for Project Configuration Management"

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P.5 Measurements/Verification

Configuration Management metrics are presented monthly, typically at the Flight Projects Directorate Pre-CMC Review. The metrics may be presented by either the Configuration Management Lead, individual Project Managers or the individual Project Configuration Managers.

P.6 Cancellation

None

Original signed on file

Cynthia C. Lee
Associate Director

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1 CONFIGURATION MANAGEMENT PLANNING

- a. The Flight Projects Directorate management is responsible for the implementation of a configuration management system. There are configuration management roles and responsibilities at each level of the organization.
- b. Formal configuration management is mandatory for all space flight projects as defined in LPR 7120.5 and for projects for which the Customer or Langley Senior Management has required Configuration Management.

1.1 Flight Projects Directorate

1.1.1 Flight Projects Directorate management shall implement configuration management for all configuration documentation, software code, data, physical media and physical parts representing or comprising organizational products, also referred to as Configuration Items.

1.1.1.1 Flight Projects Directorate management shall approve and implement CM policies and procedures.

1.1.1.2 Flight Projects Directorate management shall have a centralized filing system for the maintenance of all files.

1.1.2 Flight Projects Directorate management shall require configuration management for all space flight projects supported by the Organization.

1.1.3 Flight Projects Directorate management shall appoint a Configuration Management Lead (CML).

Note: *Flight Projects Directorate management may choose to have each project develop a project-specific Configuration Management Plan or to have one overall Configuration Management Plan to cover all projects of a similar nature. In any case, Configuration Management Plans should cover all of the requirements appropriate to the level of the Plan.*

1.2 Configuration Management Lead

1.2.1 The Configuration Management Lead shall implement Configuration Management functions in accordance with Agency guidance and this Langley Procedural Requirement (LPR).

1.2.2 The Configuration Management Lead shall provide Configuration Management infrastructure support to the projects supported by the Organization.

1.2.3 The Configuration Management Lead shall adopt the Configuration Management Standards in NASA-STD-0005, NASA Configuration Management Standard to meet Configuration Management program requirements.

1.2.4 The Configuration Management Lead shall develop configuration management products (plans, requirements, and processes) that meet the requirements of NASA-STD-0005, NASA Configuration Management Standard.

1.2.5 The Configuration Management Lead shall verify that Project Configuration Management Plans contain configuration management for applicable phases.

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Configuration Management Plans should account for evolution of Organizational projects as the Projects mature the products and services supporting configuration item life cycles. This verification is part of the activities leading to the 60 Day Review and is to be documented in that review.

1.2.6 The Configuration Management Lead shall develop and maintain the Configuration Management Plan for the Flight Projects Directorate.

1.2.7 The Configuration Management Lead shall develop and maintain CM templates (documents, presentations, forms, etc.).

1.2.8 The Configuration Management Lead shall develop and maintain CM procedures to be used by projects.

1.2.9 The Configuration Management Lead shall develop and maintain CM training materials.

1.2.10 The Configuration Management Lead shall develop and maintain the Organizational electronic library.

1.2.11 The Configuration Management Lead shall serve as the Flight Projects Directorate point of contact for electronic document configuration management activities with appropriate entities in the Center and Agency Information Technology (IT) community.

1.2.12 The Configuration Management Lead shall serve as the contact for Configuration Management activities with the Systems Management Office (LaRC), and the Safety and Mission Assurance Office (LaRC).

1.2.13 The Configuration Management Lead shall perform periodic configuration audits to verify adequacy of the CM process.

1.2.14 The Configuration Management Lead shall document the results of the periodic configuration audits in a document.

1.3 Project Manager

1.3.1 The Project Manager shall implement configuration management for all documentation describing Project configuration, software code, data, physical media and physical parts representing or comprising Project products.

1.3.2 The Project Manager shall contact the Organizational Configuration Management Lead at formation of the Project to create the configuration management infrastructure needed for the project.

1.3.3 The Project Manager shall obtain a Project Configuration Manager for the Project at formation of the Project.

1.3.4 The Manager shall have a documented Configuration Management Plan either as a section in the Project Plan or as a separate document.

1.3.4.1 The Project Manager shall allocate resources for configuration management.

1.2.4.2 The Project Manager shall plan, implement and fund the required configuration management processes and tools.

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1.3.4.3 The Project Manager shall require, as part of contracts, primary contractors and vendors supplying products to the project to have a documented configuration management system.

