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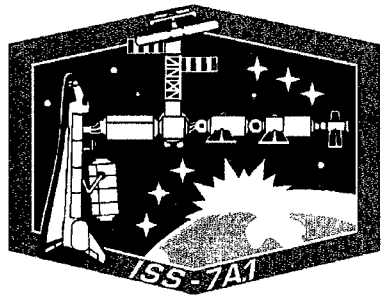


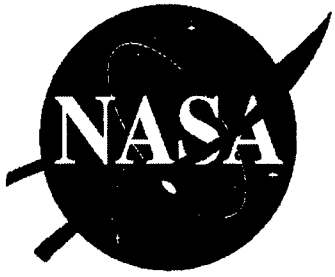
George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

Multi Purpose Logistics Module

(MPLM)/Orbiter Integrated

REFLIGHT ASSESSMENT

July 2001



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

Multi Purpose Logistics Module (MPLM)/Orbiter Integrated Reflight Assessment

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PREFACE

This document contains the reflight assessment for the Multi Purpose Logistics Module (MPLM)/Orbiter Integrated Phase III Flight Hazard Analysis. This data has been assessed in accordance with the requirements of SSP 50021, "Safety Requirements Document". The data is presented in the format for Phase III as outlined in SSP 30599, "Safety Review Process".

This document was prepared by the Marshall Space Flight Center Space Cargo Assurance Department (QS22) in response to Technical Task Agreement XXXX. The information contained herein represents the MPLM and Orbiter Interfacing Hardware (ROFU/ROEU, PRLAs, AKA, and Orbiter ATCS) design as ofJuly 2001. Any changes to the hardware design or its anticipated use will be evaluated to determine its impact to safety and changes to this document will be made accordingly.

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ABBREVIATIONS AND ACRONYMS

AAC	Aft Access Closure
ACBM	Active Common Berthing Mechanism
ACE	Advanced Carrier Equipment
ACON	Aft end cone
ACS	Atmosphere Control and Supply
ACYL	Aft cyclinder
AFD	Aft Flight Deck
AKA	Active Keel Assembly
APCA	Aft Power Controller Assembly
APCF	Advanced Protein Crystal Facility
APCU	Auxilairy Power Converter Unit
ARS	Atmosphere Revitalization System
ASE	Airborne Support Equipment
ASI	(Italian Space Agengency)
ATCS	Active Thermal Control Subsystem
ATLAS	Atmospheric Laboratory for Applications and Science
ATMK	Active Thermal Mission Kit
AVS	Avionics System
BCSS	Biotechnology Cell Science Stowage
BSTC	Biotechnology Specimen Temperature Controller
BTR	Biotechnology Refrigerator
BULK	Bulkhead
CBM	Common Berthing Mechanism
CDR	Comander
CE	Cargo Element
CELA	Cargo Element Lifting Assembly
CEWS	Cargo Element Workstand
CFA	Cabin Fan Assembly
CG	Center of Gravity
CHeCS	Crew Health Care System
CI	Cargo Item
CITE	Cargo Integration Test Equipment
CRCF	Canister Rotation and Cleaning Facility
CREEK	Cargo Element Extension Kit
CWC	Continegency Water Container
D&C	Displays and Control
DA	Depressurization Assembly
DAK	Double Aluminized Kapton
DC	Direct Current
DCPCG	Dynamically Controlled Protein Crystall Growth
DDCU	DC to DC Converter Unit
DDCU-E	DC/DC Converter Unit – External
DFRC	Dryden Flight Research Center
DOC	Document
DP	Delta Pressure (Delta Pressure Sensor)
EAS	External Ammonia Servicer
ECLSS	Environmental Control and Life Support System
ECS	Environmental Control System
EEL	Emergency Egress Lighting
EEL	Emergency Egress Lighting
EGSE	Electrical Ground Support Equipment
ELH	Electrical Harness
ELH	Electrical Harness
ELPS	Emergency Lighting Power Supply
ELS	Emergency Lighting System
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMU	Extravehicular Mobility Unit

