ISS-MPLM-PLAN-015
Rev A
EFFECTIVE DATE:07/21/03

PRESSURIZED CARRIERS/MPLM PROJECT

EXPORT ADMINISTRATION
REGULATIONS (EAR) CONTROLLED DATA

Multi Purpose Logistics Module

Sustaining Engineering Plan

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

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Signature Page

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1.0 Purpose

This document defines the MSFC plan for sustaining engineering support for the three MPLM (Multi Purpose Logistics Module) Flight Modules. The basic systems in the MPLM include avionics, thermal, Environment Control Life Support (ECLS), structural and software. These systems are required for both STS and ISS operations. The MPLM is a pressurized carrier for the ISS system, used to carry various types of cargo to and from the on-orbit ISS. The MPLM is launched in the Payload Bay of the Shuttle. After the Shuttle is docked to the ISS, the MPLM is transferred from the payload bay to a Node of the ISS using the Shuttle Remote Manipulator System (SRMS) or the Space Station Remote Manipulator System (SSRMS). While attached to ISS, the MPLM is ingressed for cargo change out. The MPLM receives no power or data during launch or landing. On orbit power and data are available for the MPLM shell heaters, MPLM systems status, and Refrigerator/Freezers.

1.1 Objective

The project objective is to provide assessments necessary to ensue the MPLM is maintained within specifications and is compatible with the ISS and orbiter, and to accomplish the delivery of these assessments to the ISSPO on schedule and within budget.

1.2 Goals

The goals shall be:

a. Budget will be managed by the MPLM Team Lead and will be reported to the ISSPO to keep the project within budget.
b. MPLM team will participate in ISSPO meetings regularly to monitor issues and changes.

1.3 Reference Documents

C 2501	KSC Inventory Management System (KIMS) Master Location & Item Management Report
FD24-CM01	Pressurized Carriers Group Configuration Management Plan
ISS-MPLM-PLAN-003	MSFC MPLM Real Time Operations Plan
JSC 07700 Volume XII	Space Shuttle Systems Description and Design Data Handbook
K-SM-12.0	Integrated Logistics Support Plan
K-SS-09.5.1	MPLM Ground Processing Plan
MPG 8040.1	Configuration Management, MSFC Programs/projects
MPG 1440.2	MSFC Records Management Program
MSFC-HDBK-527	Materials and Processes Technical Information System
MWI 8040.3	Deviations and Waiver Process, MSFC Programs/Projects
NSTS 08171	Operations and Maintenance Requirements and Specifications
QS-R-0006	S&MA Processing of ALERTS & SAFE ALERTS.
SSP 30459	ISS Interface Control Plan
SSP 41174	ISS Interface Control Working Group Operating Procedures
SSP 50123-01	ISSA Configuration Management Handbook
SSP 50200-10	Station Program Implementation Plan, Volume 10, Sustaining Engineering
SSP 50234	Sustaining Engineering Implementation Plan

SPP E-05	Processing Changes to Hardware and Software.
SPP Q-01	Nonconformance/Problem and Corrective Action System (N/PRACA)
MLM-PL-AI-0017	Integrated Logistics Support Plan
MLM-PL-AI-0018	Logistics Support Analysis Plan
MLM-PL-AI-0022	MPLM Supply Support Plan
MLM-PL-AI-0023	Maintenance Plan
MLM-RP-AI-0028	Logistics Support Analysis Report

2.0 Scope

Sustaining Engineering is the capability required to maintain the product hardware and supporting documentation, databases, and engineering expertise throughout the life expectancy of the MPLM program. It is the process through which hardware and software modifications, program paper processing and approval, and Team involvement are coordinated. The MPLM Sustaining Team includes NASA, ASI, ALTEC, and U. S. vendors of Line Replaceable Units (LRUs). Sustaining Engineering includes the following functions:

A. Establish and maintain the MPLM Baseline;
B. Define and control the MPLM configuration (ECL/ABCL);
C. Implement changes across missions and modules;
D. MPLM performance, trend and anomaly analysis;
E. Management of MPLM analytical models;
F. Development of hardware modifications and software oversight;
G. Identify Baseline items impacted by changes;
H. KSC open item status resolution;
I. Cannibalization control;
J. Configuration management of MPLM hardware and supporting documentation.
K. Mission OPS Management

NASA will refine the ASI/ALTEC Sustaining Engineering responsibilities as documented in SPIP (Station Program Implementation Plan) Vol. 10. The functions and products required from the MPLM groups to implement the NASA MPLM Sustaining Engineering Functions include:

Physical Integration Support

- Rapid problem resolution
- Procedures review & approval (SRP, WAD, FEC, MRB, OMI, Testing PR)
- OMRS control for general Module requirements
- Resolve test requirements discrepancies (Acceptable vs. Desired)

Mission Support (Analytical Integration)

- MPLM Structural & Thermal Models
  - Perform library function
  - Integrate US common hardware into models
  - Supply models to mission integrators as required
- Structural analytical integration analysis oversight of ASI/ALTEC
- Thermal analytical integration analysis oversight of ASI/ALTEC
- Flight Safety Panel Support
- Interface with developers to help with ALTEC answers
- Assess proposed changes to Mission Baseline
- MPLM representative for Analytical Integration Reviews (CIR, FOR, FAR)
- Resolution of "As Designed" vs "As Built" discrepancies
- Technical review of mission unique OMRS and MIP inputs
- Integration of Common US hardware
- Real-Time Mission Support

Logistics Support

- Concur on level of spares
- Provide concurrence in appropriate documentation for parts repair
- Provide Engineering review for parts/LRU substitution
- Provide Engineering direction for ground maintenance, repair and retest requirements
- Review and approve all Depot Repair and Acceptance Test documentation
- Present any Acceptance Test changes to the ISSP Vehicle System Integration Panel (VSIP)
- Review and approve all Equivalent Part recommendations
- Participate in Depot Certification activities

2.1 MSFC MPLM/Pressurized Carriers Organization

2.1.1 MPLM Management Team

The MPLM management team is located in the FPD (Flight Project Directorate) at MSFC. The MPLM management team is led by the MPLM/Pressurized Carriers Group Lead, who is responsible for project implementation and technical performance. The Group Lead is supported by several systems engineers and mission support engineers. The lead safety and mission assurance (S&MA) engineer is also an MSFC employee. The FPD is responsible for providing the management, administrative, institutional, and technical support necessary to meet the project commitments as outlined in this plan. The organizational structure for the FPD is depicted in Figure 2.1

FD24 Pressurized Carriers Group
R. McClendon
544-3559

- Sheri Bedwell, MSA 544-1340
- Debbie McWhorter, Records Mgr/ Web POC 544-1752

Mission Engineering Team
Shawn Reagan
544-8635

Bill Seiser	544-0870
David Harwell	544-2473
Charlotte Hazel	544-5451
Mike Morelan	544-5003

Systems Engineering Team
Jon Holladay(acting)
544-7250

Keith Presson	544-7204
Dallas Clark	544-9251
Walt Whitacre	544-0047

Safety	-	Steve Stoyanof	544-2302
	-	Gordon Deramus, III (Hernandez)	544-0624
	-	James Pierce	544-5237
CM	-	Bessie Lee (PWI)	544-7109
ECLSS	-	Cindy Upton	544-5755

MPLM Civil Service Support as Required

Ed Ricks/Structures	544-1505
Holly Chandler/Mass Prop.	544-0496
Kevin Crawford/Avionics	544-3664
John Davis/Matls. & Process	544-2494
Glenn Jamison/Structures	544-7184
Louis Simeone/Software	544-3779
Michelle Butler/Budget	544-4402

Figure 2-1 Pressurized Carriers/MPLM Organization Chart

3.0 Sustaining Engineering Functions

The MSFC (Marshall Space Flight Center) Pressurized Carrier Group Lead/MPLM Element Manager is responsible for the MPLM modules. The MPLM project office is responsible for sustaining engineering oversight of the delivered modules. MSFC, under Internal Task Agreement (ITA) to the Vehicle Office (OB), will lead the day-to-day sustaining activities for the MPLMs. The project provides assessments necessary to ensure the MPLM is maintained within specifications and is compatible with the ISS, orbiter, and GSE and delivers these assessments to the ISS. The MPLM team also interfaces with the Launch Package Manager (LPM) for MPLM flights. The Pressurized Carriers/MPLM Group Lead serves as the prime point of contact for the ISSPO to ASI/ ALTEC, Space Shuttle Program and Kennedy Space Center (KSC) payload integration organizations. Issues that specifically address the MPLM Sustaining Engineering Oversight will be handled by the Pressurized Carriers/MPLM Group Lead.

The following functions are conducted for each flight:

3.1 Program Change Management

Change management for the ISS Program is implemented through the Change Request (CR) form, Change Directive (CD) procedure for Program documents and the Preliminary Interface Revision Notice (PIRN), Interface Revision Notice (IRN) process for Interface Control Documents. Although other nomenclature is used such as Change Notices (CN), Space Station Change Notices (SSCN), Document Change Notices (DCN), and Specification Change Notices (SCN), the process is common for all forms. Program Changes are assigned SSCN numbers, which are maintained through the life of the change. Details of the ISSP Change Process are documented in SSP 50123-01.

3.1.1 ISSP Change Management for the MPLM

MSFC will lead the coordination of all SSCNs to the MPLM segment specification and all PIRNs to the various ICDs with the ISS program and ASI. MSFC will track all relative changes to closure, providing closure visibility to ASI.

3.1.2 MPLM Documentation and Drawings

MSFC will track the program baseline for MPLM documentation controlled by ASI/ALTEC, and ensure that the modifications are coordinated in accordance with the ISSP procedures. ALTEC Documents, not normally produced by ASI/ALTEC, which are required by the ISSP, will be developed by MSFC.

3.1.3 Engineering Configuration List/As Built Configuration List Resolution

MSFC MPLM reviews drawings against the as built hardware for accuracy and correctness for each flight.

3.1.4 MUA/Certification

MSFC MPLM will provide Certification Material Usage Agreement (MUA) of empty MPLM for each flight and will process new MUAs as required per base line changes.

3.2 Model Configuration Control

MSFC will track the program baseline for MPLM models controlled by ASI, and ensure that the modifications are coordinated in accordance with the ISS procedures. MSFC will develop the integrated models and provide them to SSP and ISSP users.

3.2.1 Structural Models/Library

ALTEC, as the development contractor, has responsibility for the MPLM structural model development and maintenance. MSFC integrates the MPLM model with the CBM model and provides the integrated structural model to users for design loads, verification loads and on-orbit loads analyses.

Any changes to the MPLM environment or to U.S. vendor LRUs are provided by MSFC to ASI for updating of the MPLM model as required.

3.2.2 Thermal Models / Library

ALTEC is responsible for building MPLM thermal models to represent the flight hardware. MSFC integrates these MPLM models with CBM, FRGF, and SVS Target thermal models. As the MPLM Sustaining Engineering Office, MSFC will maintain the MPLM thermal model database and provide analytical models to the various groups which perform specialized thermal analyses such as payload integration, thermal interface definitions, mission support analyses, and flight temperature predictions. This centralized MPLM thermal model repository will ensure that the various thermal analysts are using a common set of up-to-date MPLM thermal models.

A model user database will be maintained to track model deliveries. User names, organizations, and contact information are recorded along with model delivery information and delivery dates. This database provides the necessary information to keep the various user groups apprised of model updates. Notices will be sent to all users in the database when a revision is released. The notice describes the changes made for that revision and any special considerations and/or impacts associated with that revision.

3.2.3 Computer Aided Design (CAD) Models

ASI/ALTEC is responsible for providing CAD models to NASA.

3.2.4 Sustaining Engineering Model (SEM)

MSFC will support configuration control activities for the MPLM SEM and Test Support Equipment (TSE) controlled by ASI. MSFC will provide to ASI all the necessary information to ensure that the SEM and TSE are functionally and interface compatible with the ISS program baseline.

3.3 Hardware Modifications

3.3.1 MPLM Hardware

MSFC will oversee the efforts for performing MPLM hardware modifications and assess impacts to the qualification baseline. ASI/ALTEC is responsible for any required modifications to the MPLM, including non-U.S. supplied LRUs.

3.3.2 US Vendor Supplied LRU Hardware

MSFC is responsible for any required modifications to LRUs provided by U. S. vendors. Any required revisions to U.S. vendor documentation are provided by MSFC.

3.4 Software Maintenance

The MPLM MDM uses the common ISS systems software and dedicated user software. ASI/ALTEC has a direct contract with Honeywell for operating system (O/S) software maintenance. MSFC will provide engineering expertise as required to support performance assessments and anomaly resolution relative to USOS Common software in the MPLMs. MSFC will assist the ASCP (Avionics Software Control Panel) in assessing Mission effectivity for approved software modifications.

3.5 MPLM to Orbiter, ISS, and GSE Integration

MSFC provides engineering expertise to support the resolution of Orbiter, ISS, and GSE integration issues with respect to MPLM subsystems.

3.5.1 Structural Assessment

JSC performs three structural loads assessments for each mission: Design Loads Analysis, Verification Loads Analyses, and On-orbit Loads Analyses. MSFC will coordinate the requests for assessment by ASI of loads as defined by Mission Integration for each mission or of special assessment as required. MSFC has developed standard processes to coordinate and oversee the ASI/ALTEC effort. The integrated MPLM Structural Model is available in the MSFC MPLM Analytical Model Library for distribution to users for structural assessments.

