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George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

FD40

**FLIGHT PROJECTS DIRECTORATE
GROUND SYSTEMS DEPARTMENT**

**CONFIGURATION MANAGEMENT PLAN
FOR THE HUNTSVILLE OPERATIONS
SUPPORT CENTER (HOSC) PROJECT**

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**CONFIGURATION MANAGEMENT PLAN
FOR
HUNTSVILLE OPERATIONS SUPPORT CENTER (HOSC)**

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1.0 SCOPE

This plan provides a documented mechanism for Huntsville Operations Support Center (HOSC) Project compliance with MPD 1280.1, "Marshall Management Manual" and sub-tier procedures relative to configuration management. It addresses the specific requirements of MPD 1280.1, MPG 8040.1, "Configuration Management, MSFC Programs/Projects" and MWI 8040.1, "Configuration Management Plan, MSFC Programs/Projects." Implementation of this plan satisfies the intent of these MSFC Configuration Management (CM) policies and requirements.

The scope of this plan includes all hardware, software, facilities, and interfaces under the authority of the Marshall Space Flight Center, Flight Projects Directorate, Ground Systems Department, HOSC Project. It applies to all phases of the life cycles of HOSC Project products and services.

1.1 PURPOSE

The purpose of this plan is to establish and define the methods for implementing the CM functions of configuration identification, configuration control, configuration accounting, and configuration verification for HOSC Project activities.

1.2 THE HOSC SYSTEM/CONFIGURATION ITEM

The HOSC System is the top-level Configuration Item (CI) consisting of lower-level subsystem and component Hardware Configuration Items (HWCI) and Computer Software Configuration Items (CSCI). The HOSC System provides communication, computation, and display support to MSFC programs/projects. The HOSC System responds to program/project requirements with the appropriate hardware, software, and facility configuration designs. The HOSC System includes these major subsystems: Payload Operations Integration Center (POIC), Payload Planning System (PPS), Telescience Resource Kit (TReK), Shuttle Support System, Chandra Support System and MSFC Telescience Support Center (TSC).

1.3 RELATED DOCUMENTS

CM-related functions (e.g., problem resolution) may be assigned to Level IV coordination groups (CG) or subsystem teams. Such CGs/teams may be composed of combinations of civil service and contractor personnel. The processing involved in the assigned, CM-related functions will be documented in an Organizational Work Instruction (OWI). The OWI will:

- Be subject to HOSC Project Manager approval prior to utilization.
- Designate a civil service person as the control authority.
- Follow the guidance and methods defined herein.
- Be compatible with the procedures defined herein.
- Be identified in the subsystem's Product Implementation Plan (PIP), as defined in HOSC-PLAN-661, Quality Plan for the HOSC."

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Any proposed change in this Level III CM Plan resulting from a proposed Level IV OWI implementation will be subject to HOSC Project Manager approval.

1.4 SCHEDULE

The processes and procedures defined in this Level III plan are established and on-going; important CM activities relate to major subsystem milestones, as defined in the HOSC Project master schedule. Schedules providing guidance on the timeline of important CM activities for Level IV subsystem activities are included in the respective development/sustaining schedules.

The general timeline of CM activities for all HOSC subsystems is provided in Section 4, CM Phasing and Milestones.

1.5 GENERAL

The current versions of the forms referenced herein are available on-line at <http://starbase.msfc.nasa.gov:8000/forms/forms.taf>. These forms are also available through contact with the MSFC Engineering Directorate (ED) Configuration and Data Management Group (CDMG), ED43.

This document is maintained by the Flight Projects and Transportation Team (FP&TT), ED43, and is controlled by HOSC Management Coordination Group (HMCG).

2.0 APPLICABLE DOCUMENTS

OI-ED43-026	Receipt Desk Operations
FPD-OI-FD40.4	Flight Certification for Ground Systems
FPD-OI-FD40.10	HOSC Problem Report
FPD-OI-FD43.2	HOSC Configuration Request
HOSC-MCD-1200	HOSC Operations Configuration Document
HOSC-PLAN-623	HOSC Project Plan
HOSC-PLAN-661	Quality Plan for the HOSC
HOSC-SYS-085	HOSC Development CM Manual
IEEE 12207.1	Standard for Information Technology – Software Life Cycle Processes – Life Cycle Data
MIL-STD-973	Configuration Management
MPD 1280.1	Marshall Management Manual
MPG 1230.1	Center Resources Management Process
MPG 8040.1	Configuration Management, MSFC Programs/Projects
MPG 8060.1	Flight Systems Design/Development Control
MPG 8730.3	Control of Nonconforming Product
MSFC-HDBK-003	HOSC Facility Document
MSFC-HDBK-3173	Project Management and System Engineering Handbook

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MSFC-MNL-1951	Change Processing, Tracking, and Accounting System User's Guide
MSFC-PLAN-904	HOSC Functional Requirements and Implementation Plan
MSFC-PLAN-3046	Data Management Plan for the HOSC
MSFC-RQMT-1440	Generic Requirements for the Enhanced HOSC System
MSFC-RQMT-2436	Enhanced Mission Communication System Requirements
MSFC-RQMT-2467	HOSC ITS Requirements
MSFC-RQMT-2639	ISS Mission Computations Requirements Document
MSFC-SPEC-2123	PDSS Development Specification
MSFC-SPEC-3229	Payload Planning System (PPS) System Specification
MSFC-SPEC-3423	Data Reduction (DR) System Specification
MSFC-STD-555	MSFC Engineering Documentation Standard
MWI 7120.4	Documentation Preparation, Programs/Projects
MWI 8040.1	Configuration Management Plan, MSFC Programs/Projects
MWI 8040.2	Configuration Control, MSFC Programs/Projects
MWI 8040.3	Deviation and Waiver Process, MSFC Programs/Projects
MWI 8040.6	Functional and Physical Configuration Audits, MSFC Program/Projects
MWI 8040.7	Configuration Management Audits/MSFC Programs/Projects
NPR 1441.1	NASA Records Retention Schedules
TREK-040	TReK Configuration Management Plan

3.0 ACRONYMS/ABBREVIATIONS

Acronyms and Abbreviations are listed in Appendix A.

4.0 ORGANIZATION

The Director of the Flight Projects Directorate (FPD) manages the HOSC as a resource for providing communication, computation, and display support for space flight operations conducted by NASA programs/projects. The Ground Systems Department (GSD) of the FPD has overall responsibility for the HOSC System including the CM responsibility. Requirements and system definition are controlled through a multilevel Configuration Control Board (CCB) system. The GSD's governing Level III CCB is the HOSC Management Coordination Group (HMCG). Level IV coordination groups are authorized to provide CM functions at Level IV. These groups are integrated within the organization in accordance with responsibility for subsystem management. Co-located CM support is provided from the Engineering Directorate Configuration and Data Management Group (ED43), their Configuration and Data Management (C&DM) Mission Services contractor and HOSC support contractors. The organizational relationships are illustrated in Figure 4-1.

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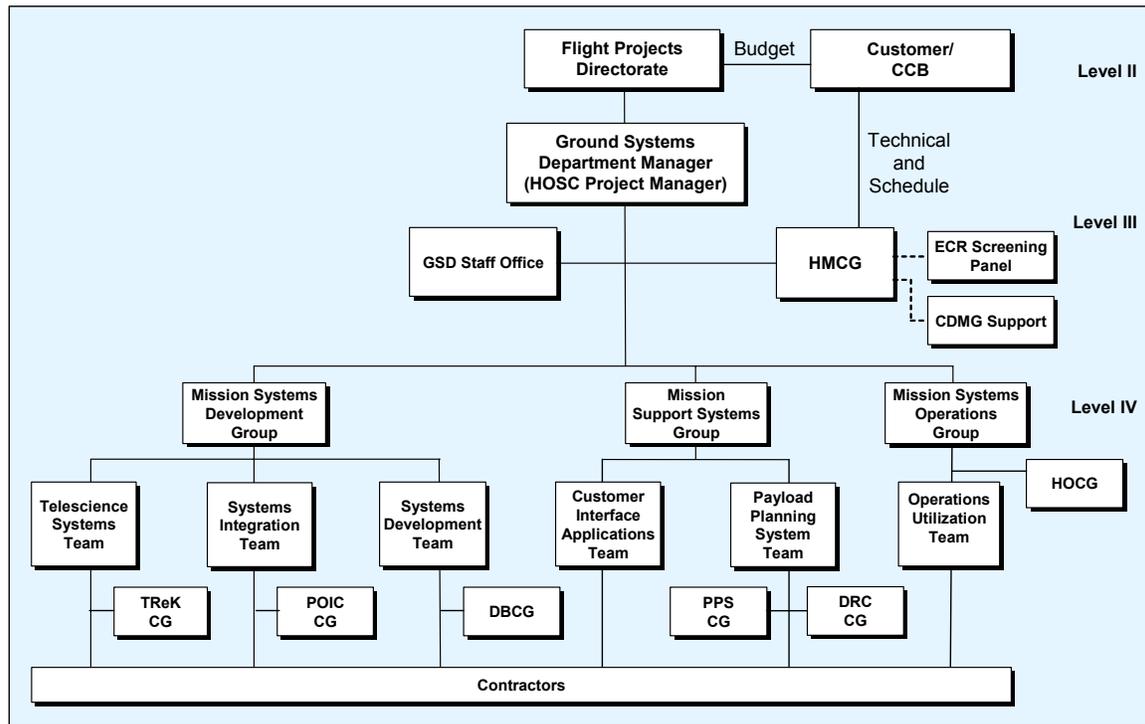


Figure 4-1. CM Organization Structure

4.1 MSFC FLIGHT PROJECTS DIRECTORATE

The MSFC FPD Director is responsible for authorizing the GSD to provide support functions for programs and projects. GSD support for non-MSFC programs/projects is requested via Technical Task Agreements (TTA). GSD support for MSFC programs/projects is requested via Collaborative Work Commitment (CWC), as defined in MPG 1230.1, "Center Resources Management Process." The FPD Director authorizes the GSD to provide the requested support through issuance of CWCs. There is generally one CWC issued per HOSC subsystem. These CWCs constitute the GSD's Authority To Proceed (ATP) with the generation of detail functional requirements and a design configuration following established MSFC and GSD procedures and policies, as defined in the HOSC Quality Plan.

4.2 MSFC GSD MANAGER AND STAFF

The GSD Manager and the GSD staff are responsible for planning, directing, and controlling the allocation and utilization of all resources authorized for the execution of the HOSC System. As a part of this overall and day-to-day responsibility, the GSD Manager or a member of the GSD staff is the Configuration Manager and is responsible for CM of the HOSC System in accordance with this CM Plan. The GSD Manager or a member of the GSD staff will be the Chairperson for the Level III HMCG, which is an MSFC chartered Level III Configuration Control Board (CCB).