ERS	Element Rotation Stand
ERS	Element Rotating Stand
ESD	Electrostatic Discharge
EURECA	European Retrievable Carrier
EVA	Extravehicular Activity
EXPRESS	Expedit the Processing of Experiments to Space Station
F/T	Feed Through
FCL	Freon Cooling Loop
FCON	Forward end cone
FCYL	Forward Cyclinder
FDI	Fault Detection and Isolation
FEU	Flight Equivalent Unit
FM1	Flight Module 1 (Leonardo)
FM2	Flight Module 2 (Rafaello)
FM3	Flight Module 3 (Donatello)
FMEA	Failure Mode and Effects Analysis
FRGF	Flight Releasable Grapple Fixture
FSE	Flight Support Equipment
FSW	Flight Software
FWD	Forward
GACU	Ground Air Cooling Unit
GAS	Get Away Special
GLA	General Luminaire Assemblies
GN_2	GASEOUS NITROGEN
GO_2	GASEOUS OXYGEN
GRAP	Grapple Fixture
GSE	Ground Support Equipment
HCU	Heater Control Unit
HDBK	Handbook
HEAT	Hitchhiker Experiments Advancing Technology
HOK	Hatch Operations and Hatch Restrain Kit
HR	Hazard Report
HRF	Human Research Facility
IBSS	Infrared Background Signature Survey
ICC	Integrated Cargo Carrier
ID	Inside Diameter
IMV	Intermodule Ventilation
ISPR	International Standard Payload Racks
ISPR	International Space Station Payload Rack
ISS	International Space Station
ITCS	Internal Thermal Control System
IV	Intravehicular
JEM	Japanese Experiment Module
JSC	Johnson Space Center
KEELFIT	Keel fitting
KHB	KSC Handbook
KSC	Kennedy Space Center
LAB	Laboratory
LB	Pound
LCC	Launch Commit Criteria
LIDAR	Light Detection and Ranging
LITE	LIDAR in Space Technology Experiment
LPIS	Launch Package Integration Stand
LSU IPT	Launch Support Integrated Product Team
MAINFIT	Main Fitting
MBE	Metal Bellows Expander
MDM	Multiplexer/Demultiplexer
MDPS	Meteoroid and Debris Protection System
MLI	Multi-Layer Insulation
MLP	Mobile Launch Platform
MMSE	Multi Misson Support Equipment

MPLM	Multi Purpose Logistics Module (formerly Mini Pressurized Logistics Module)
MS1	Mission Specialist 1
MS2	Mission Specialist 2
MSFC	Marshall Space Flight Center
MSS	MOBILE SERVICING SYSTEM
NASA	National Aeronautics and Space Administration
NCR	Non-Compliance Report
NDE	Nondestructive Evaluation
NHB	NASA Handbook
NPRA	Negative Pressure Relief Assembly
NPRV	Negative Pressure Relief Valve
NSTS	National Space Transportation System
O&C	Operations and Checkout
OD	Outside Diameter
ODA	Orbiter Disconnect Assembly
ODM	Orbiter Deployment Mechanism
ODS	Orbiter Docking System
OFA	Orthogrid Flight Assembly
OIU	Orbiter Interface Unit
ONTO	Oxygen/Nitrogen Tank ORU
OPIRS	Orbiter/Payload Interface Requirements Summary
ORU	Orbital Replacement Unit
OSVS	On orbit Space Vision System
PACK	Payload Active Cooling Kit
PAF	Personnel Access Floor
PBA	Portable Breathing Apparatus
PBFL	Payloadbay Floodlight
PCA	Pressure Control Assembly
PCBM	Passive Common Berthing Mechanism
PCMMU	Pulse Code Modulation Master Unit
PCR	Payload Changeout Room
PDA	Payload Disconnect Assembly
PDB	Power Distribution Box
PDR	Preliminary Design Review
PDV	Post Delivery Verification
PFE	Portable Fire Extinguisher
PGHM	Payload Ground Handling Mechanism
PGOC	Payload Ground Operations Center
PHA	Prelimianry Hazard Analysis
PICO	Pre Integration Check Out
PLB	Payload Bay
PMA	Pressurized Mating Adapter
PPRA	Positive Pressure Relief Assembly
PPRV	Positive Pressure Relief Valve
PRIT	Post Rack Installation Test
PRS	Payload Retention System
PRS	Payload Retention System
PSI	Pounds Per Square Inch
PTCS	Passive Thermal Control Subsystem
QD	Quick Disconnect
R/F	Radio Frequency
RAB	Rack Attachment Blocks
RCA	Remote Control Assembly
REAP	Removable End Access Platform
RHA	Rack Handling Adapter
RID	Rack Insertion Device
ROAP	Removable Overhead Access Platform
ROEU	Remotely Operated Electrical Umbilical
ROFU	Remotely Operated Fluid Umbilical
RPCM	Remote Power Controller Module
RSP	Resupply Stowage Rack