3.5.2 Thermal Assessment

As the design agent, ASI/ALTEC is responsible for the MPLM thermal model. MSFC integrates it with the Common Berthing Module (CBM) model provided by Boeing, the ROFU & ROEU models provided by Boeing North American, and the FRGF model provided by the Canadian Space Agency (CSA) and provides these data in the MSFC MPLM Analytical Model Library. For each mission, MSFC will consolidate the inputs and provide the following analyses:

- Pre-Launch
- Ascent

- On-Orbit
- Descent
- Post Landing

Added special analyses may be required for some missions based on specific payload requirements.

3.5.3 Mass Properties Assessments

The weight and center of gravity (cg) of the integrated MPLM must be computed for each mission for loads analyses. Each cargo element unit was assigned a control weight and cg for design purposes. As the units were designed and built, these numbers were updated from predicted to calculated to actual weight and cg and submitted to the MSFC MPLM Analytical Model library. ALTEC provides the basic MPLM Flight Module Model, Boeing provides the CBM model. These parameters are input into the MPLM Analytical Model Library. Each rack owner provides the model for the integrated rack. These data are used by the CEI (Cargo Element Integrator) to compute the Integrated MPLM Dynamic Structural Model and are provided to any organization required to support a loads analysis.

3.6 KSC Integration Support

Processing of the MPLM is performed by two separate teams at KSC. The mission unique integration will be performed by the KSC Mission Processing Teams (MPT) for MPLM flights, and the MPLM generic staging is performed by the Resupply and Return Office, Integrated Products Team (IPT). The generic MPLM staging is performed by KSC based on requirements from the MPLM Sustaining Engineering project. MSFC will provide staffing to represent the ISS Program Office on both the Materials Review Board (MRB) and Materials and Engineering Review Board (MERB) at KSC with respect to MPLM issues. Areas of Sustaining Engineering support to KSC Payload Integration are:

1. Rapid problem resolution;
2. Procedures review and approval
3. OMRS control
4. Test requirements resolution

3.6.1 OMRS and ACOMC Requirements

The purpose of the Operations and Maintenance Requirements and Specifications (OMRS) Document, NSTS 08171 File VIII, Volume III (MPLM), is to maintain the requirements and criteria of the MPLM activities encompassing operations and checkout tasks from which operational procedures are developed to support MPLM hardware processing at KSC. MSFC will lead the effort to define and update OMRS requirements for the generic MPLM in coordination with the ISS program. Tasks required to support OMRSD maintenance are described in paragraph 4.1.2.

The Assembly, Checkout, Operations, Maintenance, and Configuration (ACOMC) Document is the ISSP counterpart to the OMRS. Program wide requirements are entered in the ACOMC, and MSFC concurrence is required for any requirement, which affects the MPLM. Because of the MPLM

multiple flight requirement, previous program familiarity, and the OMRS requirement numbering scheme, MPLM uses the OMRS for all detailed requirements.

3.6.2 Procedures Review and Approval

MSFC reviews and approves changes to Operations and Maintenance Instructions and Standard Repair Procedures (SRPs) developed by the KSC Payload Ground Operations Contractor (PGOC). MSFC will also review and concur in Field Engineering Changes (FECs), Testing Problem Reports (PRs), and Work Authorization Documents (WADs).

3.6.3 MPLM Module Staging

The MPLM is the only pressurized element of the ISS, which is routinely returned to the launch site. To resupply the ISS, the MPLM carries both conditioned and non-conditioned cargo installed in International Standard Payload Racks (ISPR's). Missions that carry only non-conditioned cargo are "passive" missions, while missions that carry conditioned cargo, such as refrigerated food or frozen biomedical samples installed in Refrigerator/Freezers, are "active" missions. Each of these missions requires a different set of resources. Therefore, the Flight Modules must go through the staging process multiple times. When a Module is received at KSC, it will go through a unique "first time" flow that includes post delivery inspections and verification. For subsequent missions it will undergo "reflight" staging processes. These processes, shown in Figure 3.6-1, are detailed in the MPLM Ground Processing Plan, KSC document K-SS-09.5.1.

3.6.4 Logistics

Logistics is the task of managing the flow of materials and products from source to user. This includes from conception, through design, Maintenance Planning and Concept, Supportability Assessments and cost comparisons from acquisition of raw materials to the delivery of the finished products, as well as disposal of the product at end of use. MPLM logistics requirements flow down from the Shuttle Program Integrated Logistics Requirements, JSC 07700 Volume XII and the Integrated Logistics Support Plan, K-SM-12.0.

Sparing and maintenance concepts on the MPLM was gathered using MLM-PL-AI-0017, Integrated Logistics Support Plan, MLM-PL-AI-0018, Logistics Support Analysis Plan, MLM-PL-AI-0023, Maintenance Plan, MLM-PL-AI-0022, MPLM Supply Support Plan and MLM-RP-AI-0028, Logistics Support Analysis Report. These documents were ASI/ALTEC produced and provided to NASA and supporting Boeing sites. Analyses were performed to a depth required to ensure that all logistics resource requirements are defined to support Operations and Maintenance Activities. NASA has assumed responsibility for all the U. S. sourced hardware and ASI/ALTEC has assumed responsibility for all the European sourced hardware. Piece-parts to sustain the MPLM modules will be worked through analysis and sparing decisions made. There are still several issues that must be finalized by the International Partners Office prior to completion of this effort.

The Italian Space Agency (ASI) will retain Sustaining Engineering for the MPLM modules. NASA will work closely with ASI/ALTEC to identify repair modes and sparing quantities required for support.

Contents of the ALTEC documents are described below:

- Maintenance Concept
- Organizational level (black boxes, flex hoses, cables assemblies, etc.)
- Intermediate level (connectors, plugs, circuit cards, etc.)
- Depot level (designated depot repair facility)
- Spare parts selection criteria
- Potential spare parts
- Recommended personnel and special tools, equipment, etc.
- Common bulk items
- Technical data, descriptions, and manuals
- Transportation and storage, cleaning, etc.

Thus the combined NASA/Boeing and ASI/ALTEC efforts establish the maintenance concept which KSC uses to determine the various types of maintenance and criteria required.

The 2nd MPLM Integrated Logistics Support Review identified the LRUs for which both NASA and ASI have responsibility. The piece-part sparing levels were worked through both NASA and ASI/ALTEC to determine the level of sparing required for support of the MPLM. Maintenance Plans were written for the U. S. source LRUs within the MPLM. A Recommended Requirements Matrix (RRM) was built for each LRU and the repair level identified.

MSFC will provide hardware support for the ground maintenance of all MPLM U.S. sourced hardware and is responsible for all U.S. hardware Sustaining Engineering throughout the operating life of the MPLM program.

ASI/ALTEC will provide support for the ground maintenance of all MPLM hardware and is responsible for all non-US hardware throughout the operating life of the MPLM program.

An inventory of spare parts on hand at KSC, including number and unit cost, is contained in the KSC Inventory Management System (KIMS) Master Location and Item Management Report, C2501.

3.6.5 Limited Life Items Lists (LOLI & ALLI)

The Limited Life Items List (LLIL) includes the establishment of a database to track both shelf life and limited operating life items and culminates in the publication of reports that define all the life limited items. These databases (shelf life and operating life) will be maintained throughout the duration of the project and are accessible electronically to enable statusing of the design hardware.

The databases effectively track both limited operating life items (LOLI) and age limited life items (ALLI). The LOLI tracks operating life from an operation perspective as well as a dynamics perspective, such that random vibration life (as it is consumed at each launch and ascent) is tracked to assure flight readiness by monitoring nearing end-of-life components. The Fastener Reuse Policy is incorporated into the LOLI activity. The ALLI tracks the total time since manufacture for individual life limited components. This effort has required considerable coordination between the design center (ALTEC/MSFC) and the launch center (KSC) as serial number unique items are re-flown on subsequent missions. This process provides the visibility needed to assure all components

for a mission are certified for the duration of that mission. The ALLI tracks the useful life, shelf and installed, of components which have a limited life after manufacture to assure that there is useful life remaining to accomplish the next mission. The LLIL and the OMRS LMA and LMC files are the bases of the Life Critical Components Status Report (LCCSR), which is published for each MPLM mission.

3.6.6 IARs and Chits

Information and Action Requests (IARs) and Space Station Request Forms (Chits) are approved methods for requesting action or information on the MPLM Program. The IAR is a document used to expedite communication in a common manner. Requests for shipments, clarification of drawings, measurements, assessments, specific actions, or other requests that do not require direct or immediate Control Board action may be made per an IAR. The processing of IAR documentation shall not interfere with, delay, or otherwise constrain the timely processing and completion of official documentation systems such as Nonconformance/Problem Reporting and Corrective Action System (N/PRACA). The continuation page is used to provide added text to the request and is used by the implementer for the response. The IAR process is defined in KSC Standard Practices & Procedures O-25 while Forms, logs, and the Flow are available at http://osprey.ksc.nasa.gov/iss/iar/default.asp. The IAR process is discussed in section 4.6.2.

Chits serve the same purpose, but at a higher level, requiring Program Manager approval, and are required for functions which have budgetary implications. Chits may be used

1) to request performance of non-standard work by the launch site, i.e., special maintenance, inspections, and/or tests, or
2) by the launch site to request design agency assistance/instructions.

Instructions for using the Chit are contained in Management Directive ISSP-JPD-301. Forms, Mission logs, and a Quick Reference Guide is available on the ISS Chit Homepage at: http://iss-www.jsc.nasa.gov/ss/isapt/chits/. If this URL cannot be found, it may be accessed directly from the Chit homepage at: http://issa-www.jsc.nasa.gov/ss/issapt/cmr/cmr_home_76.html.

3.6.7 Waivers and Deviations

A Waiver is a granted use or acceptance (covering a specific mission or time period) of hardware or software that does not meet requirements. These may be design requirements, specifications, test requirements or flight objectives. A Deviation is a specific authorization, granted before the fact, to depart from a particular elements requirement, specification, or related document. MPLM waivers and deviations are tracked at the LRU level only. Exceptions between ASI/ALTEC and their European subcontractors that do not affect the performance at the LRU level are not tracked in the NASA system.

3.6.8 Nonconformances and Problem Reports

A Nonconformance is a condition of any article, material, or service where one or more characteristics do not conform to specified requirements. This includes failures, discrepancies, defects, and malfunctions. A Problem Reports (PR) is used to document and disposition a nonconformance isolated to a specific flight or system. An Interim Problem Report (IPR) is used to

document nonconformances (abnormal trends, unusual events, or conditions that are not understood) that cannot be isolated to a specific end item of hardware/software without troubleshooting. Once the source of the problem is understood, the IPR must be converted to a PR. The procedure for Problem Reports is detailed in KSC Standard Practices and Procedures (SPP) Q-01.

3.6.9 Acute Launch Emergency Reliability Tips (ALERTs)

An ALERT is a standardized report prepared by a GIDEP participant for the purpose of identification and notification of actual or potential problems on nonconforming parts, components, materials, manufacturing processes, test equipment, construction materials, office equipment, chemicals, or computer software. MPLM will use the MSFC ALERT system which, in addition to GIDEP ALERTs, also includes other ALERT type advisories such as Safe-ALERTs, Agency Action Notice, and NASA Advisories which require response – either applicability or not - to the ALERT Coordinator. Full reports are reported at mission milestone reviews that: (1) have been released, (2) are potentially applicable to a mission, and (3) for which responses have not been received from the applicable actionees or which are known applicable and no acceptable action has been taken. The MSFC ALERT process is described in MSFC Document QS-R-0006, S&MA's Processing of ALERTS & SAFE ALERTS. ALTEC tracks European manufacturers using the ESA equivalent of the GIDEP ALERT system.

In addition to providing ALERT type report applicability to MPLM, the MPLM ALERT coordinator will review all part purchase requests and recommend exclusion of suspect vendors.

3.7 MPLM Management Visibility

Management reviews and reports are essential in keeping all levels of management informed of current status and existing or potential problems. Reviews/reports will occur throughout the duration of the project on a routine basis or as required. It is the MPLM Sustaining Engineering Oversight project responsibility to keep management adequately informed and appraised in a timely manner to allow for problem resolution with minimum impact to project cost and schedule. The following project management reviews/reports are currently supported:

- Monthly Progress/Status Reviews to MSFC management
- Quarterly ISS Program Reviews
- Project Reviews
- Special Reviews (as required)

3.7.1 Activity Tracking

MSFC will provide reports of all MPLM activities and the status of MPLM system including spares to the ISSP. These reports are provide as written reports as required and presented at the ISSP Quarterly Program Reviews as well as reports provided through the Launch Package Managers Integrated Product Team (LPM IPT) and the KSC Mission Products Team (MPT).

3.7.2 Schedules

MSFC will provide Level III schedules for the MPLM Sustaining Engineering activities as well as inputs to Level II ISS and SSP program schedules. These schedules and the supporting Level IV schedules will also provide input to the KSC integration schedules. This, along with the reports above, will provide management visibility adequate to plan and realistically estimate project status and projected task completions.

3.8 Certification of Flight Readiness

MSFC will provide a Certificate of Flight Readiness (CoFR) input to the ISS Vehicle Office for each MPLM mission addressing the MPLM readiness to launch.