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4.3 CUSTOMER CONFIGURATION CONTROL BOARDS

The flowdown of budget authorization and requirements from the various HOSC Project customers and their (Level II/III) CCBs is discussed in Section 4 of HOSC-PLAN-623, "HOSC Project Plan." Budget authorization flows through the FPD and Ground Systems Department Manager, while technical and schedule requirements flow through the HMCG.

Customer representatives support HOSC CM activities as follows:

- Identify and document requirements.
- Provide membership on CCBs.
- Prepare and/or evaluate change packages.
- Act as Change Package Engineer for a change package when designated.
- Implement Control Board Directive (CBD) and provide closeout documentation.
- Provide support to reviews.

4.4 HMCG LEVEL III CCB

The HMCG controls the functional, performance, and system level requirements of all HOSC Project activities. The GSD Manager delegates detail CM functions to Level IV coordination groups for the POIC, PPS, TReK, Shuttle, Chandra, and TSC subsystems, as discussed below.

4.5 ECR SCREENING PANEL

The Engineering Change Request (ECR) Screening Panel (ESP) categorizes change requests for expeditious processing.

4.6 MSFC CONFIGURATION AND DATA MANAGEMENT GROUP

The CDMG (ED43) responsibilities are as follows:

- Author the HOSC CM Plan.
- Monitor the overall operations of CM to ensure an efficient system.
- Provide guidance to personnel engaged in the HOSC CM activity regarding MSFC procedures for baselining and change control, change package preparation, drawing and document release, and drawing and document maintenance.
- Document ESP categorizations of change requests and ESP directions and information.
- Provide a secretariat for Level III HMCG CCB to support the Chairperson in the administration of change package preparation, dissemination and HMCG CCB activities and generation of Control Board Directives (referred to as "CBDs").
- Maintain master change files for each change, HMCG CBD actions and HMCG CBD action close outs.

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- Track change, resulting HMCG CBD actions, and closeout of actions using the automated MSFC Change Processing, Tracking and Accounting System (CPTAS) in accordance with CPTAS User's Guide (MSFC-MNL-1951).
- Generate, maintain and analyze quality records.
- Establish CM requirements for any HOSC contracts and monitor implementation.
- Perform periodic CM audits to verify adequacy of the CM System.

4.7 LEVEL IV COORDINATION GROUPS

Specific subsystems are technically managed through Level IV coordination groups as approved by the GSD Manager. Functional/system and schedule requirements and budget guidelines are flowed down from the GSD Manager. Any specific CM-related procedures used by these groups will be documented in Level IV OWIs, which are subject to the approval of the GSD Manager. The Level IV coordination groups oversee technical reviews at the subsystem level.

The Level IV coordination groups manage the resolution of problems/product defects at the subsystem level in accordance with FPD-OI-FD40.1, "HOSC Problem Report." "Problems/defects" are defined as non-conformances with documented requirements.

4.7.1 TELESCIENCE RESOURCE KIT

Telescience Resource Kit (TReK) software, hardware, procedures and documentation are technically managed by the TReK coordination group, which is chaired by the Telescience Systems Team Lead. Specific CM-related procedures are documented in TReK-040, "TReK Configuration Management Plan."

4.7.2 DATABASE COORDINATION GROUP

The Database Coordination Group (DBCG) facilitates and manages the development, change and use of HOSC operations databases. The DBCG is chaired by the Systems Development Team Lead or his designee. HOSC operations databases are developed and maintained for each project supported. DBCG control is applied after delivery for mission support (e.g., by POIC and TReK). "Mission support" includes support provided for test and validation, simulations, countdown, ascent, on-orbit, landing and post-mission analysis activities.

4.7.3 PAYLOAD PLANNING SYSTEM

Payload Planning System (PPS) software, hardware, procedures and documentation are technically managed by the PPS coordination group, which is chaired by the Payload Planning System Team Lead. Processes are as defined in this Level III CM Plan.

4.7.4 HOSC OPERATIONS COORDINATION GROUP

The HOSC Operations Coordination Group (HOCG) manages the operations and operational configurations of the HOSC facilities. The HOCG is chaired by the Mission Systems Operations Group Lead. Specific CM-related Procedures are documented in FPD-OI-FD43.2, "HOSC Configuration Request."

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4.7.5 DATA REDUCTION CENTER

Data Reduction Center (DRC) software, hardware, facilities, interfaces, procedures and documentation are technically managed by the DRC coordination group, which is chaired by the DRC Team Lead. Processes are as defined in this Level III CM Plan.

4.7.6 CONTRACTOR SUPPORT

HOSC contractors provide these CM support activities:

- Identify and document subsystem requirements and detail design specifications in documents, drawings, and associated lists.
- Prepare and/or evaluate change packages.
- Act as Change Package Engineer (CPE) for a change package when designated by the control board.
- Implement CBDs and provide closeout documentation.
- Provide support to HOSC reviews to include tracking and statusing to closure of all Review Item Discrepancies (RIDs). Also provide a secretary for HOSC reviews, Preboard, and Board meetings to record and distribute minutes.
- Assist in verifying that hardware/software/firmware is fabricated/coded in accordance with the released documentation.

5.0 CM PHASING AND MILESTONES

The overall life cycle process of system/subsystem development, from initial CWC receipt and requirements definition through validation and operations, is illustrated in Figure 5-1.

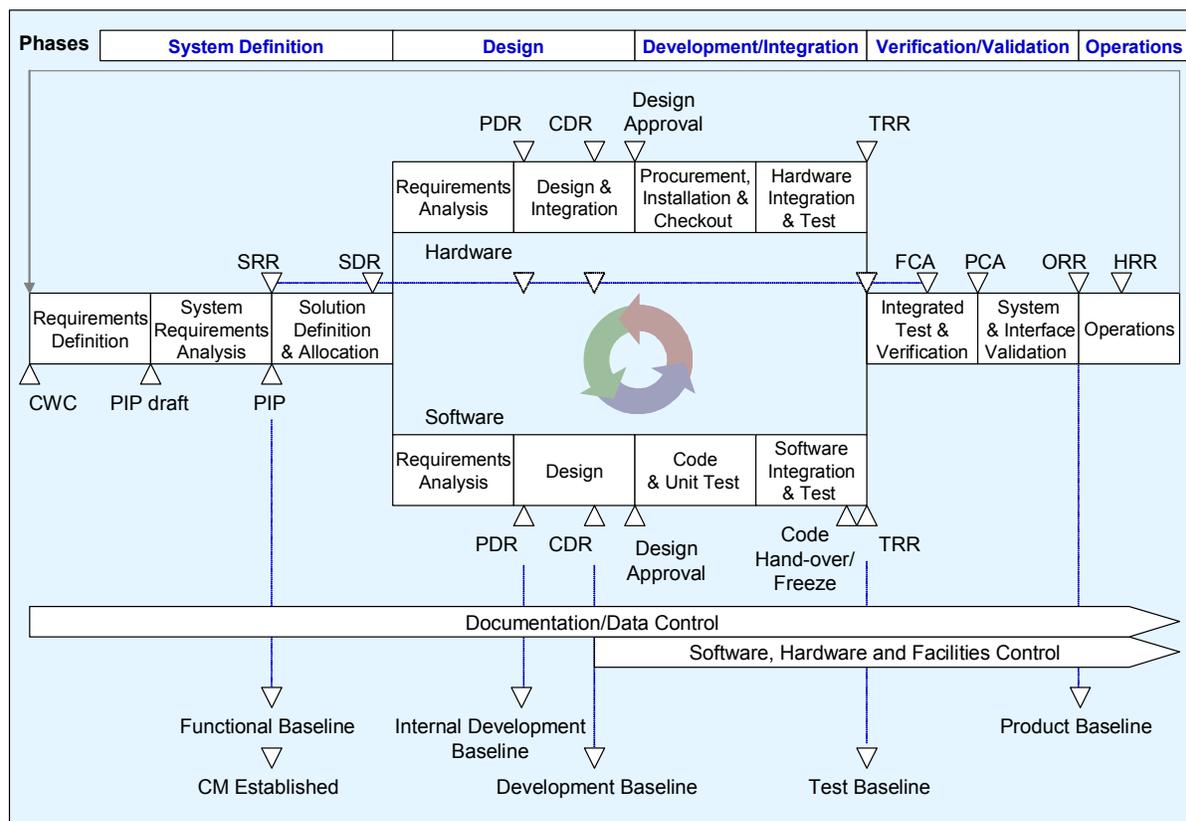


Figure 5-1. System/Subsystem Life Cycle Process

The general flow is from left to right such that the phases are executed sequentially. Iteration of the design, development/integration and test phases is common, as subsystems and components are evolved through successive intermediate releases or builds. This general process will be used for original subsystem realization and for major changes to existing subsystems. Any tailoring of this process will be documented in a Level IV OWI or Product Implementation Plan.

Configuration management, controls and baselines will be established corresponding to major technical reviews. During the operations phase, CM will continue to maintain the product baseline as it is changed due to sustaining engineering and maintenance activities. Lessons learned during the operations phase will be fed back as inputs for subsequent system life cycles. Baseline products per phase align with the reviews and will be as generally defined in MSFC-HDBK-3173, "Project Management and System Engineering Handbook." The following paragraphs briefly describe the activities of each phase.

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5.1 SYSTEM DEFINITION PHASE

The system definition phase includes definition and documentation of customer functional and performance requirements, analysis and validation of these requirements, and derivation of system/subsystem requirements from the customer requirements. This includes allocation of system requirements among the subsystems and major hardware, software and facility elements as illustrated in Figure 5.1-1. For major new subsystems, definition also includes development of a Product Implementation Plan (PIP) and associated procedures, as defined in HOSC-PLAN-661, "Quality Plan for the HOSC." The customer requirements, derived top-level system and subsystem requirements, and implementation planning documents will constitute the Functional Baseline (FBL).