Note: *This should be coordinated with the Office of Procurement and include any applicable procedural requirements.*

1.3.5 The Project Manager shall assure that the function of the Project Configuration Manager continues throughout the entire life cycle of the Project.

1.4 Project Configuration Manager

1.4.1 The Project Configuration Manager shall assist the Project Management staff in developing and maintaining a Configuration Management Plan that meets NASA and LaRC Project configuration management requirements and procedures.

1.4.2 The Project Configuration Manager shall provide guidance to Project personnel regarding procedures for baselining configuration items, document control, maintenance, and change package preparation.

1.4.3 The Project Configuration Manager shall assist the Project in recording project records to assure that hardware and software are fabricated as required.

1.4.3.1 The Project Configuration Manager shall participate in Project design reviews.

1.4.3.2 The Project Configuration Manager shall audit contractor documents for as-designed versus as-built configuration agreement.

Note: *This should be coordinated with the Office of Procurement and include any applicable procedural requirements.*

1.4.3.3 The Project Configuration Manager shall archive the documents for as-designed versus as-built configuration for in-house hardware and software.

1.4.3.4 The Project Configuration Manager shall assist the Project Manager in assuring the Functional Configuration Audits and Physical Configuration Audits have been completed. The timing of these audits is identified in the Project Configuration Management Plan.

1.4.3.5 The Project Configuration Manager shall provide action item status, document status, Change Request status, Configuration Item status, and any other configuration management-related status reports to the Project.

1.4.3.6 The Project Configuration Manager shall serve as the Project's Release Desk.

1.4.3.7 The Project Configuration Manager shall develop and maintain the library/libraries for the project.

1.4.3.8 The Project Configuration Manager shall archive and retain Project records per LPR 1440.7, Records Management Program, NPD 1440.6, NASA Records Management and NASA-STD-0005, NASA Configuration Management Standard.

Note: *NPR 1441.1 Sections 7 and 8 define the records required to be archived and retained by NASA projects and organizations.*

1.4.4 The Project Configuration Manager shall be the configuration management point of contact for Project staff, Project Suppliers, and Project sub-suppliers.

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1.5 Configuration Management Plan

1.5.1 As required by Flight Projects Directorate, the Project shall have a Configuration Management Plan.

1.5.2 The Project Configuration Management Plan shall be baselined by the Project's System Requirements Review or equivalent.

1.5.3 The standard CM Plan template shall be used by all projects in the creation of a Project CM Plan (see Appendix M of NASA/SP-2007-6105, NASA Systems Engineering Handbook). The Plan may be tailored for the project (see Appendix B, Table B.1 of this document for tailoring guidelines. These guidelines cover Category I, II and III projects.)

1.5.4 The Plan shall define the relationship between events critical to CM and schedule control; e.g., sequencing of design reviews, engineering release, production, and testing.

1.5.5 The Project Configuration Management Plan shall specify the intended time in the program when the requirements and specifications will be presented for delivery (or otherwise made available) to suppliers. Any limitation on the use of these requirements and specifications by the supplier shall be stated.

1.5.6 All Project LaRC-contracted and LaRC-developed deliverables shall be controlled in accordance with this plan.

Note: *Customers may have Customer-specific documentation Configuration Management systems that the Project is mandated to use. If so, the Project should assure that all Project documentation is placed in that system. However, this does not relieve the Project of the responsibility to place all LaRC-contracted and LaRC-developed documents in a LaRC-controlled configuration-managed document storage system.*

1.6 Configuration Management Plan Approval

1.6.1 Unless otherwise required by the Customer, the Project Configuration Manager shall submit the Configuration Management Plan to the following for approval:

- a. The Configuration Management Lead,
- b. Representative from the Systems Management Office,
- c. Langley Chief Engineer, and
- d. The Project Manager.

1.7 Configuration Management Phasing and Milestones

All Projects shall document the major milestones for implementation of Configuration Management in the Project Configuration Management Plan. These milestones shall include:

1.7.1 Phasing for implementation of the requirements, including release and submittal of requirements and supporting configuration documentation.

1.7.2 Establishment of internal developmental and contractual configuration baselines.

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1.7.3 Implementation of internal and Contractor configuration control to include the identification of Project-controlled documentation such as requirements, drawings, etc. that require Project approval before release.

1.7.4 Establishment of the Project's Change Control Board.

1.7.5 Implementation of a status accounting system and provision of reports or access to status accounting information.

2 CONFIGURATION IDENTIFICATION

Configuration identification defines requirements for Configuration Items through the use of requirements, specifications (hardware and software), interface documentation (hardware and software), drawings, and associated data.