3.9 Flight Operations

MSFC provides, on an as needed basis, leadership to resolve MPLM engineering issues identified during the on-orbit mission. This support is required to prepare for future mission changes to the MPLM system or to the user accommodations. On-orbit Sustaining Engineering support can be divided into two categories:

3.9.1 Real-Time Engineering Support

Real-time engineering support is provided by the MSFC/MPLM Representatives at the IMC and MER, the ASI representative in the IMC and MER, the MSFC MPLM team in the Engineering Support Center at the POIC (Payload Operation Integration Center) and the ASI/ALTEC support team at the ALTEC facility in Torino, Italy. The MSFC support is detailed in the MSFC MPLM Real-time Support Plan (ISS-MPLM-PLAN-003). The ASI/ALTEC support at ALTEC is summarized in the NASA/ASI Bilateral Sustaining Engineering Plan (SSP 50200-10, Appendix G).

3.9.2 Off-Line Engineering Support

Off-line engineering support is performed at the Engineering Support Center at MSFC and at the ALTEC facility in Torino, Italy. It includes performance assessment, trend analysis, and anomaly resolution. Types of support supplied are near-real-time thermal assessments based on actual attitudes and environmental conditions, long term trend predictions, and anomaly assessments.

3.10 System Problem Resolution Team

The MPLM SPRT is a multidiscipline forum for leadership, under the guidance of the International Space Station Program (ISSP), of the sustaining engineering of the MPLM hardware. Level 2 authority is delegated from the Vehicle Systems Integration Panel (VSIP) to the MSFC SPRT as defined by SSP 30223, "Problem Reporting and Corrective Action for the Space Station Program", and MGT-OA-018, "ISS System Problem Resolution Team (SPRT) Work Instruction". Problem resolution and corrective action for the parts which are unique to the MPLM shall be the responsibility of the MPLM SPRT.

3.11 Risk Management

MPLM Sustaining Engineering Risk Management is performed by ISSPO. Any risks identified by the MPLM Sustaining Engineering Oversight team, in the MPLM sustaining process in the technical, programmatic, supportability, cost and schedule categories will be identified to the ISS Program Office and will be tracked in the ISSPO Risk Process. The MPLM Sustaining Engineering Oversight team will participate in regularly scheduled meetings to present and status risks, and will support risk management efforts as deemed necessary by the ISSPO.

3.12 Safety

The MPLM Sustaining Engineering Oversight team will review MPLM hazard analyses for MPLM Flight Safety Reviews (FSR), and will participate in the Joint ISS/STS Safety Review Panel (SRP) at JSC. Ground Safety is the responsibility of ASI/ALTEC and KSC. MSFC will produce an MPLM to Orbiter Interface Integrated Hazard Assessment and present it to the PSRP for each flight of the MPLM.

3.13 Performance Assurance

The MPLM Sustaining Engineering Oversight project does not generate any hardware or software and the quality functions is not a part of this task, as defined in the scope of MPD 1280.1, Marshall Management Manual. Furthermore, the oversight of quality for the MPLM sustaining engineering is performed by the ISSPO. However, the MPLM Sustaining Engineering Oversight team is committed to providing quality products, per MPG 7120.1, Program/Project Planning, and the team follows all of the MSFC documentation requirements for the documentation produced as deliverables for this task.

3.14 Environmental Impact

The MPLM Sustaining Engineering Oversight process does not produce any hardware or utilize any manufacturing facilities. There is no environmental impact from this project.

3.15 Technology Assessment

This task does not involve MSFC development of hardware or software, therefore no NASA technology thrusts are applied to this project.

3.16 Commercialization

This task does not provide any opportunities for commercialization.

3.17 Tailoring

Tailoring is a mechanism, defined in NPG 7120.5A, to encourage innovation and achieve "faster, better, cheaper" products while meeting the expectations of the customer. Prior to 'Tailoring' the NHBs defined a more rigid and sequential process of 'phases' A, B, C, D and E.

It must be remembered that this Project was originally authorized under the 'old NHB system' and therefore may be more rigid in structure and may not possess some of the Management innovations authorized by NPG 7120.5A.

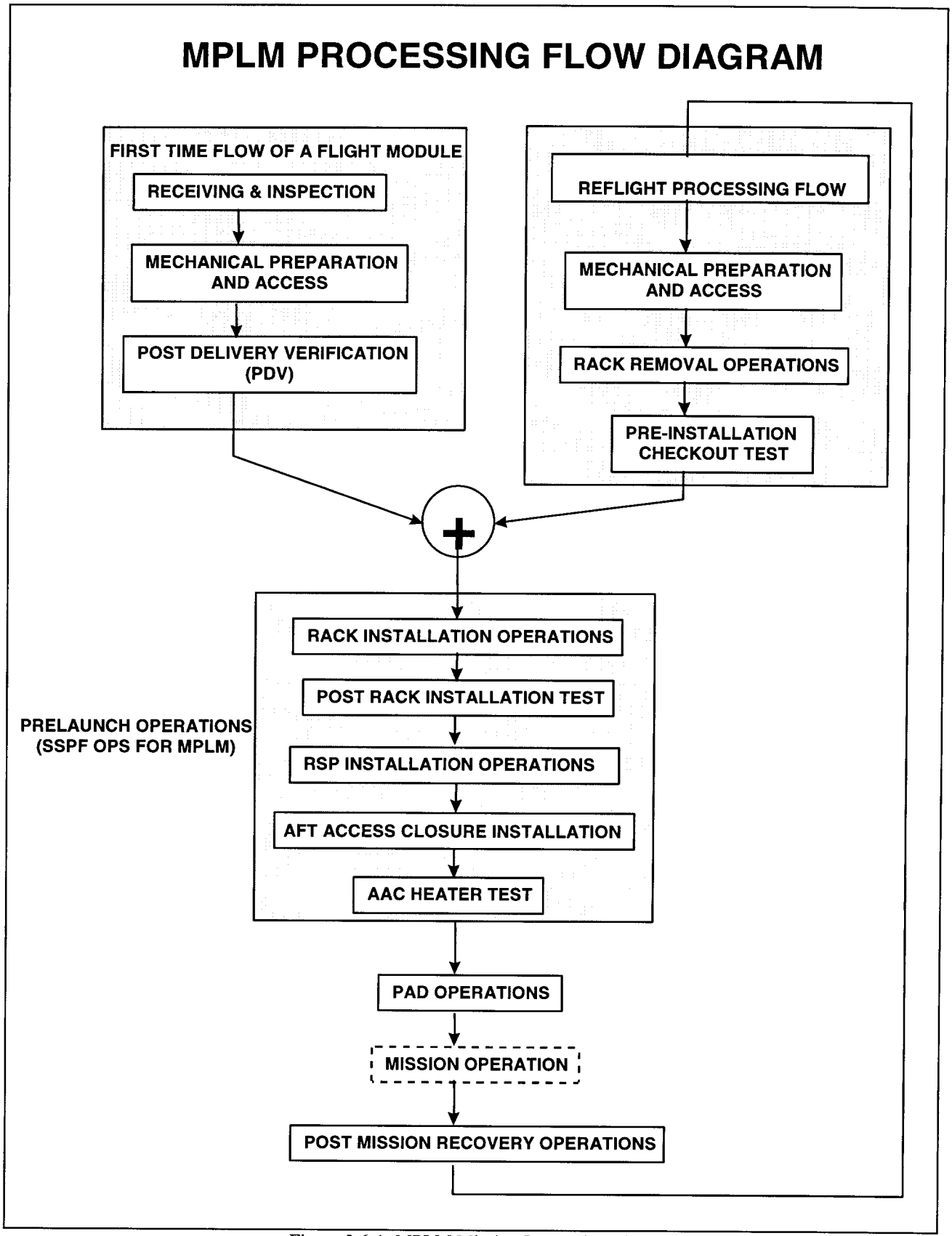


Figure 3.6-1: MPLM Mission Processing Flow

4.0 TASKS

4.1 Documentation Management

4.1.1 Systems Documentation Management

MPLM Systems documentation is supplied in the ASI MPLM Library at KSC , with copies (sometimes reduced in size) of pertinent documents supplied in the MSFC MPLM Library. The ALTEC supplied documents are managed under the ASI/ALTEC configuration management system. MSFC will lead the coordination of all CRs to SSP/ISSP documents related to MPLM and of all PIRNs to the various MPLM ICDs. ASI will assess all CRs to the MPLM Segment Specification and all PIRNs to the various ICDs with the ISSP and will maintain tracking of all changes in the MPLM library at KSC.

4.1.2 OMRS Coordination and Maintenance

The Operations and Maintenance Requirements and Specifications Document (OMRSD) is the primary source of requirements for MPLM operations and checkout tasks at KSC. Across-the-board ISS requirements are contained in the Assembly Checkout Operations Maintenance Configuration (ACOMC) Documentation. Capabilities required to manage the OMRS are:

A. Cognizance with all hardware design, qualification, and interface requirements
B. A technical understanding of MPLM functional performance capabilities
C. Updating of the MPLM Generic OMRS requirements database as applicable for operations at KSC
D. Coordination and tracking of Generic MPLM OMRS updates through the ISS review and approval cycles
E. Maintain the MPLM OMRS inclusive of:
   - Subsystem to system functional testing
   - System integration to mission simulation
   - Time critical stowage, servicing, monitoring, and calibrations
   - Closeout and launch countdown
   - Post-flight operations and maintenance requirements
F. Specific requirements and specifications that are assessed for changes/issues include:
   - Test and checkout requirements, including contingency requirements
   - Specifications, criteria and tolerances
   - Special test conditions/hardware configuration pertinent to a requirement
   - Test sequences
   - Safety considerations (warnings)
   - Hazardous operations (cautions)
   - Scheduled maintenance requirements and specifications
   - General and specific constraints to protect MPLM hardware during storage, transportation, ground processing, and refurbishment
   - OMRS waivers
   - OMRS exceptions
G. MPLM hardware status reports are developed and provided as applicable.

The RCN (Requirements Change Notice is used to introduce new OMRS requirements or revise existing OMRS requirements. The RCN contains, as required, the appropriate file information specified in NSTS 08171 for payload interfaces and MPLM.

IS/WAS change pages shall be submitted as part of an RCN. RCN review is through an electronic file accessing process. Approved RCNs shall be incorporated into the applicable OMRS File. The OMRS RCN process is shown in Figure 4-1.

4.1.3 Program Documentation Change Coordination

Program documentation affecting MPLM is maintained by different methods, depending on the specific document type and program. Changes to most Program documentation is initiated through Change Requests (CR) and implemented through Document Change Notices (DCN) or Revision Change Notices (RCN).

The Preliminary Interface Revision Notice (PIRN) is used to define proposed changes to all baselined ICDs as specified in SSP 30459 and SSP 41174.

Capabilities required to manage the Program Documentation are:

A. Be familiar/cognizant with all hardware design and interface requirements
B. Have a technical understanding of MPLM functional performance capabilities
C. Establish and maintain a tracking system for Change Requests (CR), Preliminary Interface Revision Notices (PIRN)
D. Participate in coordination of all MPLM design changes and all other changes that affect the MPLM
E. Assess changes/issues (CR, PIRN, ECR, SSCN, etc.) relative to the MPLM with regard to intra- and inter- element performance
F. Participate in Technical Interchange Meetings (TIM) as applicable
G. Provide activity reports as required

IS/WAS change pages shall be submitted for approval as PIRNs following technical concurrence by the ICD participants.

Figure 4-2. shows the change flow for processing of PIRNs. Figure 4-3 shows the procedure for the documentation of CRs.

4.1.4 Documentation Repository and Library

4.1.4.1 KSC ASI/ALTEC MPLM Library

The MPLM library at KSC contains all the ALTEC documentation and drawings necessary to stage the MPLM modules. It also contains selected MSFC documentation necessary to link the ALTEC documentation to the ISS documentation. Since this library contains ALTEC proprietary data, access is limited on a need to know basis.

4.1.4.2 MSFC MPLM Library

The MSFC MPLM library contains ALTEC documentation required for the acceptance of each MPLM module, as well as design data necessary to certify the MPLM for flight. Additional MSFC, SSP, ISSP and mission documentation are contained in the library.

4.1.4.3 MSFC Documentation Repository

The MSFC Documentation Repository is the focal point for all documents which require distribution using the MSFC Document Distribution System. MPLM project quality records will be retained by the Pressurized Carriers/MPLM Group Lead in a locked file drawer, per MPG 1440.2, MSFC Records Management Program. A master list of quality records will be stored in the same drawer and may only be updated by the Pressurized Carriers/MPLM Group Lead. All project records shall be retained for three (3) years beyond the end of the project.

4.1.4.4 MPLM Documentation Control Center

The MPLM Documentation Control Center (DCC) maintains access to all MPLM related documentation including inhouse drawings. The DCC is staffed to maintain, process, and provide support to operate the facility including:

A. Retrieval of requested documentation and assistance to customers in locating of data and information.
B. Retrieval and storage of new documentation and revised documentation from the various sources.
C. Maintenance of files for existing MPLM documentation.
D. Processing and maintenance of MPLM correspondence.
E. Maintenance of MPLM DCC database.
F. Processing of customer requests for documentation not available in DCC files.
G. Maintenance of filing, reproduction, and viewing equipment.
H. During all MPLM flights, 24-hour on-call support to retrieve data required for real-time problem resolution.