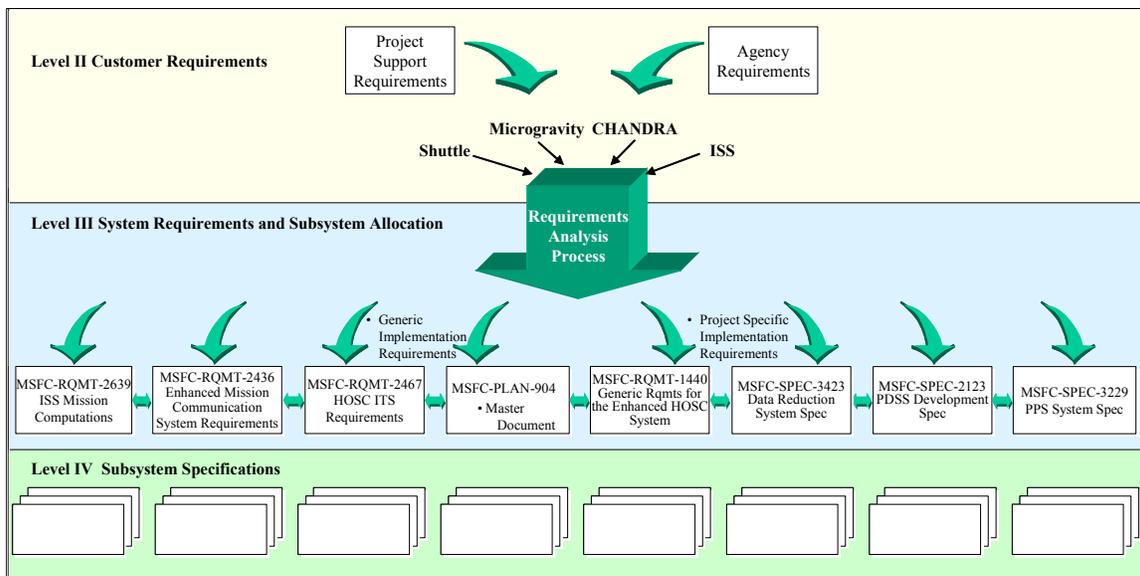


Figure 5.1-1. Requirements/Specifications Hierarchy

Level III document and data control is initiated upon receipt of the CWC. The FBL and any changes to it will be controlled at Level III throughout the life cycle. At the point of validation/baselining of the system/subsystem requirements through the System Requirements Review (SRR), Level IV configuration management of lower level requirements and documents may be authorized by the GSD Manager through approval of the PIP and CM-related Level IV OWI.

A System Definition Review (SDR) may be required for major new subsystems or system changes. The SDR will assess the allocation of requirements among subsystems/elements and the design approach.

5.2 DESIGN PHASE

The design phase includes analysis of allocated software, hardware, interface and facility requirements and definition of design specifications suitable for implementation and integration into finished products that will satisfy the customer requirements. The

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internal development baseline and development baseline will be established through the preliminary and critical design reviews, respectively. These reviews may be combined as appropriate for the specific subsystem, as approved by the GSD Manager.

The Preliminary Design Review (PDR) may be a series of incremental hardware, software and facility PDRs culminating into a system/subsystem-level PDR. PDRs will verify and ensure that the documented design approach for the hardware, software, interfaces, and/or facilities and the top-level design will result in detail designs and planning, which will satisfy the customer requirements. The functional baseline documentation, top-level design, and plans will compose/define the internal development baseline, once approved through the PDR. PDRs will be conducted in accordance with MPG 8060.1, "Flight Systems Design/Development Control."

The Critical Design Review (CDR) may be a series of incremental hardware, software and facility CDRs culminating into a system/subsystem-level CDR. CDRs will verify and ensure that the detailed designs for hardware, software, interfaces, and/or facilities and the associated test/validation plans and integration plans will result in an integrated system/subsystem, which will satisfy the customer requirements. The functional baseline documentation, top-level and detail design specifications, and verification, validation, and implementation plans will compose/define the development baseline, once approved through the CDR. CDRs will be conducted in accordance with MPG 8060.1, "Flight Systems Design/Development Control."

5.3 DEVELOPMENT/INTEGRATION PHASE

The development/integration phase includes actions as are necessary to implement and realize the approved development baseline. Actions include procurement/acquisition of Commercial-off-the-shelf (COTS) hardware and/or software, coding of custom-built software, integration of hardware/software components, unit testing of components, and integration of the system/subsystem. Unit test results will be quality records.



Any changes to the development baseline resulting from late arriving customer requirements or changes in detailed development/integration plans/specifications require CCB approval prior to implementation. Change processing will be accordance with Section 8.2. The change request and approval will be quality records.



The integrated system/subsystem of unit tested hardware, software and facilities, combined with the updated/final development baseline documentation and the test result/change records constitute the test baseline (TBL), as approved through the Test Readiness Review (TRR).

5.4 VERIFICATION/VALIDATION PHASE

As the life cycle process evolves, a GSD "configuration" or "system/subsystem" will be identified/defined by and composed of: customer requirements documents and changes, the derived system/subsystem requirements documents, the design/specification documents, the interface description documents, the integration plan, the documented test plans, and the hardware/software products themselves.

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Verification and validation involves comparison of the results/output of any given life cycle process step with input requirements of that process step. Any discrepancy between the output and input requirements will be documented as described in Section 6.0, Configuration Data Management.

Verification and validation will be performed throughout the life cycle shown in Figure 5-1 in accordance with MPG 8060.1, "Flight Systems Design/Development Control." The GSD will "validate" that the customer requirements have been clearly and completely captured, documented and understood through review with the customer at the SRR. The GSD will "verify" that the customer requirements will be completely satisfied by the allocation of derived system/subsystem requirements to hardware, software and/or facility elements at the SDR. The GSD will verify that the system/subsystem requirements will be satisfied by the hardware, software and/or facility design specifications and plans at the PDR and Critical Design Review (CDR). The GSD verify that unit testing has been completed and that adequate plans for testing the integrated (hardware/software/interface/facility) system/subsystem are in-place at the TRR.

The integrated system/subsystem will be tested by a test team, which is independent from the development teams. This testing will exercise all functions anticipated during operations, as practical. A Functional Configuration Audit (FCA) will be conducted to review the test data and ensure the system/subsystem performs as required by the documented customer requirements and the specifications. A Physical Configuration Audit (PCA) will be conducted to ensure that the system/subsystem documentation accurately represents/depicts the as-built/physical hardware, software, interface and/or facilities configuration. This includes verification that operations manuals, engineering specifications, maintenance procedures, etc. are suitable for use during the operations and maintenance phase. This includes ensuring that all requirements and engineering changes have been correctly translated/incorporated into the hardware, software, and facilities; that hardware, software, and facilities have been properly identified, released and controlled throughout the life cycle; and that the proper data has been maintained and reports generated to verify the configuration. As required, FCAs and PCAs will be conducted in accordance with MWI 8040.6, Functional and Physical Configuration Audits, MSFC Program/Projects. The Group Lead is the release authority.

The customer and/or the HOSC Integrated Support Team will validate the system/subsystem through testing/use during space flight/payload ground simulations and tests. Problems encountered during these activities will be documented using the HOSC Problem Report (HPR) system. Changes requested during this period will be processed as engineering changes requiring formal processing and CCB approval. Validation activities conclude upon successful completion of the Operations Readiness Review (ORR). The ORR constitutes acceptance of the system/subsystem delivery and readiness for system/subsystem use in the operational environment. Successful completion of the ORR establishes the product baseline, which is comprised of all of the documentation described above plus the physical hardware, software, interfaces, and facilities products.

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5.5 OPERATIONS PHASE

The GSD/HOSC system and subsystems provide continual support for space flight/payload operations. System/subsystem use for support of specific customer space flight/payload operations requires Flight Project Directorate certification of GSD/HOSC ground system readiness. In support of this FPD certification, the GSD will conduct a HOSC Readiness Review (HRR) to verify that the hardware, software, facilities and personnel are ready to support specific space flight operations activities. Further, the HRR will identify any required support function, which the HOSC system/subsystems is not capable of supporting. HRR results will be documented in a Certification of Flight Readiness (CoFR) for delivery to the FPD.



6.0 CONFIGURATION DATA MANAGEMENT

“Data” encompasses all of the documents needed for management and execution of the Project. “Configuration Identification” encompasses the subset of data needed to establish and maintain a definitive basis for control and status accounting for HOSC hardware, software, interfaces, and facility configurations. Configuration identification will be maintained under CCB control. Non-configuration identification data will be maintained under GSD Manager control for Level III and under coordination group chairperson control for Level IV. The general hierarchy of data/documentation will be as shown in Figure 6-1.

		Data Management Control	
		Configuration/Release Desk Control	
Level II	MPD 1280.1 and Second Tier Documents Technical Task Agreements		Customer Requirements and Changes
Level III (System)	Project Plan Collaborative Work Commitments HOSC Quality Plan HOSC CM Plan Integrated Master Schedule HOSC Safety Plan HOSC Security Plan HOSC Risk Management Plan HOSC Data Management Plan Organizational Work Instructions Master Level III Document List	<i>For each Level IV subsystem:</i> Product Implementation Plan CM Plan Life Cycle Cost Analysis Contract End Item Specs Validation (ORR, HRR) Results Certifications of Flight Readiness	HOSC Functional Requirements and Implementation Plan HOSC Standards HOSC Interfaces <i>For each Level IV subsystem:</i> Subsystem Functional Requirements External Interface Requirements External Interface Control Documents Subsystem Functional Requirements Change Requests/Directives
Level IV (Subsystem)	Systems Engineering Plan V&V Plan Data Management Plan Trade Studies Technology Assessment Risk Assessment Subsystem Schedule Master Level IV Document List Subsystem-specific OWIs Operations Procedures Maintenance Procedures	Unit Test Results Integration Test Results Verification (FCA, PCA) Results Failure Modes and Effects Analyses Problem Reports/Resolution	Functional Analysis Requirements Allocation Subsystem Specification/Design Component Specifications/Designs Subsystem Requirements Change Requests/Directives Internal Interface Control Documents Integration Plans V&V Procedures Component/Unit Test Procedures Integration Test Procedures Bill of Materials
Level V (Component)	Defined in contract DRDs		Defined in contract DRDs

Figure 6-1. General Documentation/Data Hierarchy

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Data related to customer and system requirements, external interfaces, top-level planning and requirements allocation to subsystems will be maintained under Level III control. Data related to subsystem realization, verification, operations and maintenance will be maintained at Level IV. The configuration identification subset of Level III documentation/data will be prepared, controlled, and released through the MSFC Release Desk in accordance with MSFC-STD-555, "MSFC Engineering Documentation Standard." Level IV/coordination group-controlled documentation/data will be prepared, controlled, and released through Level IV release desks as specified in the respective Level IV OWIs.

Data will be developed, delivered, stored and maintained in electronic form to the fullest extent practical. Level III configuration identification will be maintained on the MSFC Release Desk website/system. The balance of HOSC Project data will reside on GSD websites as defined in the MSFC-PLAN-3046, "Data Management Plan for the HOSC." Use of websites for this function will ensure that the latest versions of documents/data are uniformly available to all users.

Limited rights documentation/data will be protected using the procedures defined in the Data Management Plan.