2.1 Establishment of Baselines

2.1.1 The Project design activities shall use a series of technical reviews and audits to establish successive configuration baselines and to provide subsequent configuration control.

2.1.2 The Project Manager shall identify Sensitive but Unclassified (SBU), International Traffic in Arms Regulations (ITAR) and Export Administration Regulations (EAR)-sensitive Configuration Items.

2.1.3 The Project Configuration Manager shall consider restrictions when processing documentation.

2.1.3.1 The author of a document shall mark (subject to review by the Project Manager) the document with respect to ITAR and EAR restrictions.

2.1.3.2 The Project Configuration shall maintain documents marked as ITAR or EAR-sensitive in a document system compliant with ITAR and EAR access restrictions.

2.2 Functional Baseline

2.2.1 The Functional Baseline shall be established for any hardware, firmware, and software developed for the Project by the Government or under Project development contracts.

2.2.2 The Functional Baseline shall identify performance requirements in the form of system(s) requirements, specification, and associated interface requirements documents, if required. Functional Baseline is required by the System Requirements Review.

2.3 Allocated Baseline

2.3.1 The Project Manager, Project Chief Engineer and Project Configuration Manager shall develop an Allocated Baseline for the Project.

Note: *The Allocated Baseline describes how a configuration item operates within the next higher system of interest. These characteristics are allocated from higher-level systems, additional constraints and the verification requirements for those characteristics. The Allocated Baseline should be completed by the Critical Design Review.*

2.4 Product Baseline

2.4.1 Project personnel shall establish the Product Baseline prior to the operational portion of the implementation phase.

2.4.2 Requirements, specifications, drawings, parts lists, and documents specified thereon shall define the Product Baseline.

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2.4.3 The Product Baseline shall be maintained from start of production through operation.

2.4.4 The Project Manager shall complete the Product Baseline by the Flight Readiness Review.

2.5 Requirements/Specifications Identification

2.5.1 Requirements Documents

2.5.1.1 A document tree shall be included in the Product Baseline that depicts the interrelationship of the Project-prepared documents and the relationship to applicable higher-level documents.

2.5.1.2 The Project Manager shall ensure that the requirements are written per LMS-CP-5526, "Product Requirements Development and Management Procedure."

2.5.2 Requirements Configuration Management

2.5.2.1 Requirements shall be processed using the standard Requirements process until a baseline is established. This process is defined in LMS-CP-5526, Product Requirements Development and Management Procedure.

2.5.2.2 After the baseline is established, the requirements shall be placed under project configuration management control.

2.5.2.3 Changes shall follow the CR process (see Section 3).

2.6 Drawing Identification

2.6.1 Drawings and associated Engineering Parts Lists with other documentation as appropriate shall be employed to document the detailed design.

2.6.2 Drawings and parts lists shall be formatted and numbered in accordance with LPR 7320.1, Engineering Drawing System, NASA-STD-0005, "NASA Configuration Management Standard," and the following:

2.6.2.1 The Project Configuration Manager shall obtain a list of drawing numbers from the Engineering Drawing Files Office.

2.6.2.2 The Engineer responsible for a Project product design shall provide the Project Configuration Manager with copies of all versions of the drawings for that design.

Note: *Electronic Portable Document Format (PDF) copies are preferred. If the drawings use layering, which does not show up on Portable Document Format files, native format files are preferred.*

2.6.2.3 The Project Configuration Manager shall complete and maintain drawing record cards per LPR 7320.1. A copy of the drawing record card shall be stored in the Project Configuration Manager office.

2.6.2.4 The Project Configuration Manager shall submit the approved drawings and drawing cards to the Engineering Drawing Files office. The drawings will be maintained in an electronic Portable Document Format.

2.7 Document Identification

2.7.1 Templates and Marking

2.7.1.1 All documents created by the Project shall be numbered using a standardized numbering scheme as approved by the individual project.

Example: Project-XXXX, where Project represents the Project acronym and the XXXX represents a sequential numbering scheme for each document generated starting with the number 0001.

2.7.1.2 The document version shall be marked as 0.X during the development and review process. The document version shall be marked as Baseline when the document has been approved. As documents are updated, the revision shall be added on the line in the Title Block under the document number.