4.2 Configuration Management

The MPLM Configuration Management (CM) system meets the program requirements of SSP 50123-01 and MSFC requirements of MPG8040.1 and FD24-CM01. It ensures configuration identification, control, accounting, verification, and generation of related CM data. This includes the capability to authorize and control changes to documentation furnished by contractors. CMO responsibilities include:

A. Support to Program Requirements Control Boards (PRCB) and lower level Configuration Control Boards (CCB)
B. Impact Assessment and PRCB and CCB Technical Support
C. Maintenance and control of Configuration Documentation
D. Change Processing
E. Change Implementation

F. Maintain CM/DM Plan

The MSFC Pressurized Carriers/MPLM Space Station CCBs provide the forum for formally baselining and controlling changes to MSFC MPLM documentation and implementing higher level MPLM requirements. For implementation of MSFC Configuration Management policy defined in MPG 8040.1 and FD24-CM01. Configuration Management MSFC Programs/Projects, Space Station CCBs are designated level III Configuration Control Boards.

After configuration baselines are established, a disciplined and effective system for control of changes to these established configuration baselines must be maintained. Each proposed change will be fully described, coordinated, reviewed, and evaluated prior to submittal to the appropriate CCB.

The change process is depicted in Figure 4-4 for MSFC changes and in Figure 4-5 for ISSPO change requests. CM support to the Control Boards include the following tasks:

A. Process and distribute all documentation.
B. Maintain Program Control Number (PCN) files.
C. Maintain a standard change and integration tracking database: Enter all proposed changes into the database, maintain the information current as changes are dispositioned, and furnish reports as required. Periodically contact open-item actionees to expedite closure of actions.
D. Perform the functions of Control Board secretary: The Control Board secretary will establish the agendas, set meeting times and locations, coordinate teleconferences, provide minutes of meetings, and follow up on action items assigned.
E. Prepare and revise Configuration Control Board Directives (CCBDs): Prepare CCBDs for CCBs (including provisions for technical directives (TDs)), obtain CCB member signatures upon disposition of proposed changes, and revise CCBDs as required.
G. Maintain all related action item lists, logs, etc.

4.3 Database Management

4.3.1 ECL Database

The Engineering Configuration List (ECL) is a listing defining the current configuration required. Also defined are the requirements for verification of incorporation of post-production modifications and mission peculiar changes. The ECL establishes verification requirements and will include, but not be limited to, all revision letter sensitive hardware/software and other items whose verification is judged to be mandatory. The ECL provides an alphanumeric listing of all MPLM drawings including revision letters consistent with the level of detail required for hardware verification.

The MPLM ECL database is an electronic bank of current information on all MPLM drawings. This database will be maintained current by adding new data as MPLM drawings are revised or new drawings are released.

4.3.2 Computer Assisted Design (CAD) Database

Not applicable to MPLM.

4.3.3 Structural Math Model Database

MSFC will maintain an electronic structural math model database of the current integrated MPLM structural configuration, with a change log such that previous configurations can be recovered should that be deemed necessary. A list of pending changes will also be maintained in the database to ensure that the user community is aware of any potential changes that may affect their hardware design and analysis. The model database will be documented in a periodic report provided by MSFC/ED.

4.3.4 Mass Properties Database

A mass properties database will be maintained using the MSFC standard MP03 program. The data in each record will contain the part identification, mass, c.g., moments of inertia, products of inertia, and weight maturity, as applicable. The data will be readily exportable to other record systems (e.g., BDEALS). The MPLM Mass Properties Report is produced from these records.

4.3.5 Thermal Database

The thermal model database will be used for configuration management of the various thermal models, and version numbers will be assigned to each model to maintain traceability. As models are updated or modified, this database will provide the heritage and detailed modifications for each thermal model. A numbering convention will be used to categorize changes. Class I changes consist of major model revisions and should be implemented by users before any additional analyses are completed. Class II changes consist of error corrections and/or model improvements that should generally be implemented before additional user analyses are completed (but may not make a significant impact in all cases). Class III changes consist of minor modifications that will not impact results if not immediately incorporated by users (i.e. additional comment cards or ease-of-use changes).

4.3.6 Material and Processes Database

Materials for the MPLM are maintained in a Materials Identification Usage List (MIUL). Material ratings and approval are taken from MSFC-HDBK-527/MAPTIS (Materials and Processes Technical Information System).

4.3.7 Software Database

Not applicable to MPLM.

4.4 Systems Engineering Support

MSFC and it's Sustaining Engineering support will provide the capability required to perform MPLM sustaining tasks including analyses, improvements, and modifications to hardware and software and supporting documentation.

4.4.1 Hardware Change Request

Any proposed changes to the hardware will be processed through the MPLM Change Management system for validity and purpose. A proposed change will be coordinated with ALTEC and when approved, processed through the International Partners Office and the appropriate ISS Board.

4.4.2 Launch Package Manager (LPM) Integrated Product Team Support

Sustaining Engineering support to the LPM IPT consist of support to any mission specific thermal or structural analyses, updates to the Analytical Model Library and Mass Properties Reports, supporting manifest change analyses, supporting the mission reviews.

4.4.3 Mission Products Team (MPT) Support (KSC)

Support to the MPT consists primarily to coordinating OMRS requirements. Actual test content, duration and schedules are included. Also, any Flight Module staging requirements and post mission de-integration requirements will be handled in this forum.

4.4.4 MERB, ERB and MRB Support

The Material and Engineering Review Board (MERB) at the KSC has been assigned these tasks for ISS Program hardware, including the MPLM, located at KSC and KSC controlled contingency landing sites. The ERB process reviews the make operable changes as defined in 4.5.2. Additionally, they review all engineering issues requiring Program attention. The MRB process evaluates and approves each recommended nonconforming article or material disposition classified "use-as-is," "standard repair," "non-standard Repair," or "request a deviation/waiver." The MERB Charter and Implementation Instruction for non-conformance defines which items must be dispositioned by the MERB. The MERB process is also used to resolve disagreements or when the Quality Assurance personnel feel it is in the best interest of the ISS Program to have the Board determine the disposition of the nonconforming material.

Non-standard repair dispositions require repair procedures to be documented and be approved by the MERB prior to initiation of repair actions. Effective remedial and preventative actions are also included in the Material Review Record as appropriate. Records are filed in the Technical Data Center and are available for review. Disposition decisions consider the affect of nonconformance upon the end-item intended use, criticality classification, previous MRB actions on like nonconformance, and advisory recommendations.

4.4.5 COFR/FRR

MSFC MPLM provides engineering assessment of hardware readiness versus flight objectives for each mission.

4.4.6 Work Authorization Document (WAD)

Work Authorization Document (WAD) - An approved document that identifies/directs work to be performed and provides detailed instructions to accomplish the task. (e.g., OMI, TPS, TAP, PR, etc.)

4.5 Logistics Support

4.5.1 Spares Maintenance

MPLM spares are maintained at KSC in the KIMS. MSFC will provide the LLIL for MPLM for use by KSC in determining the requirements for Module staging. KSC PGOC will order and maintain the spares for staging and for replacement of any nonfunctional LRU.

4.5.2 Field Engineering Changes

An FEC is a time critical make work change used to request a "make-fit/make-operational" change to ISS Program configuration controlled hardware located at KSC. The change must be deemed necessary to avoid an impact to mission processing. With an MERB delegate concurrence, an "Expedited" (reversible) change, may be pre-implemented after the FEC is written and coordinated, but prior to formal MERB approval. Formal MERB discussion and approval will take place at the next MERB. Specific criteria for an "Expedited" (reversible) change are defined. A "Standard" (non-reversible) change cannot be implemented until formal MERB approval. The FEC procedure details may be found in KSC SPP E-05, Processing Changes to Hardware and Software.

4.5.3 Drawings and Specifications

ASI/ALTEC is responsible for any changes to the MPLM as built drawings. Any approved changes to U.S. built LRUs will be processed by MSFC. Changes to a Procurement Specification for a revision to a U.S. vendor part will become a MSFC document with a revised dash number for the part. ALTEC will then update the MPLM drawings to reflect the change.

4.6 Nonconformances, Actions and ALERTs

4.6.1 Problem Report (PR) and Nonconformance Report (NCR) Processing

PRs generated at KSC will be entered into the Problem Reporting and Corrective Action (PRACA) system. Failure codes will be assigned to all PRs as the result of the problem/failure analysis. A critical part of this task is to perform failure trend analyses on all MPLM hardware. The component level analyses will be used to support review of the KSC PR dispositions and Operations/Flight Readiness Assessments, and are required to isolate problem and failure trends which may require corrective action in order to maintain a trending system. All problems will be identified with a malfunction code which will be entered into the N/PRACA database.

All recurrence control actions against reliability critical hardware will be tracked and assessed. Documentation, assignment, tracking, and closure of recurrence control actions will be accomplished with engineering participation and submitted to the Level II PRCB for approval.

4.6.2 Information /Action Request Processing

IARs are provided as a communication avenue between KSC and outside organizations. IARs do not replace other forms of communication such as those involving Control Board actions (Chits, CRs, FECs). They may be used by KSC to request information from an outside organization or by an outside element to request information or actions from KSC, IARs will be tracked and maintained in the office of the KSC IAR coordinator. Figure 4-6 shows the IAR process, outlined below.

A. PROCESS I: - PROCESSING OF KSC INITIATED IARs

1. A KSC originator identifies the need for an IAR and coordinates IAR with the external agency contact, and IPT/MPT. The external agency contact supports IAR definition, and validates need, content, and Action Requested by Date.

1. The originator completes the IAR form, Signs the IAR and obtains System Engineer counterpart signature. Engineering Management Screens the IAR in conjunction with applicable IPT/MPT based on criteria, approves and signs it, and forwards the signed IAR to the IAR coordinator.

2. The IAR Coordinator Assigns the IAR tracking number, annotates the tracking number on the IAR and updates he tracking log. The Coordinator retains the IAR original, forwards a copy to the responsible External Agency technical contact, and distributes copies per the distribution list maintained by the IAR coordinator.

3. The External Agency contact develops an IAR response in coordination with originator and provides IAR response to originator and the IAR coordinator by the Action Requested by Date.

4. The IAR Coordinator receives the IAR response and updates the IAR tracking log while the Originator reviews the IAR response to ensure it meets previous coordination discussions, incorporates or implements the IAR response as appropriate and provides IAR closure status to the IAR coordinator

5. The IAR Coordinator Receives the IAR closure status, updates the in IAR tracking log, distributes copies of closed IAR per the distribution list and files the IAR.

B. PROCESS II: - PROCESSING OF EXTERNAL INITIATED IARs

1. The External Originator identifies the need for an IAR, coordinates with his KSC technical contact for definition, need, content, and Action Requested by Date, and obtains authority signature(s). He then he forwards the IAR to the KSC IAR coordinator.

2. The KSC IAR coordinator enters it into IAR tracking log, Assigns IAR tracking number, and forwards it to the Technical Contact.

3. The KSC Technical Contact receives IAR and develops a response in coordination with the Originator. The KSC Technical Contact, with External Originator support, coordinates the response with KSC Engineering Management/IPT/MPT who signs the approved response. The KSC Technical Contact takes the signed IAR response and provides it to the IAR coordinator and external originator.

4. The External Originator incorporates or implements IAR response as appropriate while the IAR Coordinator receives the IAR closure, updates the IAR tracking log, distributes copies per the distribution list and files the IAR.

4.6.3 Exceptions – Exceedances, Deviations, and Waivers

The general term, "exception" is used to identify any proposed departure from specified requirements of interfaces. An exception can be further classified as an exceedance, deviation or waiver. An exceedance is a condition that does not comply with a stated Interface Requirements Document (IRD) and/or ICD Template requirement, which is identified prior to baselining the ICD, but does not add any risk due to intended use or configuration, and can be shown to be acceptable without special analysis or controls. An exceedance can be approved by the Utilization Analysis and Integration Team, and does not require Control Board approval.

4.6.3.1 Deviations

A deviation is a specific written authorization, granted before manufacture, to depart from a particular baseline requirement for a limited application. It may require additional analysis or control to eliminate risk and is acceptable when properly documented. It requires Control Board approval. Requests for deviations, submitted by ASI/ALTEC are processed by the Space Station MERB at KSC.

4.6.3.2 Waivers

A Waiver is a granted use or acceptance, covering a specific mission or time period, of hardware or software which does not meet requirements. It may be considered suitable "as is' or it may require rework by an approved method. A waiver requires Control Board approval.

4.6.3.3 Deviations and Waivers Affecting ICDs

Deviations and waivers are proposed departures from requirement or hardware baselines. Deviations and waivers shall be submitted on Deviation/Waiver Approval Request (DAR) and shall be dispositioned by the responsible Board. Minor nonconformances not impacting level III requirements shall be processed by the organizational Material Review Board(s) if chartered by a project/team appendix, or by the Material Review Board, and documented on Discrepancy Record (DR) forms. For a more complete review of Deviations, Waivers and Non-conformances, see SSP 50123-01, CM Handbook, Appendix D.

A proposed deviation or waiver that affects an ICD shall require submittal of a DAR. The deviation or waiver shall only apply to the End Item effectivity on which the departure condition exists. The DAR will be transmitted to both sides of the affected interface for evaluation.

Deviations/waivers not originated by ASI/ALTEC but which impact the MPLM, shall be precoordinated with the ASI in accordance with the defined process set forth in SSP 50123-01, Appendix D, and shall require ASI concurrence in the form of an approved SSCB PCD.