The handling of changes to documentation/data is dependent on the nature of the data and on the life cycle phase.

- All changes in customer requirements will be transmitted via formal Engineering Change Request (ECR). (Reference Section 9.2) R
- All changes in external interface requirements will be transmitted via formal ECR, Preliminary Interface Revision Notice (PIRN), or Interface Revision Notice (IRN). (Reference Section 8) R
- During the system definition, design and development/integration phases, the development organization evolves the documentation/data (i.e., designs, test plans), as necessary to realize the physical hardware/software configuration. During these phases, the internal development, development and test baselines are established, as described in Section 5. Reviewer comments to the configuration identification documentation/data will be solicited at design reviews and the test review. These reviews will be conducted within established schedules such that the timeframe for receipt/acceptance of comments is known to the reviewers. Reviewer comments/recommendations for changes to Level III/HMCG-controlled configuration identification documentation/data will be documented as required by the Review Plan generated for the designated review. The system selected will be capable of maintaining and archiving the activities that occur for the duration of the subject review. Status reports will be generated and distributed, as required by HOSC management. Reviewer comments to Level IV/CG-controlled documentation/data will follow the same methodology as for Level III. Use of alternate forms or tracking systems will be defined in the Level IV OWI. R
- During the verification and validation and operations phases, nonconformances/"bugs" may be discovered in the hardware, software, interfaces and/or facilities.

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Such problems will be documented in a HOSC Problem Report (HPR). Changes to the configuration identification documentation/data may be required per the disposition of the HPR.

- Non-configuration identification documentation/data changes will be initiated and handled via the continuous improvement process defined in the Quality Plan.

The originators of requests for changes in documentation/data will be kept apprised of the disposition of the request via status accounting, as discussed in Section 9.

Level III configuration identification documentation/data baselines will be approved by the GSD Manager. Initial baseline documents are approved through the change process of Section 9.2. Level IV documentation/data baselines will be accepted by the respective Level IV coordination group and approved by the coordination group Chairperson as defined in the respective Level IV OWI. Approval (or provisional approval) of any baseline/version will be indicated in the document and in the corresponding master list.

In any instance wherein documentation/data are rejected by the HMCG, coordination group or approval authority, the documentation/data will be immediately removed from user access or labeled on the website as rejected. The documentation/data will remain inaccessible/unused pending resolution of the reason for the rejection and subsequent acceptance/approval by the appropriate authorities.

7.0 CONFIGURATION IDENTIFICATION

The purpose of configuration identification is to incrementally establish and maintain a definitive basis for tracking, control and status accounting for the HOSC System and subsystems throughout their life cycles. The configuration identification function provides for the selection and identification of HWCI's and CSCI's; the determination of the types of technical documentation, and the preparation and release methods/requirements required to document the physical, functional and interface characteristics of the system, subsystems and components; and the establishment of successive configuration baselines during the life cycles. Level III documentation will be prepared and identified by serial document numbers as defined in MWI 7120.4, Documentation Preparation, Programs/Projects. Level IV documentation and CI's will be identified by unique names and serialized numbers as defined in the PIP and/or subsystem OWI. Level IV documentation preparation will follow the appropriate guidance of MWI 7120.4

7.1 CI IDENTIFICATION

The top-level CI is the HOSC System, which consists of these subsystems: Payload Operations Integration Center (POIC), Payload Planning System (PPS), Telescience Resource Kit (TReK), Shuttle Support System, Chandra Support System and MSFC Telescience Support Center (TSC). Each of the subsystems contains HWCI's and CSCI's as defined in their respective specifications. The POIC and Shuttle subsystems also include facility elements. The top-level HOSC System functional

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requirements/configurations are defined in MSFC-PLAN-904, "HOSC Functional Requirements and Implementation Plan." Elaboration of Level III requirements and specifications, and their flowdown to Level IV subsystems is provided by the documents of the Level III and IV master lists, as illustrated in Figure 5.1-1 and discussed in the Data Management Plan. Elaboration of requirements and allocation to subsystems and lower level elements will be accomplished in the Solution Definition and Allocation subprocess of the Life Cycle Process.

7.2 FACILITY CONFIGURATION IDENTIFICATION

The partitioning of HOSC space and the allocation of space to the various functions will be documented in MSFC-PLAN-904. The detailed descriptions and identification of HOSC institutional room assignments, allocated hardware locations, and furniture types and layouts will be documented in the MSFC-HDBK-003, "HOSC Facility Document (HFD)." Mission-specific facility configurations will be documented in the respective HOSC-MCD-1200, "HOSC Operations Configuration Document" and supplements.

7.3 HARDWARE CONFIGURATION IDENTIFICATION

Top-level requirements for existing and future HOSC system hardware and related interfaces will be documented in MSFC-PLAN-904. Subsystem hardware requirements will be flowed down from MSFC-PLAN-904 and defined in the documents of the Level III master list and document tree. Detailed hardware (subsystem, component, and interface) configuration identification will be documented in Level IV MSFC or vendor specifications, as defined in the respective subsystem master lists, document trees, and OWIs. (Master list/document tree web locations are defined in the HOSC Data Management Plan.) The generation of this technical documentation and part marking of the hardware will depend on the hardware design responsibility, MSFC or vendor. If the hardware is designed by MSFC, the technical documentation will be prepared, approved, released, and maintained in accordance with MSFC-STD-555, "MSFC Engineering Documentation Standard."

For hardware designed by a contractor or vendor, the technical documentation will be prepared, approved, released, and maintained in accordance with each contractor/vendor's system as defined and approved in the contract. The majority of the HOSC hardware is in the vendor category, since it is COTS hardware. All hardware will be marked with a part number based on its MSFC or vendor drawing. All hardware exceeding a NASA-defined value threshold will also be marked with a NASA Equipment Management System (NEMS) tag which will be utilized as its unique serial number.

7.4 SOFTWARE CONFIGURATION IDENTIFICATION

7.4.1 DEVELOPMENTAL SOFTWARE CONFIGURATION

During the development of software, and prior to the official release of software configurations through the Level IV CGs, a Software Development Library (SDL) and software documentation method of control and storage will be implemented following

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guidance such as from IEEE 12207.1, “Standard for Information Technology – Software Life Cycle Processes – Life Cycle Data.” Subsequent software maintenance will include maintenance/update of the controlled software documentation.

7.4.2 SOFTWARE CONFIGURATION

Top-level requirements for existing and future HOSC software and related software interfaces will be documented in MSFC-PLAN-904. Subsystem software requirements will be flowed down from MSFC-PLAN-904 and defined in the documents of the Level III master list and document tree. Detailed software (subsystem, component, and interface) configuration identification will be documented in Level IV MSFC or vendor specifications, as defined in the respective subsystem master lists, document trees, and OWIs. (Master list/document tree web locations are defined in the HOSC Data Management Plan.) The generation of this technical documentation and physical identification of the software will depend on the software design responsibility, MSFC or contractor/vendor. For software designed by MSFC, the technical documentation will be prepared, approved, released, and maintained in accordance with the guidance selected (e.g., IEEE 12207.1) and the methods of MSFC-STD-555, “MSFC Engineering Documentation Standard.” For software designed by a contractor or COTS vendor, the technical documentation will be prepared, approved, released, and maintained in accordance with each contractor’s/vendor’s system as defined and approved in the contract. All software will be identified by name and version embedded in and displayed by the actual code and on any media (CD-ROM, disk, tape, etc.). A Software Library will be established for the acceptance, management, vaulting and controlled release of CG-approved software media and corresponding documentation that defines/identifies the product configuration.

7.5 BASELINE IDENTIFICATION

Baselines consist of the current approved technical documentation and corresponding physical configuration at a specific time during the system or subsystem life cycle. Baseline documentation indicates a state of design that becomes progressively more detailed and finally represents the actual developed hardware, software, facility, and interfaces. The required documentation for each review/baseline is as generally defined in MSFC-HDBK-3173, “Project Management and System Engineering Handbook.” Specific documentation guidance for software-oriented projects is provided in IEEE 12207.1, “Standard for Information Technology – Software Life Cycle Processes – Life Cycle Data.” A series of technical reviews and audits will establish the successive configuration baselines and subsequent configuration control, as discussed in Section 4. Initial baselined technical documentation, plus approved changes to these baselines, constitutes the current documentation baseline. All lower-level baselined technical documentation will be compatible with the higher-level baselined technical documentation throughout the life cycle.

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7.5.1 FUNCTIONAL BASELINE (FBL) IDENTIFICATION

The FBL will be established after the successful completion of the System Requirements Review (SRR) for hardware, software, facilities, and interfaces. The customer functional/performance requirements documents and interface documents will be approved by the Level III HMCG CCB for subsequent baseline/release through the MSFC Release Desk. These released customer functional/performance requirements documents and interface documents and subsequent approved changes to this technical documentation will define the FBL.

7.5.2 DEVELOPMENT BASELINE (DBL) IDENTIFICATION

Referring to the system/subsystem life cycle of Figure 4-1:

- Customer functional/performance requirements (the FBL) are transformed to subsystem requirements in the solution definition and allocation activity. Subsystem solution derivation results in allocation of functional requirements to hardware, software, facilities and operations personnel. The top-level solution and allocations are reviewed and approved at the System Definition Review (SDR).
- Hardware, software, facility and interface preliminary design activities result in the internal development baseline set of design documents, which is reviewed and approved at the Preliminary Design Review (PDR).
- Preliminary designs are elaborated to define the Development Baseline (DBL) in the design and integration activities. The DBL specifies detailed hardware, software, facility and interface designs as are required to procure and/or code and configure the respective hardware, software and/or facility products. The DBL also includes the detailed plans for verification and validation/testing of the products. The DBL is reviewed and approved at the Critical Design Review (CDR). The DBL is subsequently defined by the detailed specifications/documents and subsequent approved changes to them.

7.5.3 TEST BASELINE (TBL) IDENTIFICATION

The detailed designs are realized through procurement and integration of hardware and COTS software and coding/integration of custom-built software. Each element is unit tested during realization. Unit test results constitute quality records for the configuration. The integrated set of realized/unit tested hardware, software, facilities, interfaces, and associated documentation constitutes the Test Baseline. The Test Baseline is reviewed and approved at the integrated Test Readiness Review (TRR). The Test Baseline is subsequently defined by the hardware, software, detailed specifications and documents, and approved changes to them.



7.5.4 PRODUCT BASELINE (PBL) IDENTIFICATION

The PBL is established after the approval/release of changes to the Test Baseline that resulted from the successful completion of all hardware, software and interface verification and validation testing, HOSC System integration testing, Functional and

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Physical Configuration Audits (FCA and PCA) and the Operational Readiness Review (ORR). The PBL will be defined by the finalized facility, hardware, software, interfaces, specifications, drawings, parts list, software code lists, and associated documents. The PBL is reviewed and approved at the ORR.