RSR	Resupply/Return Stowage Rack
RTV	Room Temperature Vulcanizing
S&MA	Safety and Mission Assurance
S0	Starboard O Truss Element
SAFER	Simplified Aid for EVA Rescue
SAR	Safety Analysis Report
SDP	Safety Data Package
SEE	Standard End Effector
SEM	Student Experiment Module
SFOC	Shuttle Flight Operations Contract
SIP	Standard Interface Panel
SL	Spacelab
SLAR	Spacelab Action Request
SLP	Spacelab Logistics Pallet
SMCH	Standard Mixed Cargo Harness
SMWLL	Super Middle Weight Longeron Latch
SPEC	Specification
SRMS	Shuttle Remote Manipulator System
SSP	Space Station Program
SSP	Space Shuttle Program
SSP	Standard Switch Panel
SSPF	Space Station Processing Facility
SSRMS	Space Station Remote Manipulator System
STABFIT	Stabilizer fitting
STD	Standard
STS	Space Transportation System
TBE	Teledyne Brown Engineering
TCC	Thermal Control Coating
TCID	Test Configuration Identifier Build
TCS	Thermal Control System
UARS	Upper Atmosphere Research Satellite
UF-1	Utilization Flight 1
UF-2	Utilization Flight 2
UF-3	Utilization Flight 3
UNTS	USOS/NSTS Thermal Simulator
USA	United Space Alliance
W&CG EE	Weight and Center of Gravity End Effector
WMV	Water Modulation Valve
WOV	Water ON/OFF Valve
WPP	Water Pump Package
WSK	Water Servicer Kit

APPLICABLE DOCUMENTS LIST

THE APPLICABLE DOCUMENTS LISTED REPRESENT THE LATEST REVISIONS AVAILABLE AT THE TIME THIS DOCUMENT WAS PRINTED. ANY REVISIONS MADE AFTER THIS DOCUMENT WAS PRINTED ARE NOT CONSIDERED APPLICABLE.

ICD 2-19001	Shuttle Orbiter/Cargo Standard Interfaces
JSC 10615	Space Transportation System EVA Description and Design Criteria
JSC 17481 A	Safety Requirements Document for JSC Space Shuttle Flight Equipment
MSFC-HDBK-505	Structural Strength Program Requirements
MSFC-HDBK-527 F	Materials Selection List for Space Hardware Systems
MSFC-SPEC-522 B	Design Criteria for Controlling Stress Corrosion Cracking
MSFC-HDBK-1453	Fracture Control Program Requirements
MSFC-SPEC-250 A	General Specification for Protective Finishes for Space Vehicle Structures and Associated Flight Equipment
MSFC-STD-1249	Standard NDE Guidelines and Requirements for Fracture Control Programs
MSFC-STD-2594	MSFC Fastener Management and Control Practices
MSFC-STD-486	Torque Limits For Threaded Fasteners
MSFC-STD-561	Threaded Fasteners, Securing of Flight Hardware used on Shuttle Payloads and Experiments
NASA-STD-5003	Fracture Control Requirements for Payloads using the Space Shuttle
NHB 8071.1	Fracture Control Requirements for Payloads Using the National Space Transportation System
NSTS 1700.7 B	Safety Policy and Requirements for Payloads using the Space Transportation System
NSTS 07700, Volume XIV, Appendix 7	Space Shuttle System Payload Accommodations - Extravehicular Activities
NSTS 07700, Volume XIV, Appendix 4	System Description and Design Data – Structures and Mechanics
NSTS 18798 B	Interpretations of NSTS/ISS Payload Safety Requirements
NSTS 21000 IDD STD	Interface Definition Document for Standard Payload Accommodations
SSP 30233 E	Space Station Requirements for Materials and Processes
SSP 30245 C	Space Station Electrical Bonding Requirements
SSP 30558 B	Fracture Control Requirements for Space Station
SSP 30559 B	Structural Design and Verification Requirements
SSP 30599	Safety Review Process
SSP 41164	Italian Mini-Pressurized Logistics Segment
SSP 50005 B	International Space Station Flight Crew Integration Standard
SSP 50021	International Space Station Safety Requirements Document