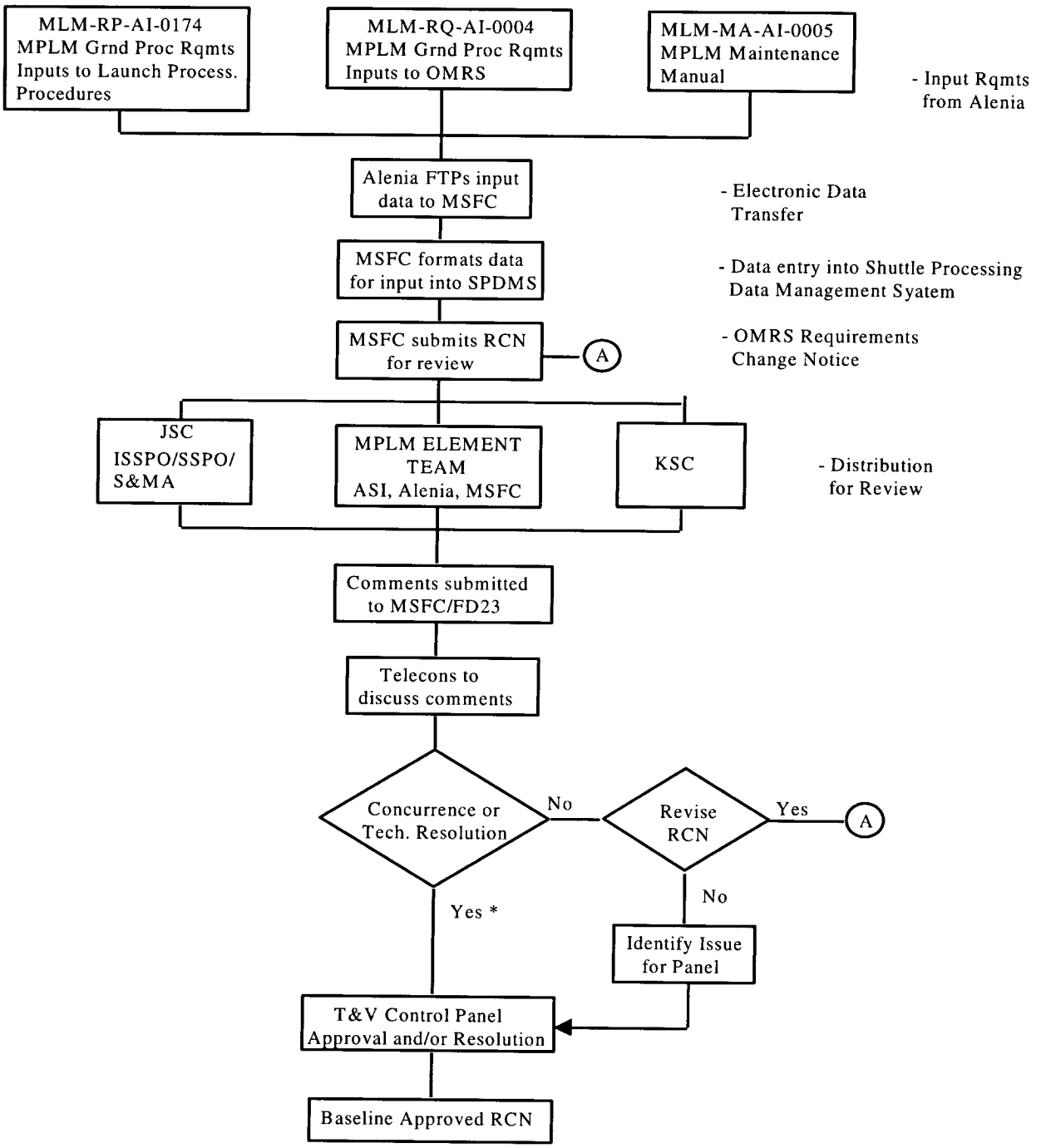
4.6.4 ALERTs Assessments

ALERTs and ALERT-type documents (such as ALERT, Safe-ALERT, Agency Action Notice, TWX, etc.) are either received from outside sources (including GIDEP and NASA sources) or are generated internally at MSFC in response to an issue experienced locally needing general evaluation and/or notification.

When a Full ALERT or ALERT-type notification is received by the MSFC S&MA ALERT Coordinator, the Coordinator generates a summary of the problem facts (part name, type, model, lot, manufacturer, time frame, and description of the issue), generates a problem summary/response sheet, and determines required MSFC distribution. A hard copy file is generated of the relevant information, and an entry is made in the MSFC ALERT Tracking data base indicating which organizations are on distribution for response. The original information, summary/response sheet, and a cover letter are then provided to the designated MSFC respondents, including MPLM. The MPLM ALERTs contact receives the notification, evaluates the impact of the issue on MPLM and forwards the information to the lab or contractor(s) for evaluation and response. Once the MPLM ALERTs contact has the evaluation, the contact returns the required response information to the S&MA ALERT Coordinator. The S&MA ALERT Coordinator assembles the responses and enters them into the MSFC ALERT Tracking data base. If requested, these results are also provided to the initiating organization (such as NASA HQ or another NASA Center).

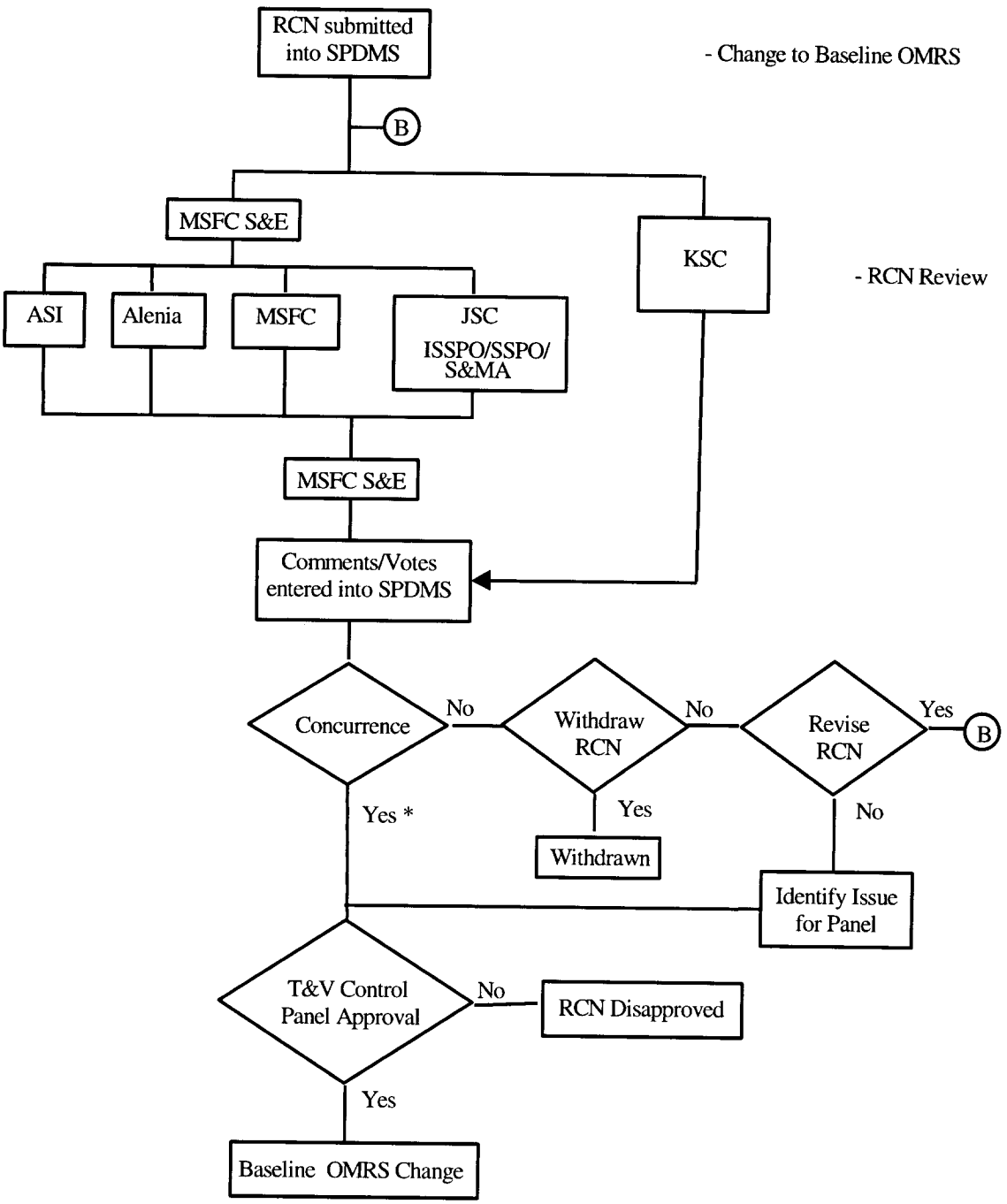
Monthly, the ALERT Coordinator generates a list of open responses and provides that list to the MSFC actionees. If a mission milestone occurs during the time frame between release and response of a Full ALERT, the ALERT Coordinator provides a list of the mission-related open responses and provides them to the mission milestone review.

When an Information ALERT or ALERT-type notification is received by the MSFC S&MA ALERT Coordinator, the Coordinator generates a summary of the problem facts (part name, type, model, lot, manufacturer, time frame, and description of the issue) and determines required MSFC distribution. A hard copy file is generated of the relevant information. The original information and a cover letter are then provided to the MPLM ALERT contact. The S&MA designated MPLM ALERT contact receives the notification, reviews the issue for MPLM and forwards the information to the Project, directorate, or contractor(s) for information only. No response is required.



* MPLM Element Manager collects concurrences from ASI, Alenia, MSFC, ISSPO, and KSC.

Figure 4-1 (1/2): MPLM OMRS INITIAL BASELINE PROCESS



* MPLM Element Manager collects concurrences from ASI, Alenia, MSFC, ISSPO, and KSC.