8.0 INTERFACE MANAGEMENT

Physical and procedural interfaces will be managed and controlled using the same procedures as are defined herein for software, hardware, and facilities.

8.1 IDENTIFICATION OF INTERFACE REQUIREMENTS

Requirements for HOSC system interfaces with external systems/organizations will be identified/documented in MSFC-PLAN-904. HMCG-controlled elaboration of such requirements will be documented in Level III Interface Requirements Documents (IRD)/Interface Control Documents (ICD) in accordance with MSFC-STD-555. Numbering will be by the MSFC Release Desk/ED43. External IRD/ICDs not controlled by the HMCG will be documented in accordance with (Level II) program/project guidance. Interfaces between HOSC subsystems, controlled by Level IV CGs, will be documented and identified by the procedures specified in the PIP and Level IV OWIs.

8.2 ESTABLISHMENT OF INTERFACE AGREEMENTS

Interface agreements (IRDs/ICDs) between the HOSC and external organizations will be managed and controlled by the Level III HMCG. This will include the original agreement and any subsequent change.

Interface agreements among HOSC organizations/subsystems will be managed and controlled by the Level IV coordination groups. This will include the original agreement and any subsequent change.

The HMCG or CG chairperson will assign Office of Prime Responsibility (OPR) designees for Level III or IV interfaces respectively. The OPR designee will be responsible for the initial preparation of IRDs/ICDs that ensure all interfaces are addressed. The IRD will specify basic performance requirements that must be defined for visibility and control. Upon approval of the interface document baseline by the HMCG/CG, the interface documents will be released and distributed. Following baseline establishment, any changes affecting the IRD/ICD will be subject to HMCG/CG approval. Documentation affecting any interface requires interface control management coordination and action. The establishment of an Interface Control Working Group (ICWG) provides a means for communication among the various interfaces at the project level. The ICWG will address issues and assess impacts of requirements and changes. The ICWG will have a technical representative from each side of the interface. The OPR designee will be the technical representative. The technical representative will coordinate all reviews of any proposed changes to the baseline then submit to the CCB for approval and subsequent release. Proposed Level III changes will be accomplished by the generation of a Preliminary Interface Revision Notice (PIRN), MSFC Forms 4229 and 4229-1. The PIRN records agreement among the



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ICWG representatives. Upon approval of a PIRN, and ECR shall be submitted to the CCB with the Interface Revision Notice (IRN) for disposition.

9.0 CONFIGURATION CONTROL

The purposes of configuration control are:

- To ensure flow-down/traceability from requirements to specifications, and to physical configurations throughout the life cycle, and
- To ensure the stability and reliability of approved hardware, software, facility and interface configurations during the operations phase.

Configuration control is exercised by CBDs and involves the systematic proposal, justification, evaluation, coordination and approval/disapproval of proposed changes to baselined requirements, specifications, and physical configurations. Configuration control also involves the implementation of approved and released changes into:

- The applicable physical configurations
- The associated documentation
- Supporting and interfacing configurations and their associated documentation.

The following subsections define the CCBs that apply configuration control and the process for change management.

9.1 CONFIGURATION CONTROL BOARDS

9.1.1 CCB LEVELS AND AUTHORITY

The CCB levels and authority for the HOSC System are as illustrated in Figure 9.1.1-1.

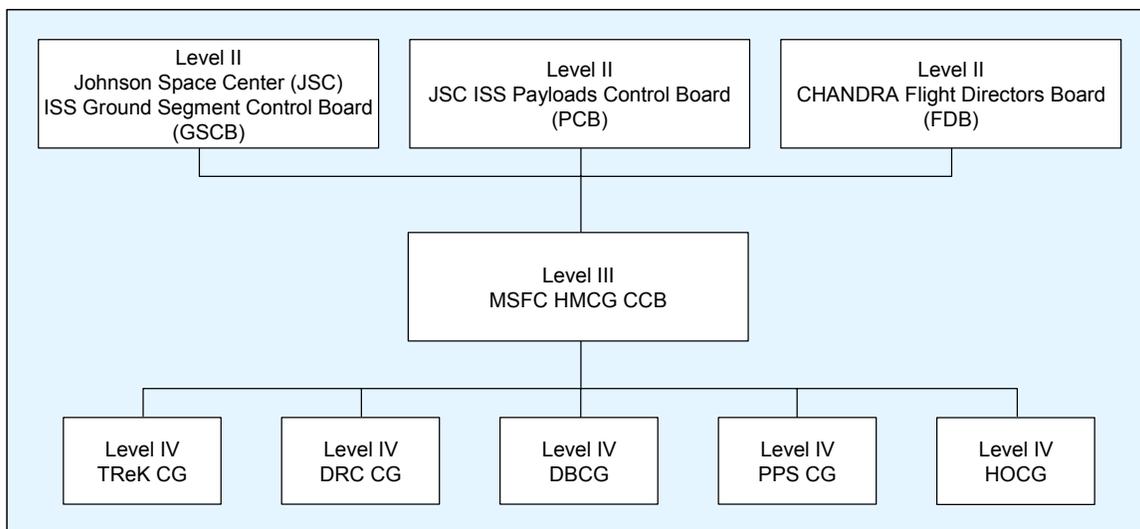


Figure 9.1.1-1. CCBs, CGs, and Their Relationships

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9.1.2 LEVEL II ISS GSCB

The Ground Segment Control Board (GSCB) is responsible for the respective Level II ISS ICDs. A HOSC representative is a member of this CCB and represents the HOSC assessment to the GSCB. GSCB PIRNs that impact the HOSC Project are assessed through the HMCG ECR process, as discussed in Section 7.2. The PIRNs and resulting impacts to Level II (e.g. cost) are signed by the HOSC representative/OPR designee and forwarded to the GSCB for disposition.

9.1.3 LEVEL II ISS PAYLOADS CONTROL BOARD

The ISS Payloads Control Board is responsible for the ISS payload requirements. A HOSC representative is a member of this board and represents the HOSC assessment to it. Payloads Control Board (PCB) PIRNs or Change Requests (CR) that impact the HOSC Project are assessed through the HMCG ECR process, as discussed in Section 8.2. The PIRNs/CRs and resulting impacts to Level II/PCB are signed by the HOSC representative/OPR designee and forwarded to the PCB for disposition.

9.1.4 LEVEL II CHANDRA FLIGHT DIRECTORS BOARD

The Flight Directors Board (FDB) is the controlling authority for its respective Chandra to HOSC ICDs. Although HOSC representatives are not members of this CCB, Level III HMCG evaluations of applicable Chandra ICDs and PIRNs/IRNs are documented and forwarded by the Level III HMCG CCB to the FDB.

9.1.5 LEVEL III HMCG CCB

The HMCG was established and authorized with a CCB charter and membership letter in accordance with MWI 8040.2, "Configuration Control, MSFC Programs/Projects." The HMCG CCB is the controlling authority for all programmatic requirements and the top-level HOSC requirements documents, operations documents, definition documents, configuration documents, implementation documents, plans, standards, Level III HOSC MSFC ICDs and associated configurations. The Level III HMCG CCB is responsible for:

- Identifying and approving the MSFC Level III HOSC configuration baseline definition documents, performance and programmatic requirements.
- Evaluating and dispositioning proposed changes to the authorized MSFC Level III HOSC configuration baseline (reference Section 9.3).
- Evaluating and dispositioning proposed deviations and waivers and exceptions to the authorized MSFC Level III HOSC configuration baseline.
- Classifying and assigning changes according to their impact to Level II, III and/or IV requirements.
- Submitting all Level III changes affecting Level I or II requirements to the Level II CCB along with a recommended disposition.
- Reviewing Level I and II change requests and change proposals, and submitting a consolidated change evaluation to the Level II CCB.

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9.1.5.1 Membership

The Level III HMCG CCB is comprised of a membership which varies with time, depending on the status of a program/project and the spectrum of the affected organization. The membership always includes representatives from all of the authorized HOSC Level IV Coordination Groups (CGs) (e.g. the Group/Team Leads) to ensure coordination of requirements and change impacts between the system and subsystem levels. Typical membership at a point in time would include:

- Chairperson – FPD, Ground Systems Department Manager/FD40
- Alternate Chairperson – FPD, Ground Systems Department Assistant/FD40
- Lead System Engineer – Mission Systems Development Group Lead/FD41
- Secretariat – ED, Configuration and Data Management Group/ED43
- COD, Operations Group Lead/AD32
- COD, Protective Services Department Manager/AD50
- POID, Payload Operations and Integration Department Manager/FD30
- POID, Multi-use Payload Group Lead/FD31
- POID, Payload Operations Directors Group Lead/FD32
- POID, Payload Systems Group Lead/FD33
- POID, Mission Design Group Lead/FD34
- POID, Operations Training Group Lead/FD35
- POID, Operations Development Group Lead/FD36
- GSD, Computer Security Official/FD41
- GSD, Mission Support Systems Group Lead/FD42
- GSD, Mission Support Operations Group Lead/FD43
- Space Shuttle Projects Office representative/MP71
- Chandra X-ray Observatory representative/FD03
- Ames Research Center (ARC) remote representative
- Glenn Research Center (GRC) remote representative
- Johnson Space Center (JSC) remote representative
- Kennedy Space Center (KSC) remote representative.

9.1.5.2 Chairperson Responsibilities

The Level III HMCG CCB Chairperson is responsible for the following:

- Approve CCB agenda.
- Conduct the CCB.
- Make the final decision and disposition each proposed change or evaluation.
- Sign CBDs after review of applicable CCB member concurrence or non-concurrence.
- Approve Level III documents and document changes.
- Review minutes of CCB.

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- Provide management oversight for efficient closure of CBDs and other CCB actions.
- Serve on the HMCG ECR Screening Panel as needed.

9.1.5.3 Lead System Engineer (LSE) Responsibilities

The LSE is responsible for the following:

- Assure the top-level system requirements are met.
- Engineer and integrate the overall system.
- Integrate the subsystems.
- Ensure that the requirements are valid, that they trace from the top level to the component level, and that they are properly assessed.
- Ensure proper verification planning and execution.