Example: Line one: Project-XXXX; Line two, "Rev A, Chg 1". For a subsequent revision, if the changes are editorial in nature, line two would be "Rev A, Chg 2". If there are major changes to the document, line two would be "Rev B".) See the document standard template for the Project.

Note: A major change to a document is defined as any change more substantial than an editorial change to the document.

2.7.1.3 All Project documents shall use a standardized document template created by the Project Configuration Manager.

Note: Sequential numbering of documents based on the document tree or list is not required.

2.7.2 Document Maintenance

2.7.2.1 The Project Configuration Manager shall maintain an electronic copy of each product in the Electronic Data Management System (for example, NX, if that is the Electronic Data Management System used by the Project) as a historical record until the Project is terminated. The Project Manager may request a hardcopy also be retained by the Project Configuration Manager in the Project archive. Hardcopies of signature pages will be maintained in the Project Archive.

2.7.2.2 Archiving of documentation shall be completed at the termination of the Project per LPR 1440.7 and NPD 1440.6.

2.7.3 Document List

2.7.3.1 The document list shall catalog Memorandum of Agreements, plans, project requirements, detailed derived requirements, the Configuration Items, and Interface Control Documents.

2.7.3.2 The Project Configuration Manager shall maintain the document list. The list shall contain at least the document name, number, author, Change Control Board control level, version and release date.

2.7.3.3 Configuration Management items include all Project-related documents such as: Project control documents and plans; papers that have been written; analyses that have been performed (i.e., trade studies); Center Management Council and Senior Management Council presentations; action items; Configuration Management metrics presented at least monthly; deliverables from Contractors; agreements; decisions; meeting notes; schedules; financial information; project rosters; documentation

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templates; Change Control Board membership; Change Control Board minutes; requirements documents; interface control documents; design documents; test documents; version control documents; change requests; and baselines.

Note: *This is not an inclusive list. It is the responsibility of the Project Manager to determine additional documents and information to be placed under Configuration Management.*

2.8 Hardware Identification

2.8.1 An identification number consisting of a part number, serial number, and/or drawing number shall identify all hardware parts and assemblies.

2.8.2 Methods used to identify hardware such as engraving, ink markings, or tags shall be compatible with NASA-STD-0005, NASA Configuration Management Standard.

2.9 Software Identification

Identification of software versions shall be in accordance with NPR 7150.2, NASA Software Engineering Requirements.

2.10 Presentation Identification

2.10.1 Unless otherwise required by the Customer, presentations for major meetings shall be numbered and dated using a standardized numbering scheme. These meetings include the System Requirements Review, Preliminary Design Review, and Critical Design Review.

Example: *Project-meeting name-XXXX, where Project represents the project acronyms, meeting name represents the name of the meeting (SRR, PDR, CDR, etc.), and the XXXX represents a sequential numbering scheme for each meeting starting with the number 0001.*

2.10.2 Project Presentations shall include the following in addition to all customer-specified requirements: the meeting name, name of presentation, date of presentation and presenters' name when beginning creation of a presentation.

2.10.3 The Project presentations not subject to Customer format requirements shall include the following:

2.10.3.1 Presentation number received from the Project Configuration Manager on every page.

2.10.3.2 Date of meeting on every page.

2.10.3.3 Page number on every page.

2.10.3.4 Title of presentation.

2.10.3.5 Presenters name.

2.10.4 The Project Configuration Manager shall maintain electronic copies of each product as a historical record until the Project is closed. Disposition of these records at project completion shall follow LPR 1440.7 and NPD 1440.6.

3 CONFIGURATION CONTROL

Configuration control is the systematic definition, evaluation, coordination, and disposition of each proposed change, deviation, or waiver, and the implementation of each approved change in the Project configuration.

3.1 Configuration Control Database

3.1.1 The Project Configuration Manager shall utilize a database for configuration control.

3.2 Configuration Change Control Process

3.2.1 The Project shall use the process shown in LMS-CP-5510 for configuration change control.

3.3 Change Request Form

3.3.1 A standard Change Request form shall be used for requesting changes. The Langley-standard form is available on the Langley Management System as form LF – 181 “Configuration Change Request (CCR).”

Note: A Change Request Form mandated by the Customer may be used in place of the Langley form.

3.4 Change Requests

3.4.1 Each Change Request shall have a unique identifier that includes the document number.

3.4.2 Any changes that will modify a baselined Configuration Item shall be documented by the Change Request form.

3.4.3 Changes to any of the Configuration Items may be initiated by members of the Project, supporting organizations, or personnel involved with the Project. The Change Request is submitted against baselined Configuration Items. The Change Request may be a new requirement, an enhancement/ modification, or a defect correction.