REFERENCED DOCUMENTS LIST

	7A.1/STS-105 Quick Reference Summary
CONT OPS 2101	EVA Contingency Training Workbook
JSC-37965	Safety Analysis Report on the Flight Releasable Grapple Fixture
K-PSM-11.510-ISS-7A.1-BL-CHG1	International Space Station Program Space Station Assembly Flight (ISS-7A.1) Launch Site Support Plan
K-SS-09.5.1	International Space Station Kennedy Space Center Min Pressurized Logisitics Module (MPLM) Ground Processing Plan
MLM-RP-AI-0055	System Hazard Analysis for Flight OP's
MLM-RP-AI-0462	Safety Verification Analysis for MPLM FM2 (Flight Op's)
RSS00HB260	Safety Assessment Report (SAR) for Orbiter Mutli Purpose Logistics Module (MPLM) Cooling System Modification
RSS99D0518	Cargo Integration Risk Assessment Report (CIRAR) STS-102
SFOC-FL0884	Shuttle Crew Operations Manual OI-27
SSD96D0304	Rockwell Aerospace ROFU Failure Modes and Effects Analysis and Hazard Analysis
SSMDH-0189	International Space Station Mission 6A MPLM Reflight/Series Assessment
STS89-0819	Rockwell Aerospace ROEU Safety Analysis Report PDR/CDR

1.0 INTRODUCTION

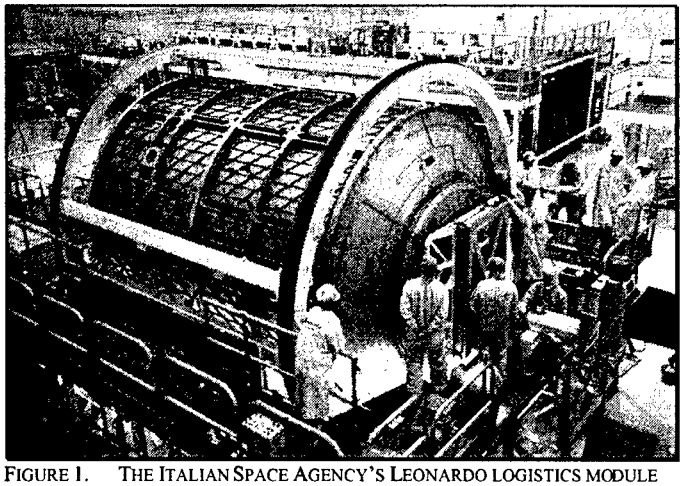


FIGURE 1. THE ITALIAN SPACE AGENCY'S LEONARDO LOGISTICS MODULE AS FINAL TESTING AND LAUNCH PREPARATIONS BEGIN AT THE KENNEDY SPACE CENTER, FLORIDA.

The Italian Space Agency (ASI)-built Leonardo Multi Purpose Logistics Module (MPLM) is the first of three pressurized modules that will serve as the International Space Station's "moving vans," carrying laboratory racks filled with equipment, experiments and supplies to and from the station aboard the Space Shuttle.

The unpiloted, reusable logistics modules function as both a cargo carrier and a space station module when they are flown. Mounted in the Space Shuttle's cargo bay for launch and landing, they are berthed to the station using the Shuttle's robotic arm after the Shuttle has docked. While berthed to the station, racks of equipment are transferred from the module to the station and are then replaced with racks and equipment from the station to be returned to earth. The logistics module is then detached from the station and positioned back into the Shuttle's cargo bay for the trip home. While in the cargo bay, the MPLM is independent of the Shuttle cabin, with no passageway for Shuttle crewmembers to travel from the Shuttle cabin to the module.

In order to function as an attached station module as well as a cargo transport, the logistics modules also include components that provide some life support, fire detection and suppression, electrical distribution and computer functions. Eventually, the modules will also carry refrigerator freezers for transporting experiment samples and food to and from the station. Although built in Italy, the logistics modules are owned by the U.S. and provided in exchange for Italian access to U.S. research time on the station.

The Leonardo module is the first of three such modules and was launched on Shuttle mission STS102 in March 2001. On that flight, Leonardo was filled with equipment and supplies to outfit the U.S. laboratory module. The US Laboratory was launched on STS-98 in January 2001. The Rafaello module is the second MPLM module and was luanched on Shuttle mission STS-100. On its flight, Rafaello was used to continue outfitting the US Laboratory and to resupply the International Space Station.