9.1.5.4 Secretariat Responsibilities

The Level III HMCG CCB Secretariat is responsible for the following:

- Serve as single point receipt desk of ECRs, Deviation Approval Requests (DARs) and other program/project change requests.
- Document ESP categorizations of change requests and ESP directions and information.
- Assign Program Control Number (PCN) to ECRs and DARs.
- Review change package and list evaluators on HMCG Review Request form.
- Coordinate evaluation with CPE to obtain change evaluations and assure change is ready for CCB consideration/processing.
- Generate CCB agenda based upon inputs from CPEs and Level IV coordination group chairpersons; coordinate with CCB Chairperson; distribute CCB agenda.
- Assign CBD number and generate CBDs.
- Generate CCB minutes; coordinate with CCB Chairperson; distribute CCB minutes.
- Provide and distribute CBDs after approval.
- Receive completed CCB actions closeout paper, i.e., Documentation Package/ Routing Slip (DP/RS), procurement documentation, Implementation Forms, etc.
- Facilitate processing of Level III documentation through the MSFC Release Desk.
- Status and investigate open CBD actions and report to CCB Chairperson.



9.1.5.5 Member Responsibilities

Each Level III HMCG CCB member is responsible for the following:

- Evaluate all changes applicable to the member's area of responsibility.
- Identify all impacts applicable to the member's area of responsibility.
- Attend and participate in CCB meetings.

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- Concur or non-concur with CCB Chairperson disposition of change in the appropriate block on the HMCG Level III CCB Coordination/Concurrence Sheet.

9.1.5.6 CPE Responsibilities

The Change Package Engineer is responsible for the following:

- Coordinate and compile evaluations for assigned change packages.
- Generate integrated change implementation plan and rationalized impacts in terms of technical content, cost, and schedule.
- Coordinate integrated evaluation and implementation plan with applicable organizations.
- Provide change evaluations/actions to implement change to CCB Secretariat for CBD preparation.
- Present change, integrated evaluation, recommendations, draft implementation plan, and draft CBD at CCB meeting.
- Determine and ensure updates to all configuration identification documentation affected by the change.
- Ensure complete implementation, verification, validation, and closure of assigned CBDs.

9.1.5.7 Master List Custodian

The master list custodian creates the master list of Level III documents and updates it whenever a document is added, revised or cancelled by the HMCG.

9.1.5.8 Documentation Custodian

A documentation custodian/GSD Owner is designated for each document listed in the master list of Level III documents. The documentation custodian is responsible for maintaining and ensuring control (vaulting) of the approved baseline versions of the documents listed in the master list of Level III documents.

9.1.5.9 Release Desk

The Level III HMCG CCB Release Desk is the MSFC Release Desk.

9.1.6 ECR SCREENING PANEL

The purpose of the ECR Screening Panel (ESP) is to facilitate the timely and responsive processing of change requests (e.g., ECR, PIRN). The ESP is responsible for:

- Ensuring each change request describes a valid requirement.
- Assessing change requests in terms of technical, cost, and schedule impacts to enable categorization.
- Categorizing change requests to determine how they will be processed.

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- Assigning the Change Package Engineer (CPE).
- Assigning the change/ECR evaluators.
- Scheduling the approval due date or CCB date, if required.

The ESP is chaired by the LSE/Mission Systems Development Group Lead or a named alternate. Membership will include:

- A representative from the Ground Systems Department.
- The HOSC Project Group and Team Leads, as needed for specific change dispositions.
- A representative from FD 30, Payload Operations & Integration Department.
- A representative from the contractor systems engineering organization.
- The HMCG Secretariat.

Change/ECR originators attend ESP meetings, as required. The ESP will convene as necessary to ensure responsive attention to change request processing, nominally once or more weekly.

9.1.7 LEVEL IV COORDINATION GROUPS

The MSFC Level III HMCG CCB authorizes Level IV Coordination Groups (CGs) to manage documentation and configurations related to the specific subsystem as defined in Section 4.7. The CGs are authorized to disposition changes to Level IV documents and to the corresponding hardware, software, facilities and interfaces, as described in Section 9.2.

9.1.7.1 Subsystem CG Responsibilities and Functions

Subsystem PPS, TReK, and DRC coordination group chairperson, secretariat, member, CPE, master list custodian, documentation custodian and release desk/vault responsibilities and functions are the same as those described above for the HMCG – tailored to fit the needs of the particular subsystem and coordination group. These are defined herein or in a project-specific OWI which is subject to the approval of the GSD Manager.

The Level IV coordination group reviews Level II and III change requests and change proposals, and submits a consolidated change evaluation to the Level III HMCG via the Change Package Engineer.

9.1.7.2 DBCG Responsibilities and Functions

The DBCG is responsible to the HMCG for the following functions:

- Coordination of database delivery and implementation schedule for the HMCG and the project.
- Review and disposition of Database Change Requests (DBCRs) which do not have cost or schedule impacts.



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- Coordination of the definition and development of HOSC operations databases with the project and the HOSC database development team.
- Evaluation of operations database problems during the development, operations, and implementation phases to determine the source of the problem and recommend a resolution.
- Provision of recommendations to the HMCG and the project on the resolution of all database problems, which impact cost or schedules.
- Initiation of appropriate changes to the project source database in response to problems identified by HOSC use of the operations databases.

The DBCG includes representatives from these organizations:

- System Development Team (FD41) Representative (chair).
- Flight Operations.
- HOSC Database Development.
- HOSC Integrated Test Team (HITT).

9.1.7.3 HOSC Operations Coordination Group

The HOSC Operations Coordination Group (HOCG) is responsible to the HMCG for the following functions:

- Coordination of detailed operations requirements within the baseline capabilities approved by the HMCG.
- Coordination of the HOSC standard operating procedures.
- Coordination of HOSC operations schedules.
- Review and disposition of HOSC Configuration Requests (HCR).
- Control of HOSC variable operating configurations in support of daily operations.
- Real-Time problem escalation will be worked with the on-duty Project Lead operations personnel, the HOSC manager, and the lead IST member on duty.
- Coordination of HOSC Level IV documentation.

The HOCG is chaired by the Mission Systems Operations Group Lead (FD43) and is open to applicable HOSC contractors and any project users supported by the HOSC.

9.2 CHANGE PROCESSING

Changes to configurations and the associated documents that define the configurations are processed as illustrated in Figure 9.2-1. Changes to documents that do not describe system configurations (e.g., the Quality Plan) are processed via the continuous improvement process defined in the HOSC Quality Plan.

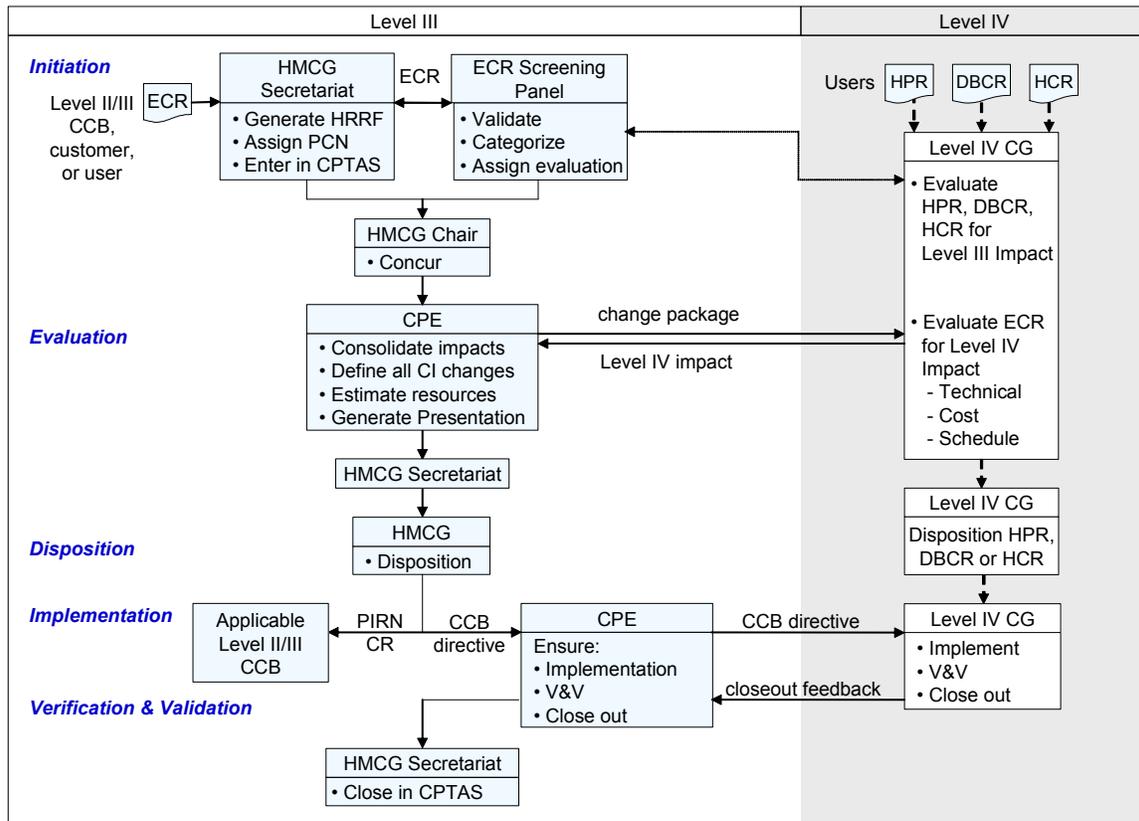


Figure 9.2-1. Configuration Change Processing

Figure 9.2-1 shows the relationships of Level III and Level IV processing.

- Both Level III and Level IV processing shall include the same steps – initiation, evaluation, disposition, implementation, and verification and validation. The forms and tracking systems used for Level III are defined in the following subsections. The forms and tracking systems (e.g., status accounting) used for Level IV will be defined in a Level IV OWI.
- The initiation media (ECR, problem report, etc.), evaluation results, change directive, and V&V results will be treated as quality records for all levels.
- The ECR Screening Panel defines/routes change processing through categorizing change requests.
- Facility changes that do not affect Level III documentation are documented with a HOSC Change Request (HCR) and processed as defined in FPD-OI-FD43.2, HOSC Configuration Request. Problem report processing is defined in FPD-OI-FD40.10, HOSC Problem Report (HPR). Database Change Request processing is defined in Section 9.1.7.2.

MSFC Form 2327, “MSFC Engineering Change Request”, (i.e., ECR) will be used to submit initial HOSC hardware, software, facilities, and interface control documentation



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for baselining and to submit subsequent baseline changes. The ECR form is available on the Informed Forms website at <http://starbase.msfc.nasa.gov:8000/forms/forms.taf>. ECRs will be prepared in accordance with the Informed Forms instructions and will be submitted along with required attachments by any individual to the HMCG Secretariat.

The following sections elaborate the process of Figure 9.2-1.