3.4.4 The Project Manager shall establish the priority of all Change Requests.

3.4.5 The priority of the Change Request shall establish the initial method of processing the change. If the requester has not established a priority, the Project Configuration Manager, in conjunction with other technical engineers, will recommend a priority to the CCB chairperson.

3.4.5.1 Three priority levels shall be used:

- a. Emergency –This priority is used if the proposed change is to correct a safety condition that could result in fatal or serious injury to personnel or in extensive damage to or destruction of NASA equipment. Emergency changes are to be acted upon within 24 hours of receipt.

- b. Urgent – This priority is used to affect a change that, if uncorrected, could cause schedule slippage or cost increases. Urgent changes are to be acted upon within 15 days of receipt.
- c. Routine – This priority is used when the conditions specified above do not exist. Routine changes are to be acted upon within 30 days of receipt.

3.4.5.2 All changes shall be classified as either Class I or Class II.

- a. Class I changes are changes that impact cost, schedule, performance, interface or other Project-defined criteria. Class I changes shall require a full Configuration Management Change Control Board review.

Note: Class I changes may require additional review and approval from the NASA customer or other higher level sponsor prior to adoption by the Project.

- b. Class II changes are those that are administrative in nature, i.e., spelling, clarifying notes, etc. Class II changes may be adopted with minimal review by a Configuration Management Change Control Board.

Note: “Minimal review” here means that the Configuration Management Change Control Board does not have to physically meet to review the proposed changes. The review may be accomplished, for instance, by email.

3.5 Configuration Control Board

3.5.1 Convening a Control Board

Each Project shall hold a Change Control Board when changes to requirements, documents or products are requested.

Note: There may be restrictions on the time between when the request is made and the Change Control Board convenes, depending on the priority of the request.

3.5.2 Responsibilities for Change Control Board Participants

3.5.2.1 Project Manager

3.5.2.1.1 The Project Manager shall ensure Project compliance with the Project Configuration Management Plan.

3.5.2.1.2 The Project Manager shall serve as the Change Control Board Chair.

3.5.2.1.3 Project Manager shall provide sufficient time for high-quality evaluations of change requests.

3.5.2.2 Project Configuration Manager

3.5.2.2.1 The Project Configuration Manager shall schedule Change Control Boards as needed.

3.5.2.2.2 The Project Configuration Manager shall distribute an agenda to Change Control Board members prior to the Change Control Board, listing all Change Requests to be covered at the Change Control Board. The goal is to enable the individuals involved to review the material in depth prior to the CCB, and thus to have an opportunity to work issues with the Change Request.

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3.5.2.2.3 The Project Configuration Manager shall prepare the change request package to be reviewed for the Change Control Board.

3.5.2.2.4 The Project Configuration Manager shall document Change Control Board decisions in the Change Control Board minutes.

3.5.2.2.5 The Project Configuration Manager shall track the status, disposition of Change Requests and Change Control Board actions.

3.5.2.3 Work Breakdown Structure Leads

All Work Breakdown Structure Leads affected by the proposed changes shall be represented on the Change Control Board.

3.5.2.4 Change Request Author

3.5.2.4.1 The Change Request author shall provide an electronic copy of the Change Request to the Project Configuration Manager prior to the Change Control Board.

3.5.2.4.2 The author shall provide the Project Configuration Manager a list of reviewers. The reviewers should not be part of the board membership.

Note: *The intent here is that the of the proposed change are independent of the Project. The list of reviewers should be approved by the Change Control Board.*

3.5.1.1 Safety and Mission Assurance

3.5.2.5.1 The Safety and Mission Assurance Office shall provide membership on the Change Control Board.

3.5.2.5.2 The Safety and Mission Assurance Office representative shall provide review of all changes, especially those with respect to safety-critical changes and mission assurance.

3.6 VARIANCES

Waivers, deviations, adaptations and exceptions are requests to vary from baseline requirements either before or after the products are manufactured.

Note: *Variations approved by the Change Control Board may require subsequent approval from a higher authority than the Project Manager. Any change that modifies the performance, cost, schedule or safety of the product may require customer, program or Center approval. It is incumbent on the Project Manager to assure that these higher approvals are obtained prior to implementation of such a change.*

3.6.1 These variances shall follow the same procedures previously identified for a change to a baselined item.

3.6.2 All approved changes shall be documented in either a contract modification or an approval letter from the CCB and shall be processed through the Project change process.