Construction of ASI's Leonardo module began in April 1996 at the Alenia Aerospazio factory in Turin, Italy. Leonardo was delivered to Kennedy in August 1998 by a special Beluga cargo aircraft. The cylindrical module is approximately 21 feet long and 15 feet in diameter, weighing almost 4.5 (english) tons. It can carry up to 10 (english) tons of cargo packed into 16 standard space station equipment racks. Of the 16 racks the module can carry, five can be furnished with power, data and fluid to support a refrigerator freezer. The second module, named Rafaello, was delievered to KSC in 1999. The third module, named Donatello, was delivered to KSC in 2000.

1.1 SCOPE

This doucment was written to provide a safety reflight assessment of the Leonardo module (FM1). The information contained in this document was taken directly from ISS-MPLM-DOC-002 "Multi Purpose Logistics Module (MPLM)/Orbiter Integrated Phase III Safety Data Package" which was approved before the first flight of the MPLM FM1. There have been no design changes made as a result of the first flight of the MPLM FM1 system. As a result, the orginal hazard reports are still valid and remain unchanged.

The safety data presented in ISS-MPLM-DOC-002 relates to flight hazards associated with the interfaces between the Multi Purpose Logistics Module (MPLM) and the Orbiter Payload Hardware (PRLAs, AKA, ROEU, and the ROFU). This data was prepared in accordance with the requirements for a Phase III Safety Data Package as outlined in SSP 30599. The Hazard Analysis attached in Appendix A of ISS-MPLM-DOC-002 is based on information taken from the following Hazard Reports shown in Table 1.

TABLE 1. HARDWARE HAZARD REPORTS.

Hardware	Doc. No.	Title	Organization
MPLM	MLM-RP-AI00055	System Hazard Analysis for Flight OP's	Alenia
ROEU	STS89-0819	Remotely Operated Electrical Umbilical Safety Analysis Report PDR/CDR	Boeing RSS
ROFU	SSD96D0304	Failure Modes and Effects Analysis and Hazard Analysis Remotely Operated Electrical Umbilical	Boeing RSS
FRGF	JSC-37965	Safety Analysis Report on the Flight Releasable Grapple Fixture	JSC
Orbiter/ Cargo Interfaces	RSS99D0518	Cargo Integration Risk Assessment Report (CIRAR) STS-102	Boeing RSS
Orbiter/MPLM Cooling System	RSS00HB260	Safety Assessment Report (SAR) for Orbiter Mutli Purpose Logistics Module (MPLM) Cooling System Modification	Boeing RSS

In writing this hazard analysis, the causes, controls, and verifications identified in Appendix A were taken directly from an existing hazard analysis where possible. New controls and verifications were only written in cases where an existing hazard report could not be used. Hazard controls dealing with the MPLM are based on the Alenia MPLM Hazard Analysis. This hazard report was presented to the SRP and was signed at a phase III level. Hazard controls for the ROEU and the ROFU are based on Hazard Analysis done by Boeing RSS. Since both pieces of hardware are considered shuttle hardware, their reports were never presented to the SRP but where presented to a shuttle panel instead. The ROEU analysis was signed in 1990. The ROEU was flown on theshuttle approximately eight times before the first MPLM flight. Table 13 in section 4.10 gives a flight history of the ROEU. The ROFU analysis is still being developed and is considered to be at a CDR level. The latest revision of this analysis was done in 1996. The ROFU is not expected to fly until ISS Flight UF-3. Hazard controls related to the FRGF are based on the hazard analysis written by the Automation, Robotics and Simulation Division of the JSC Engineering Directorate. This analysis was approved in 1995 and consists of a Preliminary Hazard Assessment (PHA) and one hazard report. The report was written to address an uncommanded release of a payload due to the structural failure of the FRGF. All of the other hazards in the PHA were not taken forward for reasons given in the PHA. A copy of this PHA is provided in Appendix G of ISS-MPLM-DOC-002. Existing hazard reports for the PRLAs and the AKA could not be found. Hazard controls related to the PRLAs, the AKA, and other Orbiter to Cargo interfaces are based on a preliminary copy of the analysis done by Boeing RSS for STS-102. Boeing RSS has the responsibility to address all of the hazards involved with the Boeing cargo integration process, the cargo mix, and the Orbiter/Cargo interfaces for each Shuttle flight. As part of this process, a Cargo Integration Risk Assessment Report is released for each shuttle flight. Hazard controls related to the Orbiter/MPLM Cooling System are based on a preliminary copy of the Safety Assessment Report done for the Orbiter/MPLM Cooling System PDR. The United Space Alliance (USA) has the resposibility for certifiying all of the shuttle owned Orbiter to cargo interfacing hardware (PRLAs, AKA, ROEU, ROFU, and so on). Any problems related to this hardware are addressed by USA through Shuttle Program processes.