9.3 CHANGE INITIATION AND EVALUATION

9.3.1 CHANGE INITIATION

ECRs and other program/project change packages (e.g., PIRN) will be presented by the HMCG Secretariat to the ECR Screening Panel (ESP). The ESP will validate the change request and inform the initiator of any invalid request. The ESP members will conduct initial assessment as necessary to characterize the change in terms of technical, cost and schedule impacts. The ESP will categorize ECRs by matching the nature of the ECR-described change with the entries of Table 9.3.1-1.

Table 9.3.1-1. Change Categories

Category I <ul style="list-style-type: none"> • Change in Level II or III requirement and/or configuration documentation • Change outside the scope, budget, or schedule of an existing TTA or CWC • Change requiring Group or Team budget modification • Change in external interfaces • Change requiring evaluation by multiple offices 	Category II <ul style="list-style-type: none"> • Minor software or system change within Group/Team budget/schedule guidelines
	Category III <ul style="list-style-type: none"> • Facility or room layout change • Minor change to Shuttle Project systems/facilities • Change to voice system/circuit allocation
	Category IV <ul style="list-style-type: none"> • Level III documentation-only changes

If the category assignment is unclear after applying the criteria of the table, the ESP will default the ECR to Category I. The HMCG Secretariat will record the ESP actions and change categorizations. This record will include CPE and evaluator assignment and date for change evaluation presentation to the HMCG, if required.

For ESP-validated ECRs, the HMCG Secretariat will:

- Assign a PCN in accordance with OI-ED43-026, Program Control Number Assignment.
- Establish the PCN folder in which all the related documentation will be stored.
- Enter the ECR number and PCN into the Change Processing, Tracking, and Accounting System (CPTAS).

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- Record ESP direction and information on the HMCG Review Request Form (HRRF; FD40-FORM-001).
- Provide copies of the original ECR, HRRF, and any attachments for evaluation processing.
- Retain the original ECR and attachments as quality records.



The HMCG Secretariat will forward ECRs and any attachments to the HMCG Chair for concurrence signature. The HMCG Secretariat will deliver ECRs, attachments, and HRRF (if applicable) to the CPE for evaluation processing.

9.3.2 CHANGE EVALUATION PROCESSING

Upon receipt of the change package, the CPE will assess its adequacy and coordinate any recommendations for change package modifications with the change originator, HMCG Secretariat, ESP Chairperson, and/or HMCG Chairperson, as appropriate. The CPE will coordinate the evaluation of the change with the change evaluators and ensure consensus in the integrated evaluation results.

Change evaluators will perform their evaluations using the Assessment Checklist Criteria of Appendix B as a guide. Evaluators will provide their impacts and comments to the CPE in either electronic (e.g., e-mail) or paper form. Verbal evaluations will not be accepted. The CPE will compile and integrate a Change Presentation Package, as shown in Appendix C, ensuring:

- All relevant requirements of the Assessment Checklist Criteria have been satisfied
- The change solution and implementation are clearly defined in an Implementation Plan meeting the requirements shown in Appendix D
- Updates to the Level II and/or III documentation are provided (Level III documentation which can only be finalized after design (e.g., MSFC-DOC-1949 are identified, not provided)
- Updates to Level IV documentation are identified
- Cost and schedule impacts are defined and rationalized.

The CPE will ensure that all subsystems affected by the change are identified. The CPE will also identify the associated HMCG member/signature authority for the respective affected subsystems. For Category II or III ECRs, the CPE will secure subsystem HMCG member approval of the Change Implementation Plan in coordination with the associated Level IV Coordination Group Chairperson.

The CPE will provide the original of the Change Presentation Package to the HMCG Secretariat for inclusion into the PCN Folder and for updating CPTAS. The CPE will retain a copy of the package and the various evaluator inputs as records.



The HMCG Secretariat will forward Category II and III ECR Change Presentation Packages to the GSD Manager for disposition and approval of the associated CBDs. The HMCG Secretariat will forward approved CBDs and change packages to the CPE for change implementation, as described in Section 9.5.

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9.4 CATEGORY I CHANGE DISPOSITION

The HMCG Secretariat will prepare a CCB agenda in accordance with MWI 8040.2, "Configuration Control, MSFC Programs/Projects" and based on HRRF assignments. The agenda will include identification of HMCG members required for disposition of the ECR set planned for consideration at the meeting. The HMCG Secretariat will coordinate the agenda with affected CPEs to determine readiness for presentation, and with the HMCG Chairperson for concurrence prior to distribution of agenda to HMCG members. Should any CPE not be ready for HMCG presentation on the assigned date, the CPE will negotiate re-scheduling with the ESP Chairperson.

The CPE will present the Change Presentation Package at the HMCG meeting. The HMCG members who are stakeholders in the particular change will discuss the change, as needed, and arrive at a disposition - approved, approved with modifications, or disapproved. The stakeholder HMCG CCB members indicated in Table 9.4-1 will initial the HMCG CCB Coordination/Concurrence Sheet signifying concurrence or non-concurrence with the disposition of change. The funding representative will provide concurrence or non-concurrence signature on the CBD. The HMCG CCB Chairperson will provide final signature on the HMCG CBD for disposition.

Table 9.4-1. Document Type/Signature Matrix

Document Type	Subsystem Engineer	CG Chair	Lead System Engineer	MSFC Operations Dir.	P/L Ops & Integ. Dept.	Customer Reps.	Funding Rep	HMCG Chair
Category I Change to:								
HOSC Functional Requirements	*	*	C	*	*	*	*	A
HOSC Requirements Implementation Planning	*	*	C	*	*	*	*	A
HOSC Standard	*	*	C	*	*	*	*	A
HOSC External Interface (Level II/III)	*	*	C	*	*	*	*	A
Subsystem Functional Requirements	*	*	C	*	*	*	*	A
Data (Plan/OWI)	*	*	*	*	*	*	*	A

A – Approval

C – Concurrence

* – Concurrence as appropriate

The HMCG Secretariat will prepare the minutes of the HMCG CCB meeting in accordance with MWI 8040.2, "Configuration Control, MSFC Programs/Projects." The minutes will include a record of the dispositions of the change requests addressed during the meeting. The minutes will be coordinated with the HMCG Chairperson prior to distribution. If an Interim Control Board Directive (ICBD) is used by the HMCG to approve a partial implementation of a change, the ICBD will authorize the necessary



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work to begin in parallel with the preparation of the final CBD. The format of the ICBP will be identical to the final CBD, but will be clearly titled "Interim." The ICBP will direct the preparation and schedule to board the final CBD to the HMCG CCB. The final CBD, when boarded, will be inclusive of, and supersede the ICBP statements. The final CBD will identify any CBDs that were initiated and completed under authorization of the ICBP. The CDMG will update CPTAS based on the HMCG ICBP/CBD actions.

When an evaluation results in potential impacts to non-HOSC configurations, the HMCG will advise the appropriate organization of the potential impact via notifications such as a PIRN and/or change request.

9.5 CHANGE IMPLEMENTATION

For Category I changes, if the change was modified during the HMCG approval process, the CPE will reflect the modification in the affected Level III documentation and/or the Implementation Plan. Subsequent to any documentation updates, the HMCG Secretariat will provide the signed CBD and the updated Level III documentation to the MSFC Release Desk for official release. A completed DP/RS, stamped by the MSFC Release Desk and depicting the released Level III documentation, will be provided to the CDMG for updating CPTAS. The HMCG Secretariat will provide the HMCG-approved CBD and Implementation Plan to the CPE and the CBD-designated change implementation actionees.

Actionees will act under the coordination of the CPE to implement the hardware, software, facility, documentation, and/or interface change. The CPE will ensure the change is implemented, verified, validated and closed out as authorized in the CBD.

The actionees will update all Level IV documentation affected by the change to accurately and completely reflect the changed configuration.

The hardware, software, facility, and/or interface configuration and associated Level IV documentation will be verified and validated in accordance with the procedures of the implementation plan and the respective subsystem Product Implementation Plan. The results of the V&V activity will be retained as quality records.



The change implementation actionees and V&V team will inform the CPE of completion of their assigned actions under the specific CBD via e-mail message. The CPE will ensure that all actions specified and authorized by the CBD are completed. Subsequently, the CPE will initiate CBD closeout via e-mail message to the HMCG Secretariat. The e-mail message will certify successful completion of the implementation and V&V, and completion of all related documentation updates. CBD closure will only be initiated after all of these actions are completed. The Group Lead is the product release authority.



The HMCG Secretariat will update CPTAS to indicate CBD closure.

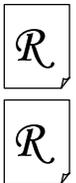
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9.6 DEVIATIONS AND WAIVERS

Any deviation or waiver to MSFC Management System procedures and guidelines will be processed in accordance with MWI 8040.3, "Deviation and Waiver Process, MSFC Programs and Projects."

A system requirements deviation may be proposed by a Level IV project leader during the planning or implementation activities leading up to delivery of a software/hardware item for operations support. Such a deviation typically involves omitting inclusion of one or more customer-required capabilities in a delivery in order to meet the overall delivery schedule. The omissions are typically the result of limited implementation resources and/or schedule. The deviation is documented in the delivery schedule, which reflects that the identified/omitted capabilities will be completed in a subsequent delivery. The schedule change is reviewed and accepted by the respective coordination Group Lead. Deviations that impact Level III requirements or schedules are communicated to the Group Lead and HMCG for coordination with the Level II CCB, as appropriate.

Similarly, a system requirements waiver may be applicable when a software/hardware delivery will not satisfy all of the requirements planned for a particular delivery or support of a specific customer mission. Waiver items are tracked using the process of FPD-OI-FD40.10, "HOSC Problem Report." These items are identified as "exceptions" and reported to the Level III HMCG through the HOSC Readiness Review process. Exceptions are communicated to the Level II CCB through the process of FPD-OI-FD40.4, "Flight Certification for Ground Systems."



The material review board functions of evaluating and dispositioning deviations, exceptions and nonconforming products are provided by the HMCG and Level IV coordination groups in accordance with MPG 8730.3, "Control of Nonconforming Product."

10.0 CONFIGURATION STATUS ACCOUNTING

The purpose of configuration status accounting is to provide traceability and current status of configuration identification documentation and physical configurations, and changes thereto; to provide the current released configuration documentation; and to provide the status of discrepancies from technical reviews.

10.1 LEVEL III CONFIGURATION STATUS ACCOUNTING

Configuration status accounting for Level III CM activity will be accomplished by the CDMG utilizing the CPTAS and the automated MSFC Documentation Release System (DRS). Entry of change status data and the generation of reports will be in accordance with MSFC-MNL-1951, "Change Processing, Tracking, and Accounting System User's Guide." CM status reports will be generated and distributed, as required by HOSC management. Entry of approved/released configuration documentation data, deviations and any waivers, and the generation of reports will be in accordance with the MSFC-Integrated CM System. Reports will be generated and distributed, as required by HOSC management.