4 CONFIGURATION STATUS ACCOUNTING

4.1 Records System

4.1.1 A records system shall be maintained that assures the systematic recording of information required for the complete identification of the configuration.

4.1.2 The Configuration Status Accounting System shall be implemented by the Configuration Management Lead and Project Configuration Manager.

4.2 Record System Requirements

The Record System shall provide for recording and reporting:

4.2.1 The current approved configuration documentation and identification number associated with each Configuration Item.

4.2.2 The status of proposed changes from initiation to final approval/contractual implementation.

4.2.3 The results of configuration audits to include the status and final disposition of identified discrepancies.

4.2.4 The status of all critical and major requests for variances that affect the configuration of a Configuration Item.

4.2.5 The implementation status of authorized changes.

4.2.6 The traceability of all changes from the original baselined configuration documentation.

4.3 Traceability

The Project Configuration Manager shall report the status of configuration changes to all Configuration Items.

4.4 Reports

4.4.1 The Project Configuration Manager shall create additional reports as requested by the Project Manager for the purposes of project control.

4.4.2 The Project Configuration Manager shall submit configuration management reports to the Project Manager.

5 CONFIGURATION VERIFICATION AND VALIDATION

Configuration verification assures that requirements and design have been correctly translated into the hardware and/or software. Configuration verification occurs in multiple ways. Periodic verification is performed during design reviews when the progressive Project baseline is established. The Project Manager and Project Chief Engineer verify requirements by utilizing the verification compliance process. The following on-going practices in the Configuration Management, quality, and manufacturing systems provide the traceability that helps to ensure that the configuration will be verifiable:

- a. Configuration documentation release
- b. Configuration accounting of changes
- c. Manufacturing against released documentation

5.1 Inspection against Released Documentation

The Project Configuration Management Plan shall describe the system for verifying and validating hardware and software/firmware and show that the configuration identification documentation and deliverable Configuration Items/Computer Software Configuration Items are in compliance with the contractual baseline.

5.2 Verification and Validation Methods

The Project Manager shall determine Verification and Validation methods for the following:

5.2.1 Demonstrating that the required qualification verification was accomplished and that it showed compliance of the "as-verified" and "as-validated" (software/firmware) design with the original performance and configuration design requirements and approved changes.

5.2.2 Demonstrating that the required acceptance verification/validation was accomplished and that it showed compliance of the performance and configuration of the article being delivered with the "as-qualified" design.

6 CONFIGURATION AUDITS

6.1 Configuration Reviews

The Project Configuration Manager shall support configuration reviews conducted by the Project in accordance with LPR 7120.7, Space Flight Independent Life Cycle Review Procedural Requirements.

6.2 Configuration Inspections

The Project Configuration Manager shall conduct configuration inspection using the processes defined in the Configuration Management Plan.

6.3 Configuration Audits

Project Configuration Audits are a joint activity potentially involving all of the Project staff. Periodic audits are performed to assure that the Product actually being provided matches the deliverable's baseline.

6.3.1 General

6.3.1.1 The Functional and Physical Configuration Audits described below shall be utilized to verify the functional and physical configuration prior to acceptance or shipment.

6.3.1.2 The Project Configuration Manager shall audit the Project Functional Configuration, Physical Configuration Audits to assure that the project processes are being followed.

6.3.2 Functional Configuration Audit

6.3.2.1 The Functional Configuration Audit shall be conducted to verify that the product meets the functional requirements. The Functional Configuration Audit may be included as part of the Systems Acceptance Review.

6.3.2.2 Evidence presented at a presentation conducted by engineering, test, and quality assurance shall prove that the products meet the specified requirements. For items that require qualification, qualification test results are reviewed during this audit.

6.3.2.3 Each Configuration Item shall be included in the Functional Configuration Audit.

6.3.2.4 The Functional Configuration Audit shall be conducted. This audit may be conducted at the manufacturing or coding site.

6.3.2.5 The Project Configuration Manager shall include as part of the project record the proof of verification utilizing documentation. Proof of verification forms may be found in NASA-STD-0005, NASA Configuration Management Standard, Appendix E.

6.3.3 Physical Configuration Audit

6.3.3.1 **Project personnel shall conduct** Physical Configuration Audits to verify that the product was built in accordance with the design documentation. The Physical Configuration Audit may be included as part of the Systems Acceptance Review.