Hardware	Manufacturer	Responsible Organization	
MPLM	Alenia	MSFC	Station Hardware
ROEU	Boeing RSS	JSC (USA)	Shuttle Hardware
ROFU	Boeing RSS	JSC (USA)	Shuttle Hardware
FRGF	SPAR	JSC (USA)	Station Hardware
PRLA	Boeing RSS	JSC (USA)	Shuttle Hardware
AKA	Boeing RSS	JSC (USA)	Shuttle Hardware
MPLM Heat Exchanger	Boeing RSS	JSC (USA)	Shuttle Hardware

2.0 MISSION OVERVIEW

Flight 7A.1 is scheduled to fly on STS-105 (Discovery) in the July to August timeframe of 2001. The primary objective of this flight is crew rotation with the Expedition 3 crew replacing the Expedition 2 crew on the International Space Station at the conclusion of this flight. Subsequent objectives include the transfer of logistics and utilization payloads for Station Increment 3. Table 2 shows the Flight 7A.1/STS-105 crewmembers.

TABLE 2. FLIGHT 7A.1/STS-105 CREWMEMBERS.

Flight 7A.1/STS-105 Crewmembers					
	ISS 7A.1 Crew	Expedition 3 Crew		Expedition 2 Crew	
CDR	Scott J. Horowitz	ISS3-1	Frank Culbertson (CDR)	ISS2-1	Yuri Usachev (CDR)
Pilot	Frederick W. Sturkow	ISS3-2	Vladamir Dezhurov	ISS2-2	James Voss
MS1	Patrick G. Forrester EV1	ISS3-3	Mikhail Turin	ISS2-3	Susan Helms
MS2	Daniel T. Barry EV2				
Note: Flight 7A.1 is currently planned as a crew rotation mission.					

For Flight 7A.1, Discovery has been outfitted with the Orbiter Docking System (ODS) and the following payload carriers: the Integrated Cargo Carrier (ICC), the Multi Purpose Logistics Module (MPLM) Leonardo, and Hitchhiker Experiments Advancing Technology (HEAT). The ICC is an unpressurized carrier used to secure Orbital Replacement Units (ORUs) during the launch and on orbit phases of the missionuntil they can be installed during mission EVAs. The Flight 7A.1 ICC is used to carry the S0 truss cables, the External Ammonia Servicer, and MISSE experiments. Current plans are to install these payloads on the station during the two scheduled EVAs. The MPLM is used primarily to carry logistics equipment related to Station Increment 3 and is described in greater detail below. The current mission profile calls for the Orbiter to dock to PMA 2 of the ISS on Flight Day 3. Station Crew handover and middeck equipment transfers are expected to begin immediately upon ingress. Shuttle middeck equipment consists primarily of equipment for crew rotation, MPLM activation, and the HRF and Dreamtime projects. The MPLM will be installed on the ISS and activated on Flight Day 4. This will give the STS-105 crew four full days to complete all rack and soft stowage transfers. The HEAT payload is actually a collection of Get Away Special (GAS) canisters under the direction of Goddard Space Flight Center. Heat consists of the following experiements: the Advanced Carrier Equipment (ACE) avionics system, Simplesat, the Student Experiment Module (SEM), G-774, and G-780.

The MPLM is a pressurized carrier that supports the ISS logistics scenario by providing the capability for cargo uploading and downloading without the need for Extravehicular Activity (EVA). The MPLM can be set up in one of two different configurations. These are the active configuration and the passive configuration. In the passive configuration, the MPLM is attached to the orbiter at its structural interfaces and receives power through the ROEU in order to operate the shell heaters and monitor the MPLM systems. These heaters are only powered while the MPLM is on orbit. During the launch and landing phases of the mission, the MPLM is unpowered. The active configuration is identical to the passive configuration except for the addition of the refrigerator/freezer system. This system allows the MPLM to carry payloads that have to be maintained at low temperatures and requires the use of the ROFU. The ROFU is an umbilical used to establish a fluid connection between the MPLM and the Orbiter heat exchanger system. An MPLM in the active configuration is also unpowered during the launch and landing phases of the mission. The MPLM is currently planned to operate in the passive mode until Flight UF-3.