Figure 4-1 (2/2): MPLM OMRS RQMTS CHANGE PROCESS

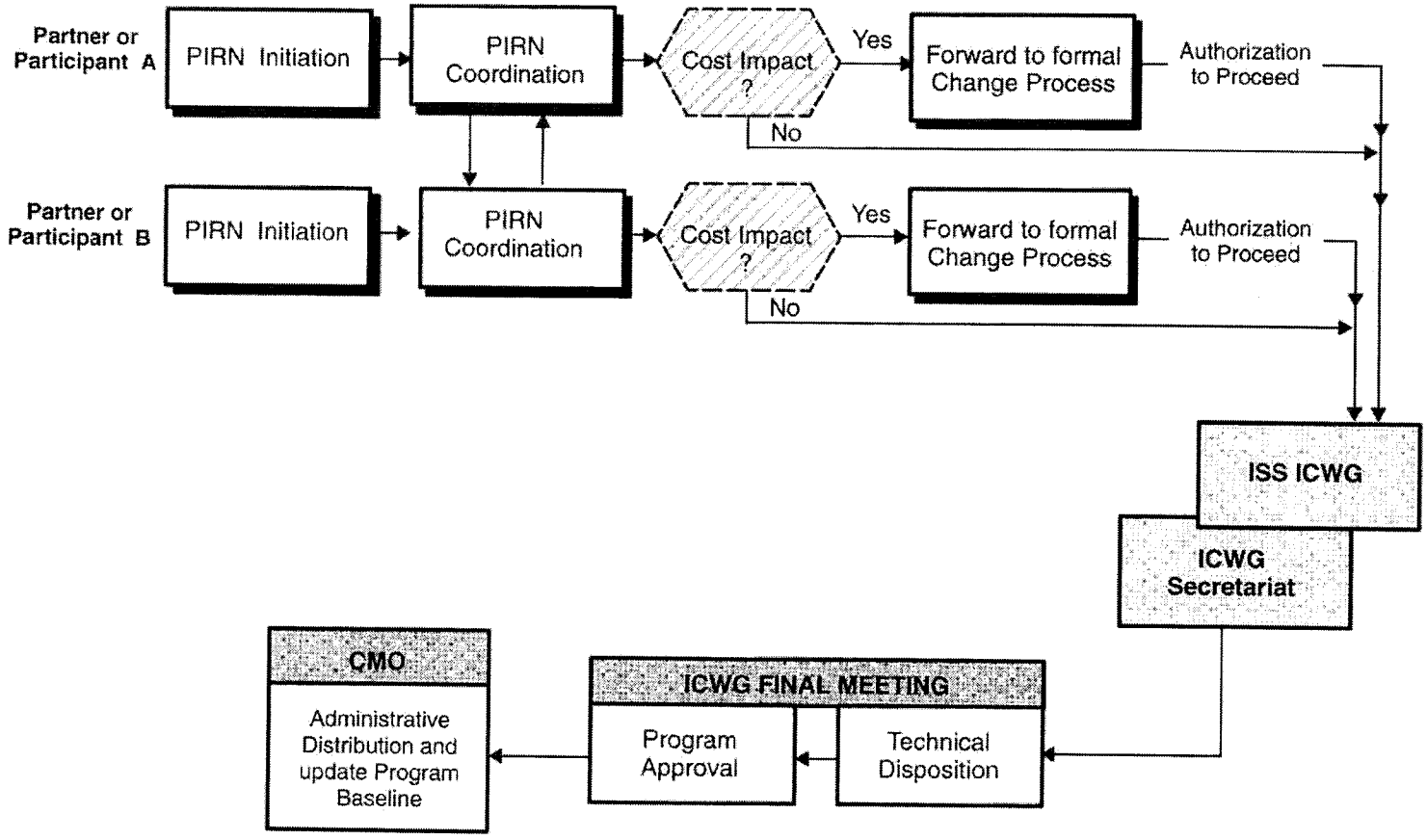


Figure 4-2: Interface Control Concept Change Flow

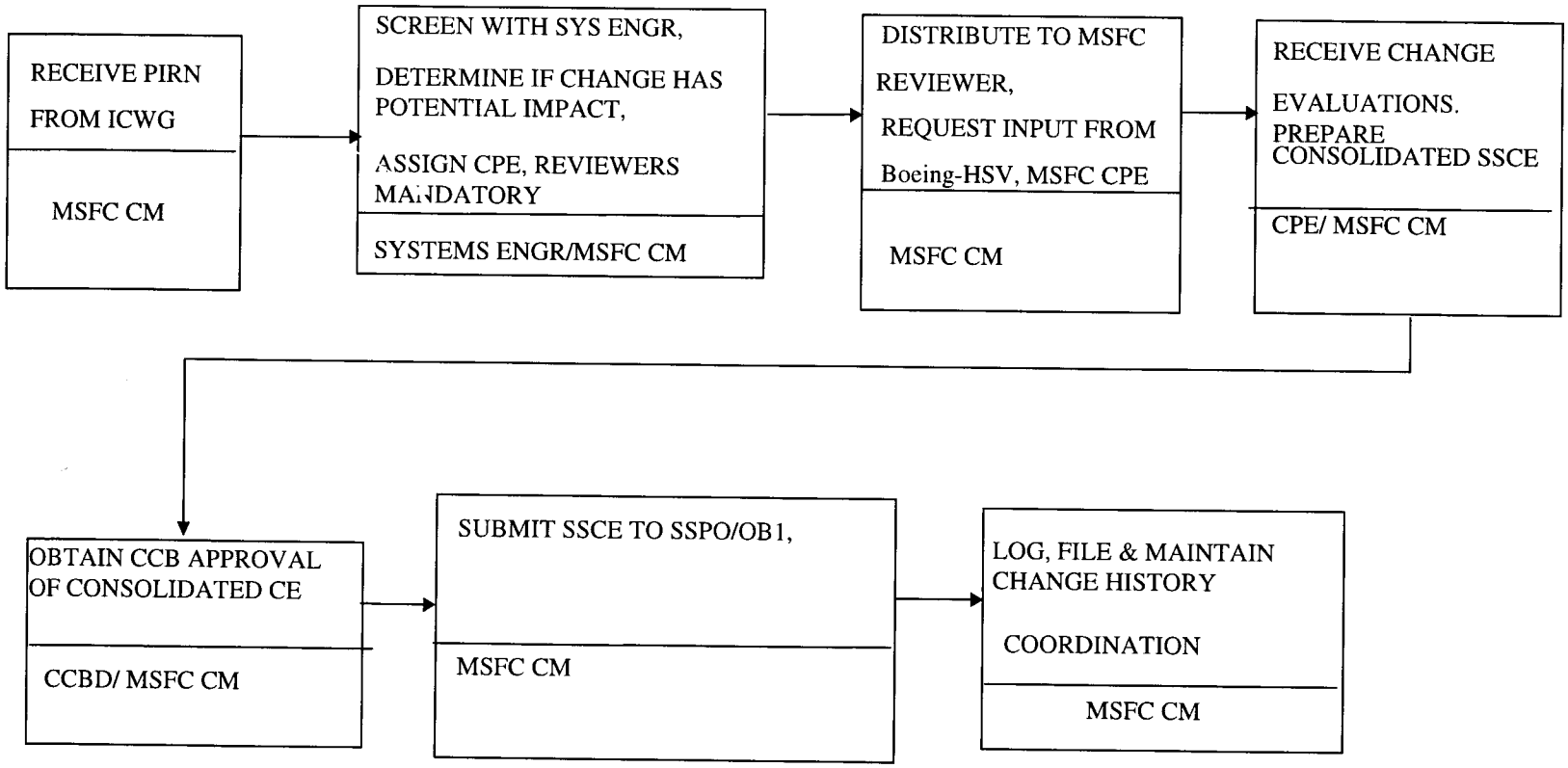


FIGURE 4-3: CR Processing Flow

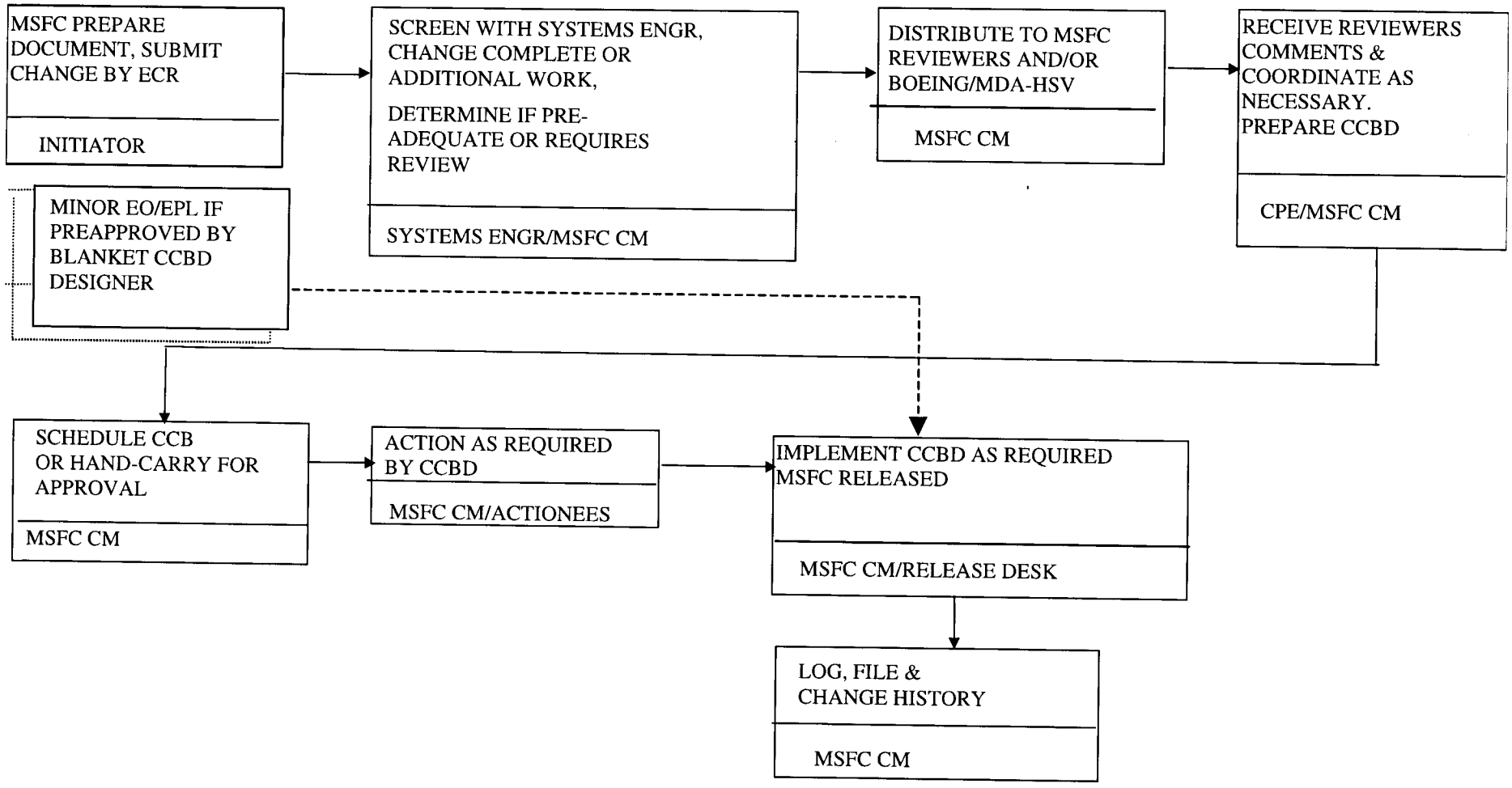


Figure 4-4: MSFC Configuration Management Process

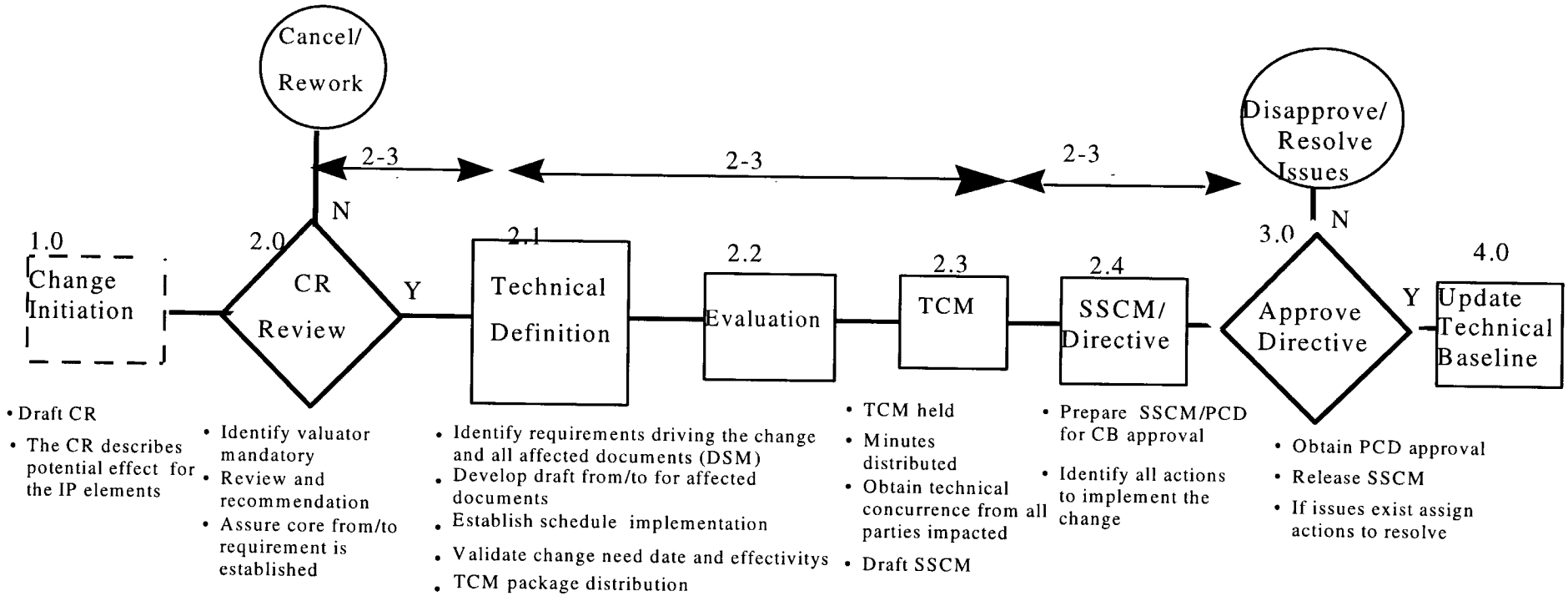


Figure 4-5: ISS Configuration Management Process

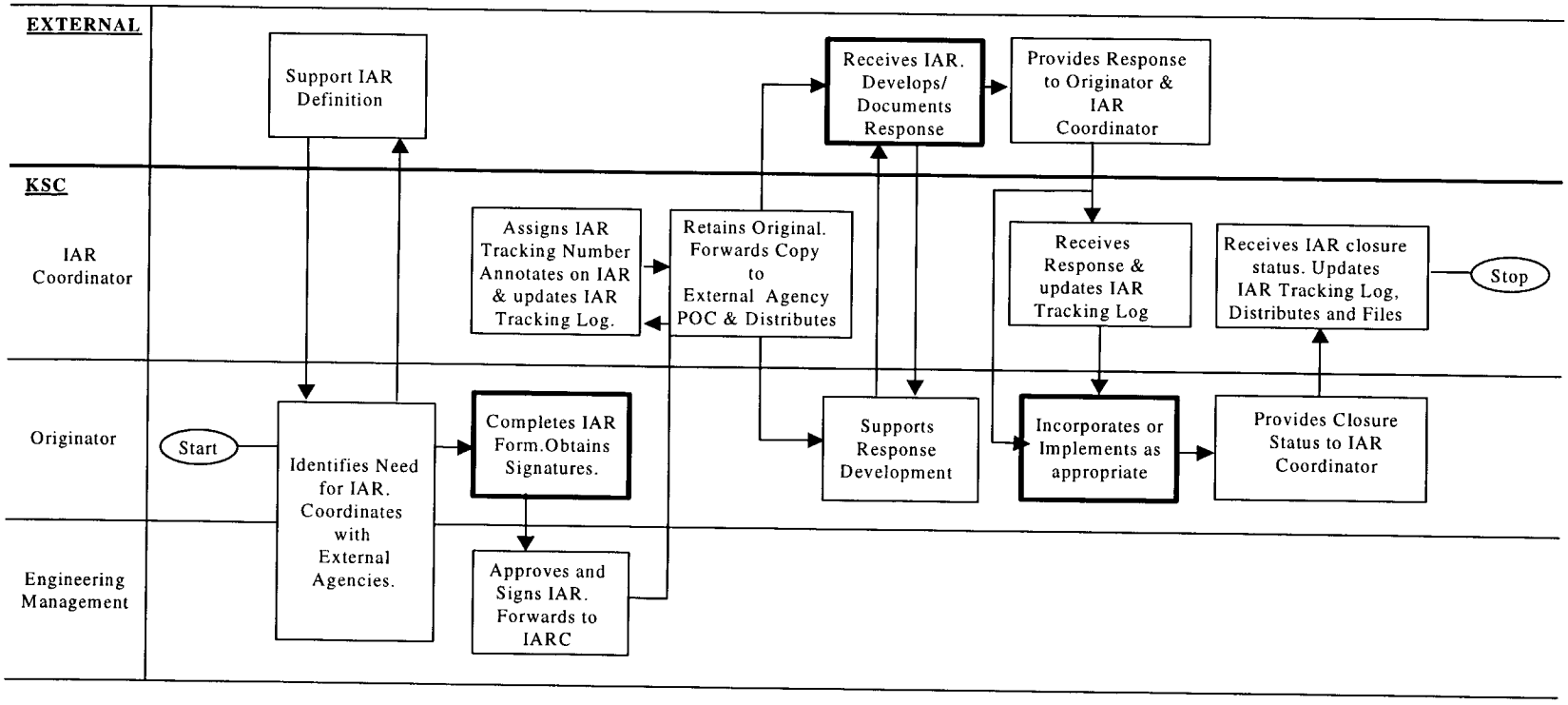


Figure 4-6 (1/2): INFORMATION/ACTION REQUEST (IAR) PROCESSING - KSC INITIATED IAR

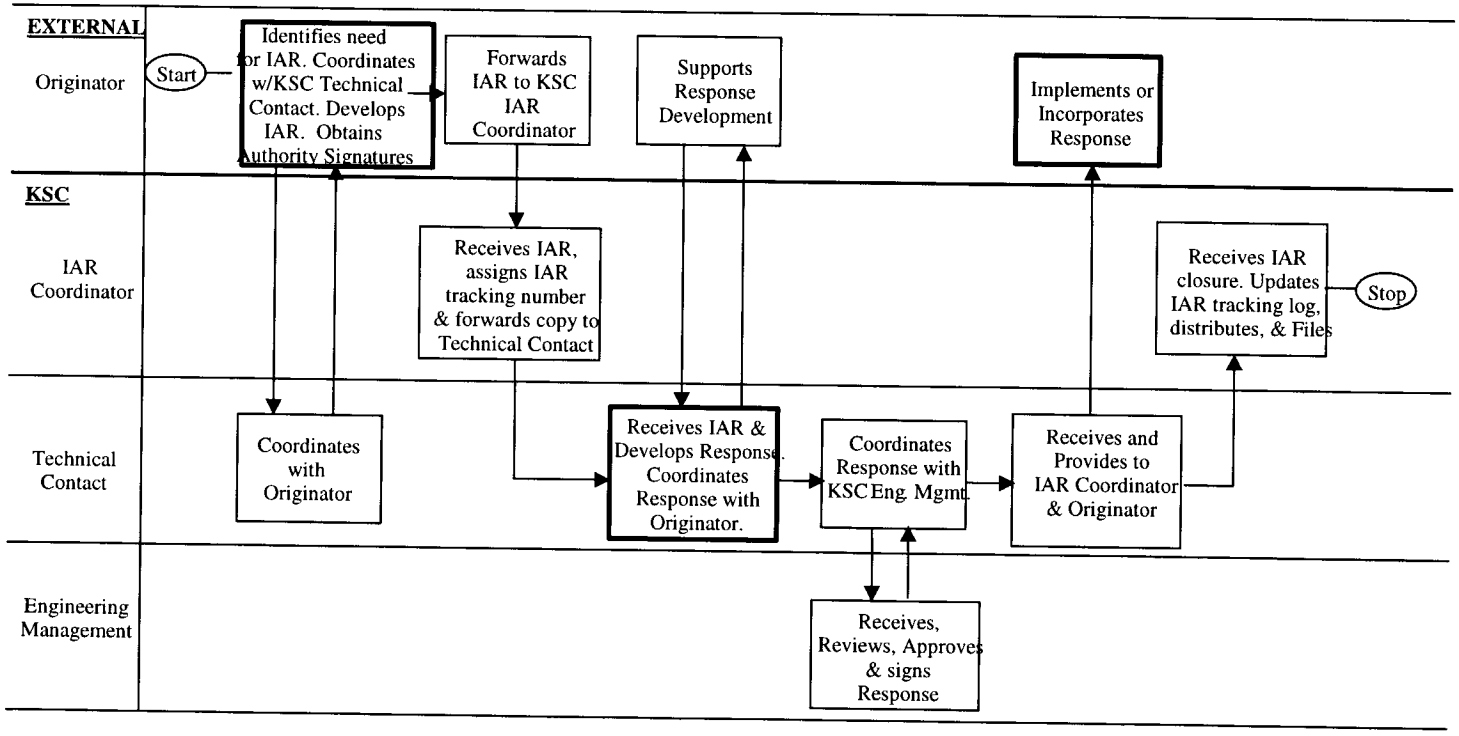


Figure 4-6 (2/2): INFORMATION/ACTION REQUEST (IAR) PROCESSING - EXTERNAL INITIATED IAR

4.7 Real Time Operations

4.7.1 Real Time Operations Plan

The MPLM Real Time Operations Plan, MSFC document, ISS-MPLM-PLAN-003, describes the overall concept for operating in the POIC during any mission manifesting an MPLM Flight Module. It gives the MPLM Support organizational structure, Console positions and descriptions, Call Signs, voice loops, JSC interfaces, and data formats. Other support data such as locations, Redstone Arsenal gate open and close times, and support function telephone numbers are also given. A Flight Specific annex is published for each mission.

4.7.2 Facilities

On-Orbit support operations are focused in the Space Station Engineering Support Center at the Huntsville Operations Support Center (POIC), in Building 4663, MSFC. Communications services are provided through the MSFC Communications Center (Building 4207) and associated facilities. These facilities and their functions for MPLM missions are described in the MPLM Real Time Operations Plan.

4.7.3 Displays

MPLM display for the Engineering Support Team consist of selected JSC MER displays as well as special purpose analysis processes unique to the MPLM sustaining engineering functions. These displays are depicted in the MPLM Real Time Support Plan, Mission Appendix.

4.7.4 Communications

Voice communications in the MPLM Real Time Operations area of the HOSC will consist of discipline internal loops and program loops to KSC and JSC which may be shared with other mission carrier facilities. Monitor-only capability will be provided on special loops such as Flight Director and the Air-to-Ground loops while dual capability will be provided on loops such as the MER loops, Prime Operations, Operation Action, and Operations Support. A full listing of the voice loops is found in the Real Time Support Plan. Data circuits are provided pre-launch from KSC and for the mission duration though JSC for the MPLM data and selected Orbiter parameters. Data and voice circuits between MSFC and ALTEC are provided to support analyses. Standard voice loops which are extended to the HOSC include:

FD (M)	Shuttle Flight Director
ISS FD (M)	Station Flight Director
A/G-1, A/G-2 (M)	Air to Ground Crew Voice
EGIL1	
Prime Ops (T/M)	Primary loop between the POIC and the MCC
CSR Coord (T/M)	LPM, MSFC Rep., and FIM Coordination Loop
IMC Coord 1	
ISS MER 1, 2 (T/M)	Primary contact loops for the MER Mgr. & alternate MER Mgr.
ISS MER Prob (T/M)	Coordination Loop Between the MER and the MPLM Team
ISS MER Mgr	
S/G 1, S/G 2 (M)	Space to Ground (ISS crew)
Thor1 (M)	THOR Team control loop
TCS Coord (T/M)	Back Room coordination loop for THOR personnel

4.8 Safety

4.8.1 Safety Reflight Assessment (Flight)

MSFC MPLM provides Safety Reflight Assessments and presents to the MSFC PSRRB and JSC Safety Panels (ISS SRP or PSRP) as necessary.