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Discrepancies from technical reviews will be documented as required by the Review Plan generated for the designated review. The system selected will be capable of maintaining and archiving the activities that occur for the duration of the subject review.



10.2 LEVEL IV STATUS ACCOUNTING

Status accounting for Level IV CG-managed activities (e.g., HPR tracking) will generally follow the methodology defined above for Level III CM activities. The specific methodology will be documented in a Level IV OWI, which will define the following:

- The method for collecting, recording, processing, and maintaining data necessary to provide the status accounting information via reports and/or data base access.
- Description of reports/information system content related to, as applicable:
 - Status of proposed fixes/changes from initiation to implementation.
 - Traceability of fixes/changes to released documentation through implementation, as appropriate.
 - Effectivity and installation status of fixes/changes to all CI's at all locations.
- Methods of access to information in status accounting systems and/or frequency of reporting and distribution.

11.0 CM SYSTEM AUDIT

The CDMG will conduct audits of HOSC CM activities and records, as necessary, to verify the adequacy of CM procedures and the implementation of the requirements of this plan. CM system audits will be conducted in accordance with MWI 8040.7, "Configuration Management Audits, MSFC Programs/Projects." Any discrepancy from the CM System Audits will be documented on a CM Audit Finding Description/Resolution Form in accordance with MWI 8040.7. Findings/observation reports and a final CM System Audit Report will be generated and distributed, as required by HOSC management.



12.0 CONTRACTOR/VENDOR CONTROL

The purpose of contractor/vendor control is to ensure contractor/vendor compliance with the CM requirements defined in this CM Plan. Control of hardware and software purchased from vendors will be in accordance with MIL-STD-973, "Configuration Management" or as specified in the contract/purchase order. HOSC support contractors will provide support as authorized in their contract and specified in any required contractor CM Plan.

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13.0 RECORDS

The records related to configuration management are as specified in Table 13-1.

Table 13-1. Records

Record	Responsibility	Location	Authority	Retention/Disposition	Maintenance
PCN Files	CDMG	Building 4610	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, or suspension of project, or when 5 years old, whichever is sooner.	Hardcopy/sequentially by PCN number and chronologically with PCN
RID Files	CDMG	Building 4663	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, or suspension of project whichever is sooner.	Electronic
Level III Drawings, Documents	Repository	Building 4481	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, or suspension of project, or when 5 years old, whichever is sooner.	Hardcopy
Level IV Drawings, Documents	CG Custodian	Building 4663	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, or suspension of project whichever is sooner.	Electronic
CCB Agendas/ Minutes	CDMG	Contractor Support PC	NPR 1441.1	Retire to Federal Records Center when 2 years old. Destroy when 30 years old. Earlier destruction is authorized upon receipt of specific authorization from pertinent Center Director or Program Manager.	Hardcopy/chronologically per CCB in notebook - Electronic/PC hard drive (Word)
CCB and ESP Action Files/Logs	CDMG	Contractor Support PC Building 4610	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, or suspension of project, or when 5 years old, whichever is sooner.	Hardcopy/chronologically per CCB/ESP in notebook - Electronic/PC hard drive (Excel)
CM Audit Findings/ Closures	CDMG	Building 4610	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, or suspension of project, or when 5 years old, whichever is sooner.	Hardcopy/sequentially by finding number per review
CM Database Data	CDMG	Contractor Support PC Building 4610	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, or suspension of project, or when 5 years old, whichever is sooner.	Hardcopy/notebook - Electronic/MSFC institutional database (CPTAS) or PC hard drive (Excel)
Test Results	CG	GSD DB Admin Server	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, or suspension of project whichever is sooner.	Electronic
ECRs CCBDs	CDMG	Building 4610/2061	NPR 1441.1	Retire to Federal Records Center when 2 years old. Destroy when 30 years old. Earlier destruction	Hardcopy/8600, Numerical

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Record	Responsibility	Location	Authority	Retention/Disposition	Maintenance
				is authorized upon receipt of specific authorization from pertinent Center Director or Program Manager.	
HPRs	CG	HPR Database	NPR 1441.1	Destroy hardcopy when no longer needed for reference, or upon completion, termination, or suspension of project, whichever is sooner. Retain electronic copies of closed HPRs in an archive database.	Black_star.msfc.nasa.gov by HPR #
PIRN/IRN	CDMG	Building 4610	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, or suspension of project, or when 5 years old, whichever is sooner.	Hardcopy/ chronologically
HRRF	CDMG	Building 4610	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, or suspension of project, or when 5 years old, whichever is sooner.	Hardcopy/ chronologically
CoFR	PM	4663/A179	NPR 1441.1	Handle as permanent pending retention approval.	Hardcopy by increment and flight
DBCR	DBCG	DBCR database	NPR 1441.1	Destroy when no longer needed for reference, or upon completion, termination, cancellation, or suspension of the project whichever is sooner.	Electronic

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APPENDIX A –ACRONYMS

ARC	Ames Research Center
ATP	Authority to Proceed
C&DM	Configuration and Data Management
CBD	Control Board Directive
CCB	Configuration Control Board
CDMG	Configuration and Data Management Group
CDR	Critical Design Review
CG	Coordination Group
CI	Configuration Item
CM	Configuration Management
COD	Center Operations Directorate
CoFR	Certification of Flight Readiness
COTS	Commercial Off the Shelf
CPE	Change Package Engineer
CPTAS	Change Processing, Tracking, & Accounting System
CR	Change Request
CWC	Collaborative Work Commitment
DB	Database
DBCg	Database Coordination Group
DBL	Development Baseline
DM	Data Management
DP/RS	Documentation Package/Routing Slip
DRC	Data Reduction Center
DRS	Documentation Release System
ECR	Engineering Change Request
ED	Engineering Directorate
ESP	ECR Screening Panel
FBL	Functional Baseline
FCA	Functional Configuration Audit
FPD	Flight Projects Directorate
FDB	Flight Directors Board
FP&TT	Flight Projects and Transportation Team

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GRC	Glenn Research Center
GSCB	Ground Segment Control Board
GSD	Ground Systems Department
HCR	HOSC Configuration Request
HFD	HOSC Facility Document
HITT	HOSC Integrated Test Team
HMCG	HOSC Management Coordination Group
HOCG	HOSC Operations Coordination Group
HOSC	Huntsville Operations Support Center
HPR	HOSC Problem Report
HRR	HOSC Readiness Review
HRRF	HMCG Review Request Form
ICBD	Interim Control Board Directive
ICD	Interface Control Document
ICWG	Interface Control Working Group
IRN	Interface Revision Notice
ISS	International Space Station
JSC	Johnson Space Center
KSC	Kennedy Space Center
LSE	Lead System Engineer
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NEMS	NASA Equipment Management System
OPR	Office of Prime Responsibility
ORR	Operations Readiness Review
OWI	Operations Work Instruction
PBL	Product Baseline
PC	Personal Computer
PCA	Physical Configuration Audit
PCB	Payloads Control Board
PCN	Program Control Number
PDR	Preliminary Design Review
PIP	Product Implementation Plan
PIRN	Preliminary Interface Revision Notice
POIC	Payload Operations Integration Center

CHECK THE MASTER LIST - VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

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POID	Payload Operations and Integration Department
PPS	Payload Planning System
RID	Review Item Discrepancy
SDL	Software Development Library
SDR	System Definition Review
SRR	System Requirements Review
TBL	Test Baseline
TReK	Telescience Resource Kit
TRR	Test Readiness Review
TSC	Telescience Support Center
TTA	Technical Task Agreement

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APPENDIX B – EVALUATION CHECKLIST CRITERIA

The purpose of this checklist is to provide evaluators with some factors to consider when evaluating a change.

1. What is the effectivity of change incorporation? Or, which delivery/build will incorporate the change?
2. Are other projects or configuration items affected by the change?
3. How does the change affect unit or system reliability?
4. Can the change be implemented as proposed?
5. Are the hardware, software and/or interfaces involved custom-built or Commercial-Off-the-Shelf (COTS)?
6. What will the change cost and the basis/rationale for the cost estimate?
7. How long will it take to procure/develop and what is the basis/rationale for the schedule estimate?
8. Will the change affect the HOSC manifest? If so, what are the impacts?
9. What drawings, specifications, manuals and procedures, including Level II, III and IV documentation, will have to be changed? What are the specific changes?
10. How is the configuration item's weight, size, balance, stability and power consumption affected by the change?
11. Is the safety/security of the operator or configuration item affected?
12. Does the change affect spare parts?
13. Is the service life of the configuration item affected?
14. Are repair and maintenance made more difficult/costly by the change?
15. Will the mechanical and electrical installation of the configuration item be affected?
16. Will parts procurement present any problems?
17. How does the change affect total system performance?
18. What tests will be required as a result of making this change? What is the schedule and cost impact of testing?
19. Will interchangeability, substitutability, or replaceability be affected?
20. Will suppliers of configuration items be changed?
21. Will changes be required to skills, manning, training, or training devices be affected?
22. Will compatibility with other equipment, trainers, or training devices be affected.
23. Is Automated Data Processing (ADP) security affected in any way?
24. What process/procedures are required to accomplish the change?

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APPENDIX C – CHANGE PRESENTATION PACKAGE

The change presentation package to be presented to the Level III HMCG CCB will contain the following:

1. The ECR or change request
2. HMCG Review Request Form
3. Evaluation Summary
4. Cost and schedule impacts
5. Implementation Plan including schedule
6. Level II and/or III documentation changes (change pages)
7. Draft CBD(s).

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APPENDIX D – IMPLEMENTATION PLAN

The Implementation Plan is intended to supply sufficient details to implement each action of the CBDs involving hardware/software/interface change implementation, installation and test. The Implementation Plan will be written and made available electronically to all interested parties. Minimum contents will include, but not be limited to the following list of items:

1. Brief restatement of ECR requirements
2. Copy of CBD (draft)
3. Enough detail to perform action of the CBD
4. NEMS numbers for all equipment associated with the CBD action
5. Drawings showing placement of all equipment being installed, removed or reconfigured
6. Software design specification of changes to be incorporated in software
7. Specification of interface changes
8. Details for disposition of excess equipment
9. Identification of hardware power consumption requirements
10. Facility change requirements
11. Enough information to perform Integrated Testing
12. Specification of all affected Level III and IV documents
13. Implementation schedule addressing Life Cycle process steps (reference Figure 6-1).

Implementation Plan Checklist

1. Have implementation actions on the CBD been addressed?
2. Are all NEMS numbers listed?

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