On Flight 7A.1, the MPLM will carry twelve integrated racks. Two of these are experiment racks that will be transferred to the US Laboratory once on orbit (EXPRESS rack 4 and 5). The remaining ten racks are used for logistics and consit of six Resupply Stowage Racks (RSRs), and four Resupply Stowage Platforms (RSPs). All of these racks and platforms will be passive on Flight 7A.1 and no power is provided to the rack locations. The MPLM is composed of a cylindrical shell terminated on one side by a forward cone that includes hatch and berthing mechanism to allow on-orbit transfer of crew and utilities, and on the other side, by a large access door for cargo installation and removal on the ground.

The MPLM will not be powered during the ascent phase of Flight 7A.1. MPLM on-orbit activities begin after the payload bay doors have been opened. The MPLM is powered during this phase and is unpowered prior to docking. Once the Orbiter rendezvous and docks to the ISS, the MPLM is removed from the Payload Bay (PLB) and attached to the ISS. The racks and RSP stowage bags are transferred between the MPLM and the ISS. The Boeing Prime Hazard Analysis will address the hazards that could occur during rack and stowage transfer. The MPLM is detached from the ISS and secured in the Orbiter PLB. The hazards that are associated with the MPLM transfer to and from the ISS are addressed by the Boeing Prime Hazard Analysis. TheOrbiter undocks, de-orbits, and lands.

Post flight the MPLM is inspected in the airlock area for any immediate damage, installed in the Element Rotating Stand where it is opened and the racks are removed and returned to the rack processing area. The maintenance activities are then performed including a possible reconfiguration from passive to active and a leak check. A MPLM storage period may be necessary.

The following tables provide additional data on the Flight 7A.1 mission. Table 4 shows the primary tasks set for the Flight 7A.1 mission. Those items in bold are tasks that involve the MPLM. Table 5 shows the US and Russian hardware to be transferred on this flight. Items in bold are items that aremanifested in the MPLM.

TABLE 3. KEY MISSION OBJECTIVES.

Key Mission Objectives or Flight 7A.1/STS-105	
1	Water Transfer from Shuttle to ISS (10 CWC's)
2	Rotate Expedition 2 crew with Expedition 3 (includes mandatory crew equipment transfer and mandatory crew handover
3	**Berth MPLM to Node 1 nadir port, activate and checkout MPLM**
4	**Transfer to ISS from MPLM and middeck: critical systems, maintenance, and crew related cargo**
5	**Return MPLM to cargo bay**
6	EVA: Transfer and install the EAS, connect associated umbilicals, and apply heater power
7	EVA: Transfer and S0 LTA ORU heater power cables
8	Generic crew handover
9	**Transfer and stow EXPRESS racks in US lab**
10	Transfer active payloads from Shuttle middeck to US Lab, install inRack #1, apply power. Transfer on-orbit payloads from US Lab to middeck for return.
11	**Transfer and stow critical return hardware from ISS to MPLM and middeck**
12	**Transfer and stow remaining hardware from MPLM and middeck to ISS**
13	**Transfer and stow remaining hardware from ISS to MPLM and middeck**
14	Flight specific crew handover
15	EVA: Transfer, install, and deploy MISSEPECs on joint airlock crew lock and high pressure gas tank #2
16	Perform Human Research Facility (HRF) Hoffman Reflex (H-Reflex) experiment data collection.
17	Perform Dreamtime payload activities
18	EVA: Install S0 LTA ORU heater power cables
19	EVA: Remove/relocate 2 handrails from the US Lab in preparation for Flight 8A.
Note: Activities related to the MPLM are in bold.	

TABLE 4. US AND RUSSIAN HARDWARE.