Flight Hardware falls into three basic categories based on its projected use on orbit. Hardware designated as part of a station element or as Government Furnished Equipment (GFE) must meet the requirements of SSP 50021. Hardware designed to fly only on the Space Shuttle must meet the requirements of NSTS 1700.7. Hardware (such as payloads) designed to be flown onboard the International Space Station (ISS) must meet the requirements of NSTS 1700.7 Addendum. Based on the current agreement with the ISS Safety Review Panel (SRP) and the Payload Safety Review Panel (PSRP) all MPLM related hardware classified as series or reflight hardware must be assessed in accordance with NSTS/ISS 13830.

Once the Reflight Assessment has been completed, it is submitted to the MSFC MPLM project and MSFC S&MA for internal review. MSFC S&MA then decides if a review needs to be scheduled with the MSFC Payload Safety Readiness Review Board (PSRRB). After all internal reviews are complete, the Reflight Assessment is then submitted to the JSC PSRP. The PSRP then determines if a formal review is necessary.

4.8.2 Integrated Hazard Analysis

MSFC MPLM provides an updated Phase III MPLM/Orbiter Integrated Hazard Analysis and presents to the MSFC PSRRB and JSC Safety Panels (ISS SRP or PSRP) as necessary.

The MPLM and its associated hardware are considered to be station elements and must meet the safety requirements of SSP 50021. The Integrated Hazard Analysis for the MPLM must meet the data submittal requirements of SSP 30309 and must follow the Safety Review Process as laid out in SSP 30599. Once the Integrated Hazard Anlysis has been completed, it is submitted to the MSFC MPLM project and MSFC S&MA for internal review. MSFC S&MA then decides if a review needs to be scheduled with the MSFC Payload Safety Readiness Review Board (PSRRB). After all internal reviews are complete, the Integrated Hazard Analysis is then submitted to the JSC ISS SRP. The ISS SRP then determines if a formal review is necessary.

Based on the current agreement with the ISS SRP and the PSRP, any Integrated Hazard Analysis for the first flight of MPLM hardware will be submitted to the ISS SRP for approval. Subsequent flights of the same hardware will require a reflight assessment to be submitted to the PSRP. It is up to the ISS SRP and/or the PSRP to determine if a formal presentation is necessary.

5.0 Forms

The sources for the forms used on MPLM are as diverse as the forms themselves. The following forms are used in the MPLM documentation process:

5.1 IAR Form

The IAR From, KSC Form Boeing-KSC/PGOC-F224, is an electronic form accessible on the IAR Homepage, http://osprey.ksc.nasa.gov/iss/iar/default.asp

5.2 Chit Form

The Chit Form, or Mission Action Request (MAR) is available on the ISS Chit Homepage which may be accessed directly from the Chit homepage at: http://issa-www.jsc.nasa.gov/ss/issapt/cmr/cmr_home_76.html. To access individual Chits, go to the PALS Homepage at http://iss-www.jsc.nasa.gov/ss/issapt/pals/ and select "Search Index. On the search index page, select Chit info, "the mission" and the type (no more than four letters) or leave that entry blank to get all. You may have to play with "the mission" since 5A.1 doesn't work, but 5A_1 does.

5.3 Change Request Form

The Change Request, JSC Form 130, can be accessed from the JSC PALS Blank CM Forms page at http://issa-www.jsc.nasa.gov/ss/issapt/cmr/cmr_home_68.html.

5.4 PIRN/IRN Form

The Interface Revision Notice, used for proposed and approved changes to ICDs, can be accessed from the JSC PALS Blank CM Forms page at http://issa-www.jsc.nasa.gov/ss/issapt/cmr/cmr_home_68.html. Typically, inputs for proposed changes to ICDs are given to the Book Manager who fills out the form.

5.5 FEC Form

The Field Engineering Change, KSC Form 14-129, may be acquired from KSC or PGOC CMO.

5.6 PR Form

The Problem Report, KSC Form 2-151, may be acquired from KSC or PGOC CMO.

5.7 MARS Form

Mission Action Requests are submitted and processed on the CHIT Form.

5.8 MPLM SPRT Form

Requests for problem resolution or corrective action to be taken by the SPRT shall be submitted to the SPRT in writing.