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6.3.3.2 The Physical Configuration Audit for a Configuration Item shall not be started unless the Functional Configuration Audit for the Configuration Item has already been accomplished or is being accomplished concurrent with the Physical Configuration Audit.

6.3.3.3 The Physical Configuration Audit shall include a detailed audit of engineering drawings, specifications, and technical data, tests utilized in production of Configuration Items, and design documentation, listings, and operation and support documents for Computer Software Configuration Items.

6.3.3.4 The Physical Configuration Audit shall include an audit of the released engineering documentation and quality control records to verify the product was completed as-built or as-coded.

6.3.3.5 Each Configuration Item shall be included in the Physical Configuration Audit.

6.3.3.6 The Physical Configuration Audit should be conducted at the manufacturing or coding site.

6.3.3.7 The Project Configuration Manager shall include as part of the project record the proof of verification utilizing documentation that meets the intent of the forms found in NASA-STD-0005, NASA Configuration Management Standard, Appendix E.

6.3.4 Configuration Management Audits

6.3.4.1 The Configuration Management Lead shall initiate and conduct Configuration Management audits of in-house Configuration Management activities and records as necessary to verify the Configuration Management procedures and the implementation of the requirements of this plan.

6.3.4.2 The Project Configuration Manager shall initiate Configuration Management audits of contractor Configuration Management activities and records as necessary to verify the Configuration Management procedures and the implementation of the requirements of this plan.

Appendix A – Acronyms and Definitions

Acronyms

| | |
|------|---|
| CCB | Change Control Board |
| CCR | Configuration Change Request |
| CDR | Critical Design Review |
| CI | Configuration Item |
| CM | Configuration Management |
| CML | Configuration Management Lead |
| CMR | Critical Milestone Review |
| CR | Change Request |
| CSA | Configuration Status Accounting |
| EAR | Export Administration Regulations |
| ESOD | Exploration and Space Operations Directorate |
| FPD | Flight Projects Directorate |
| IT | Information Technology |
| ITAR | International Traffic in Arms Regulations |
| LAPD | Langley Policy Document |
| LaRC | Langley Research Center |
| LF | Langley Form |
| LMS | Langley Management System |
| LPR | Langley Procedural Requirement |
| NASA | National Aeronautics and Space Administration |
| NPR | NASA Procedural Requirements |
| PCM | Project Configuration Manager |
| PDF | Portable Document Format |
| PDR | Preliminary Design Review |
| PMI | Project Management Institute |
| SBU | Sensitive But Unclassified |
| SRR | Systems Requirement Review |

Definitions

Definitions of common words may be found in Webster's Third New International Dictionary (unabridged). The following definitions are thought to be particular to CM and are set out for the reader to prevent any misunderstanding of the intent and content of this document.

| | |
|--------------------------------|--|
| Category I, II, or III Project | Categorization of a project in NPR 7120.5D Table 2.1 with respect to project priority and Life Cycle Cost, with I being the highest and III being the lowest. These categories determine the rigor of some requirements, the higher the category the higher the rigor. The category of a project is determined very early in the project life cycle. |
| Class I Change | Changes that impact cost, schedule, performance, interface, or other Project defined criteria. |
| Class II Change | Changes that correct documentation errors, add clarifying notes, etc. |
| Change Package | The group of documents (Change Requests (CRs), presentations, etc.) put together by the Configuration Manager to be reviewed at a Configuration Control Board (CCB). |
| Configuration audit | The CM function that reviews processes and products to verify compliance with requirements, and verifies that products have achieved the required attributes and conform to released product definition information. Configuration audits may be divided into separate Functional and Physical Configuration Audits. |
| Configuration Baseline | The technical requirements of a program/project/CI as approved by the responsible CCB at a specific time during the life cycle and recorded in a configuration identification document or set of documents and all approved changes. There are three types of configuration baselines at NASA: Functional Configuration, Allocated Configuration, and Product Configuration. |
| Configuration Control | An element of CM consisting of the evaluation, coordination, approval or disapproval, and implementation of changes to configuration items after formal establishment of the configuration identification. |
| Configuration Identification | The CM function that (1) establishes a structure for products and product configuration information; (2) selects, defines, documents, and baselines product attributes; and, (3) assigns unique identifiers to each product and product configuration information. |

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| | |
|-----------------------------------|--|
| Configuration Control Board (CCB) | The controlling authority of all baseline changes to the Project requirements. |
| Release Desk | The configuration manager releasing documentation to the electronic library and sending notification to the project team. |
| Status Accounting | The recording and reporting of information needed to manage configuration items effectively. |
| Supplier | An individual, partnership, company, corporation, association or other service having a contract or agreement for the design, development, manufacture, maintenance, modification, or supply of items under the terms of a contract or agreement. A government activity performing any or all of the above is considered a supplier. |
| Validation | Authentication that the requirements for a specific intended use or application have been fulfilled. |
| Verification | Confirmation that a specified requirement has been fulfilled by the product. |

Appendix B - Tailoring

Table A.1 Tailoring for Flight Hardware and Ground Support Projects

This table is taken from NPR 8040.1 (DRAFT) and extended to include Langley guidance. Tailoring is permitted to the extent permitted by NPR 8040.1 (DRAFT) at the time this LPR was issued. The following table is included as a convenience. Prior to tailoring, it is strongly suggested that one consult the current version of the NPR.

| | | Category I and II | Category III |
|-----------------------|---|--|--|
| Phase | CM Function | Reference to NASA-STD-0005 | Tailoring Instructions |
| Planning | (Supplier) Prepare Configuration Management Plan | Appendix B | LPR 7120.5 Space Flight Project Practices Handbook |
| | (Project) Prepare Configuration Management Plan | Appendix B | LPR 7120.5 Space Flight Project Practices Handbook |
| | Software Configuration Management | NPR 7150.2, IEEE Std 828 | LMS Processes and Procedures |
| Identification | Select Configuration Items and determine interface requirements | Paragraph 4.2 (full implementation required) | LMS Processes and Procedures |
| | Establish baseline | Paragraph 4.2 (full implementation required) | LPR 7120.5 Space Flight Project Practices Handbook |
| | Control baselines: Functional, Allocated, Product | Paragraph 4.2 (full implementation required) | LPR 7120.5 Space Flight Project Practices Handbook |
| | Assign unique identifiers to products, including serial, lot, etc. | Paragraph 4.2 (full implementation required) | LMS Processes and Procedures |
| | Maintain software libraries to produce Version Description Document | Paragraph 4.2 (full implementation required); NPR 7150.2 | LMS Processes and Procedures |
| | Physically mark products | Paragraph 4.2 (full implementation required) | LMS Processes and Procedures |
| | | | |

| | | Category I and II | Category III |
|--|--|--|--|
| Phase | CM Function | Reference to NASA-STD-0005 | Tailoring Instructions |
| Control | Establish evaluation criteria | Paragraph 4.3 (full implementation required) | Paragraph 4.3 (full implementation required) |
| | Document each change request | Paragraph 4.3 (full implementation required) | Paragraph 4.3 (full implementation) |
| | Determine effectiveness and implementation of each change | Paragraph 4.3 (full implementation required) | Paragraph 4.3 (full implementation required) |
| | Develop processes including classes for change and Board disposition authority | Paragraph 4.3 (full implementation required) | Paragraph 4.3 (full implementation required) |
| | Release and implement change | Paragraph 4.3 (full implementation required) | Paragraph 4.3 (full implementation required) |
| | Prescribe method for baseline deviations/waivers/adaptations/exceptions | Paragraph 4.3 (full implementation required) | Paragraph 4.3 (full implementation required) |
| Configuration Status Accounting | Record information as created over life cycle | Paragraph 4.4 (full implementation required) | LMS Processes and Procedures |
| | Report as required (as-designed/as-built/as-tested) work records | Paragraph 4.4 (full implementation required) | Paragraph 4.4 (full implementation required) |
| | Maintain Quality records as required including specific products (documents, change requests, evaluations) | Paragraph 4.4 (full implementation required) | Paragraph 4.4 (full implementation required) |
| | Maintain Release System | Paragraph 4.4 (full implementation required) | Paragraph 4.4 (full implementation required) |
| | Software records | Per NPR 7150.2 | Per NPR 7150.2 |
| Verification and | Periodic CM Process Audits | Paragraph 4.5 (full implementation) | LMS Processes and Procedures |

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| | | Category I and II | Category III |
|------------------------------------|---------------------------|--|-------------------------------|
| Phase | CM Function | Reference to NASA-STD-0005 | Tailoring Instructions |
| <i>Configuration Audits</i> | | required) | |
| | Final delivery audits | Paragraph 4.5 (full implementation required) | LMS Processes and Procedures |
| | Verification requirements | Paragraph 4.5 (full implementation required) | LMS Processes and Procedures |