Appendix A Abbreviations & Acronyms

AAC	Aft Access Closure
ABCL	As Built Configuration List
ACOMC	Assembly, Checkout, Operations, Maintenance, and Configuration
ALERT	Acute Launch Emergency Reliability Tip
ALLI	Age Limited Life Item
ALTEC	ASI Logistic Technological and Engineering Center (@ ALTEC – Torino, Italy)
ASCP	Avionics Software Control Panel
ASI	Agenzia Spaziale Italiana (Italian Space Agency)
BDEALS	(A Loads Analysis Library System)
CAD	Computer Aided Design
CBM	Common Berthing Mechanism Common Berthing Module
CCB	Change Control Board
CCBD	Change Control Board Directive
CD	Change Directive (also see CR)
CG	Center of Gravity (also CoG)
CHIT	Mission Action Request - MAR
CI	Configuration Item
CMO	Configuration Management Office
CN	Change Notice
CoFR	Certificate of Flight Readiness
CR	Change Request (for a document change)
CSA	Canadian Space Agency
CSR	Customer Support Room (JSC)
DAR	Deviation/Waiver Approval Request
DCC	Document Control Center
DCN	Document(ation) Change Notice
DR	Discrepancy Record
ECL	Engineering Configuration List
ECP	Engineering Change Proposal
ECR	Engineering Change Request
ERB	Engineering Review Board
FEC	Field Engineering Change
FEU	Functional Equivalent Unit
FRGF	Flight Releasable Grapple Fixture
FTP	File Transfer Protocol
GIDEP	Government - Industry Data Exchange Program
GSE	Ground Support Equipment

HOSC	Huntsville Operations Support Center
IAR	Information/Action Request
ICD	Interface Control Document
ICWG	Interface Control Working Group
IPR	Interim Problem Report
IPT	Integrated Product Team
IRD	Interface Requirements Document
IRN	Interface Revision Notice
ISPR	International Standard Payload Rack
ISS	International Space Station
ISSP	International Space Station Program
ISSPO	International Space Station Program Office
ITA	Internal Task Agreement
JSC	Lyndon B. Johnson Space Center
KIMS	KSC Inventory Management System
KSC	John F. Kennedy Space Center
LCCSR	Life Critical Components Status Report
LLIL	Limited Life Items Lists (ALLI & LOLI)
LMA	OMRS – Preventive Maintenance, Age Critical
LMC	OMRS – Preventive Maintenance, Cycle Critical
LOLI	Limited Operational Life Item
LPM	Launch Package Manager
LRU	Line Replaceable Unit
MAPTIS	Materials and Processes Technical Information System
MATE	MDM Applications Test Environment
MDM	Multiplexer/DeMultiplexer
MER	Mission Evaluation Room
MERB	Materials and Engineering Review Board (KSC)
MIP	Mission Integration Plan
MPLM	Multi-Purpose Logistics Module
MPT	Mission Products Team (KSC)
MSFC	George C. Marshall Space Flight Center
MRB	Materials Review Board
NCR	Nonconformance Report
NSTS	National Space Transportation System (STS)
OMI	Operations and Maintenance Instruction
OMRS	Operations and Maintenance Requirements and Specifications
OMRSD	Operations and Maintenance Requirements and Specifications Document

ORU	On-Orbit Replaceable Unit
O/S	Operating System
PCD	Program Change Directive
POC	Point of Contact
PCN	Program Control Notice
PDV	Post Delivery Verification
PGOC	Payload Ground Operations Contractor
PIRN	Preliminary Interface Revision Notice (Proposed ICD change)
PR	Problem Report
PRACA	Problem Reporting and Corrective Action
PRCB	Program Requirements Control Board
RCN	Requirements Change Notice
RMM	Recommended Requirements Matrix
ROEU	Remote Operated Electrical Umbilical
ROFU	Remote Operated Fluid Umbilical
RSP	Resupply Stowage Platform
S&E	Science and Engineering
S&MA	Safety and Mission Assurance
SCIT	Standard Change and Integration Tracking
SCN	Specification Change Notice
SEM	Sustaining Engineering Model
SPDMS	Shuttle Program Data Management System
SPP	Standard Practices and Procedures
SPRT	Systems Problem Resolution Team
SRP	Safety Review Panel
	Standard Repair Procedure
SSCB	Space Station Control Board
SSCN	Space Station Change Notice
SSPF	Space Station Processing Facility
T&V	Test and Verification
TCM	Technical Coordination Meeting
TD	Technical Directive
TSE	Test Support Equipment
U.S.	United States
USOS	United States On-orbit Segment
VCB	Vehicle Control Board
VCLA	Verification Coupled Loads Analysis
VICP	Vehicle Integration Control Panel
WAD	Work Authorization Document

PACKAGE NUMBER:	DOCUMENTATION PACKAGE / ROUTING SLIP	SHEET 1 OF 1

PROGRAM/PROJECT:
PC/MPLM

CEI NUMBER:	NOMENCLATURE: Mutli Purpose Logistics Module Sustaining Engineering Plan Rev. A
ECR NUMBER: FD24-0027	CCBD NUMBER: MP3-00-0058
PCN NUMBER: MP00056	DATE PREPARED: 07/22/2003

DRAWING / DOCUMENT NUMBER	DRL / EPL NUMBER	EO NUMBER

SUBMITTED BY ENGINEERING AREA:

BASIC RELEASE [X] ; PARTIAL [ ] COMPLETE [X]

CHANGE RELEASE [ ] ; PARTIAL [ ] COMPLETE [ ]

THIS SUBMITTAL CLOSES ACTION ON ABOVE CCBD BY: [X] YES [ ] NO

PREPARED BY: FD24/Bessie Lee Bessie Lee	DATE: 07/22/2003	TRANSMITTAL DATES
SUBMITTED BY: FD24/Bessie Lee Bessie Lee	DATE: 07/22/2003	TO RELEASE: 07/22/2003
CONCURRENCE: FD24/Charlotte Hazel Charlotte Hazel	DATE: 07/22/2003	TO MSFC REPOSITORY:

REMARKS:

MSFC Form 3418 (Rev. November 2001)

Informed

1. NUMBER: FD24-0027	2. PCN: MP00056	**MSFC ENGINEERING CHANGE REQUEST (ECR)** (See Instructions: MSFC Form 2327-2)	3. DATE: 03/22/2003	4. PAGE: 1 OF 1

5. TO:	6. THRU:	7. FROM:
FD24/Randy McClendon	FD24/Bessie Lee/PWI	FD24/Charlotte Hazel

8. TITLE OF CHANGE:

Mutli Pourpose Logistics Module Sustaining Engineering Plan Rev. A

9. RECOMMENDED PRIORITY:	10. NEED DATE:
☐ EMERGENCY ☐ URGENT ☒ ROUTINE	03/23/2003
11. PROGRAM(S)/PROJECT(S) AFFECTED: ISS MPLM	12. CONFIGURATION ITEM(S) AFFECTED BY NOMENCLATURE: MPLM
13. RECOMMENDED EFFECTIVITY(IES): MP01	14. DOCUMENTATION AFFECTED (Specs, ICD, etc.): NONE
15. RELATED CHANGES (ECR, ECP, CR, etc.) BY NUMBER: None	15A. INITIATING DOCUMENT NUMBER (e.g., DR, Software Trouble Report, etc.): None

16. JUSTIFICATION FOR CHANGE (Include effect if not incorporated. If necessary, continue on MSFC Form 2327-1, Continuation Sheet):

To update Organizational Charts and Signature Page

17. EFFECTS ON:

☐ HARDWARE ☐ FACILITY ☐ SCHEDULE (SEE ENCLOSURE _____ FOR IMPACT ☒ REQUIREMENTS DOCUMENTATION

☐ SOFTWARE ☐ ENVIRONMENT ☐ COST (ESTIMATED COST INCLUDED IN ENCLOSURE _____) ☐ OTHER (SPECIFY): _____

18. DESCRIPTON OF CHANGE (Include reference to enclosure. If necessary, continue on MSFC Form 2327-1, Continuation Sheet.):

To update Organizational Charts and Signature Page ISS-MPLM-PLAN-015 Rev.A attached

19. MOD KIT INFORMATION:

YES	NO		Enclosure	Paragraph
☐	■	Previously issued modification instructions affected? (Explain)		
☐	■	Proofing of modification instructions and kit installation required? (Explain)		
		Proofing location:		
☐	■	Retest required? (Identify test invalidated by change)		
☐	■	Requalification required? (Include description of test plan for requalification)		

Vehicle/Site & CI Serial No.	Change Period	Mod Kit Delivery Date	Est. M/H for Mod Kit Instl.	Out-of-Service Time

20. SIGNATURE OF ORIGINATOR:	DATE:	TELEPHONE NUMBER:	OFFICE SYMBOL:
Charlotte Hazel	7/22/03	(256) 544-5451	FD24

21. **CONCURRENCE**

SIGNATURE	ORG. CODE	DATE	SIGNATURE	ORIG. CODE	DATE

22. **TECHNICAL APPROVAL**

SIGNATURE	ORG. CODE	DATE	SIGNATURE	ORIG. CODE	DATE

MARSHALL SPACE FLIGHT CENTER
CONTROL BOARD DIRECTIVE (CBD)

1. CBD NUMBER: MP3-00-0058	2. CONTROL BOARD: MPLM Level III CCB	3. DATE: 07/22/2003
4. CHANGE NUMBER: FD24-0027		5. PAGE 1 OF 1
6. PROGRAM CONTROL NUMBER: MP00056	7. RESPONSIBLE INDIVIDUAL(S) ORGANIZATION(S): Bessie LEE/ FD24 / PWI phone: 544-7109 e-mail: bessis.lee@msfc.nasa.gov	
8. CHANGE TITLE: Multi Purpose Logistic Module Sustaining Engineering Plan Rev.A	9. BASELINE DOCUMENT(S) OR DATABASE AFFECTED:	
10. CONFIGURATION ITEM (CI)/CSCI NO. AND NOMENCLATURE:	11. EFFECTIVITY (CI/CSCI ONLY): MP01	

12. BASELINE AFFECTED:

	YES	NO
CONFIGURATION	☒	☐
NON-CONFIGURATION	☐	☒
BUDGET	☐	☒
SCHEDULE	☐	☒
OTHER:		

13. IMPACT COST: ☐ YES ☒ NO

☐ COST SPECIFIED IN ATTACHMENT

FY- ____ COST: ____ FY ____ COST: ____

FY- ____ COST: ____ FY ____ COST: ____

FY- ____ COST: ____ TOTAL COST: N/A

14. IMPACTS:

	YES	NO
WEIGHT	☐	☒
MEMORY	☐	☒
POWER	☐	☒
COST PER FLIGHT	☐	☒
ENVIRONMENTAL	☐	☒
OTHER:		

15. CHANGE DISPOSITION:

1. ECR FD24-0027 is approved as written.

2. Document ISS-MPLM-PLAN-015 Rev. A Multi Purpose Logistic Module Sustaining Engineering Plan is approved for release.

3. Bessie Lee/PWI shall provide a copy of this CCBD of Multi Purpose Logistic Module Sustaining Engineering Plan Rev .A to the MSFC Documentation Repository for file and distribution per the PC/MPLM distribution list.

16. BOARD MEMBERS	CONCUR YES	CONCUR NO	BOARD MEMBERS	CONCUR YES	CONCUR NO	17. BOARD CHAIRPERSON
Jon Holladay /FD24			Additional Distribution:	X		Randy K McClendon 22 Jul '03
Jon Holladay	X					
						Randy McClendon/FD24 PC/MPLM .
Shawn Reagan/FD24	X					Chairman
Shawn E. Reagan						DATE
						18. SECRETARIAT
for Michelle Butler/FD11						
M Butler	✓			X		Bessie Lee
						Bessie Lee/FD24/PWI
						MPLM/PC CCB Secretariat
						DATE

MSFC Form 2312 (Rev. March 2003)

Informed

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I. GENERAL INFORMATION

1. APPROVED PROJECT:	2. DOCUMENT/ DRAWING NUMBER:	3. CONTROL NUMBER:	4. RELEASE DATE:	5. SUBMITTAL DATE:
PressurizedCarriers Group/MPLM	ISS-MPLM-PLAN-015 REV.A	MP00056	02/22/2003	7-22-03

6. DOCUMENT/DRAWING TITLE:	7. REPORT TYPE:
Multi Purpose Logistics Module Sustaining Engineering Plan Rev. A	Plan

8. CONTRACT NUMBER / PERFORMING ACTIVITY:	9. DRD NUMBER:	10. DPD / DRL / IDRD NUMBER:
477-72-61	NA	NA

11. DISPOSITION AUTHORITY (Check One):	12. SUBMITTAL AUTHORITY:	13. RELEASING AUTHORITY:
☒ Official Record - NRRS 8/5/A/1 (c) ☐ Reference Copy - NRRS 8/5/A/3 (destroy when no longer needed)	Charlotte Hazel/FD24	MPLM LEVEL III CCB

14. SPECIAL INSTRUCTIONS:
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15. CONTRACTOR/SUBMITTING ORGANIZATION, ADDRESS AND PHONE NUMBER:	16. ORIGINATING NASA CENTER:
MSFC	MSFC
	17. OFFICE OF PRIMARY RESPONSIBILITY: Jon Holaday/ FD24

18. PROGRAMMATIC CODE (5 DIGITS):	19. NUMBER OF PAGES:
477-72-61	51

II. ENGINEERING DRAWINGS

20. REVISION:	21. ENGINEERING ORDER:	22. PARTS LIST:	23. CCBD:
Revision A	NA	N/A	MP3-00-0058

III. REPORTS, SPECIFICATIONS, ETC.

24. REVISION:	25. CHANGE:	26. VOLUME:	27. BOOK:	28. PART:	29. SECTION:

30. ISSUE:	31. ANNEX:	32. SCN:	33. DCN:	34. AMENDMENT:

35. APPENDIX:	36. ADDENDUM:	37. CCBD:	38. CODE ID:	39. IRN:
		MP3-00-0058		

IV. EXPORT AND DISTRIBUTION RESTRICTIONS

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- ☐ Patent (see MPG 2220.1)
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40. ORG. CODE:	41. PHONE NUMBER:	42. NAME:	43. SIGNATURE/DATE:
FD24	(256) 544-3559	Randy K.McCLENDON	Randy K McClendon 22 Jul 03

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