US and Russian Hardware manifested on Flight 7A.1/STS-105	
US Hardware	Russian Hardware

• CHeCS, crew provisions, and housekeeping pantry
• Temporary Sleep Station (TESS)
• Radiation Protection Bricks
• Utilization
  • **EXPRESS Racks 4 and 5**
  • Advanced Protein Crystal Facility (APCF)
  • Biotechnology Refrigerator (BTR)
  • Dynamically Controlled Protein Crystall Growth (DCPCG)
  • Dreamtime
  • Human Research Facility (HRF)
  • Biotechnology Cell Science Stowage (BCSS)
  • Biotechnology Specimen Temperature Controller (BSTC)
  • (2) MISSE Passive Experiment Carriers (PECs) (External)
• DC/DC Converter Unit – External (DDCU-E)
• Remote Power Controller Module (RPCM)
• S0 LTA ORU heater power cables and EVA handrails
• SAFER and EVA tools
• **Portable Fire Extinguisher (PFE)**
• ISS Ham
• 10 CWC's
	800 A Battery
	(50) Food Containers
	PTAB

Note: Items manifested on the MPLM are in bold.	

TABLE 5. PROJECTED UPCOMING MPLM MISSIONS.

Projected MPLM Missions					
Flight	Date	STS	MPLM	MPLM Manifest	MPLM/Orbiter Interfaces
5A.1	**Mar 2001**	**102**	**Leonardo**	**6 System Racks, RSRs, RSPs**	**PRLAs, AKA, ROEU**
6A	**Apr 2001**	**100**	**Rafaello**	**RSPs, RSRs, ISPRs**	**PRLAs, AKA, ROEU**
7A.1	Aug 2001	105	Leonardo	RSRs, RSPs, ISPRs,	PRLAs, AKA, ROEU
UF-1	Nov 2001	106	Rafaello	ISPRs, RSRs, RSP-2s	PRLAs, AKA, ROEU
UF-2	Apr 2002	109	Leonardo	ISPRs, 3 RSRs, 1 RSPs, 1 RSP-2s, MELFI	PRLAs, AKA, ROEU
ULF1	Aug 2002	113	Rafaello	RSRs, RSPs, ISPRs,	PRLAs, AKA, ROEU
UF-3	Jan 2005	129	Donatello	ISPRs, 1 JEM rack, 1 RSP, 1 RSP-2	PRLAs, AKA, ROEU, ROFU
UF-5	Sep 2005	133	Leonardo	ISPRs, 1 RSP, 1 RSP-2,	PRLAs, AKA, ROEU, ROFU
17A	Dec 2005	139	Rafaello	1 Lab system rack, 4 Node system rack, 3 CHeCS, 2 RSP-2s, ISPRs	PRLAs, AKA, ROEU, ROFU
UF-6	Jan 2006	135	Donatello	3 RSP-2s, 1 RSP, ISPRs	PRLAs, AKA, ROEU, ROFU
19A	Feb 2006	141	Leonardo	5 RSP-2s, RSR, ISPRs, 4 Crew Quarters	PRLAs, AKA, ROEU, ROFU

Note: Flight UF-3 may be the first flight of an MPLM in the active configuration, which means that the ROFU wll be flown as well. Missions subsequent to Flight UF-3 may also be flown in the active configuration. Missions in bold have already flown.

3.0 SYSTEM DESCRIPTION

For any given MPLM mission, the Orbiter carries the MPLM and its interfacing hardware. This hardware consists of the Payload Retention Latch Assemblies (PRLAs), the Remotely Operated Electrical Umbilical (ROEU), and the Remotely Operated Fluid Umbilical (ROFU). The ROEU is attached to the Starboard side of the Orbiter payload bay and provides electrical power to the MPLM through a connector. The Orbiter half of this connector is called the Orbiter Disconnect Assembly (ODA). The MPLM half of the connector is called the Payload Disconnect Assembly (PDA). The orbiter side of the ROEU is connected directly into the Shuttle wiring harness through a one quarter Standard Mixed Cargo Harness (SMCH). The ROFU is mounted on the Port side of the Orbiter payload bay. Its purpose is to provide a connection between the MPLM refrigerator/freezer system and the Orbiter cooling system. It connects to the MPLM through the same type of connector as the ROEU. The only difference is that this connector houses a set of fluid connections instead of electrical connections. The orbiter side of ROFU is attached directly to the orbiter heat exchanger system through the Payload Active Cooling Kit (PACK). Both the ROEU and ROFU are designed to be operated remotely. The MPLM is structurally attached to the Orbiter through the Payload Retention System (PRS). This system is made up of the Payload Retention Latch Assemblies (PRLAs) and the Active Keel Assembly (AKA). There are 4 PRLAs and 1 AKA holding the MPLM in position when in the Orbiter payload bay. The PRLAs and the AKA can be remotely latched and unlatched during MPLM transfer.

The following four figures represent the MPLM and its subsystems while in the payload bay.

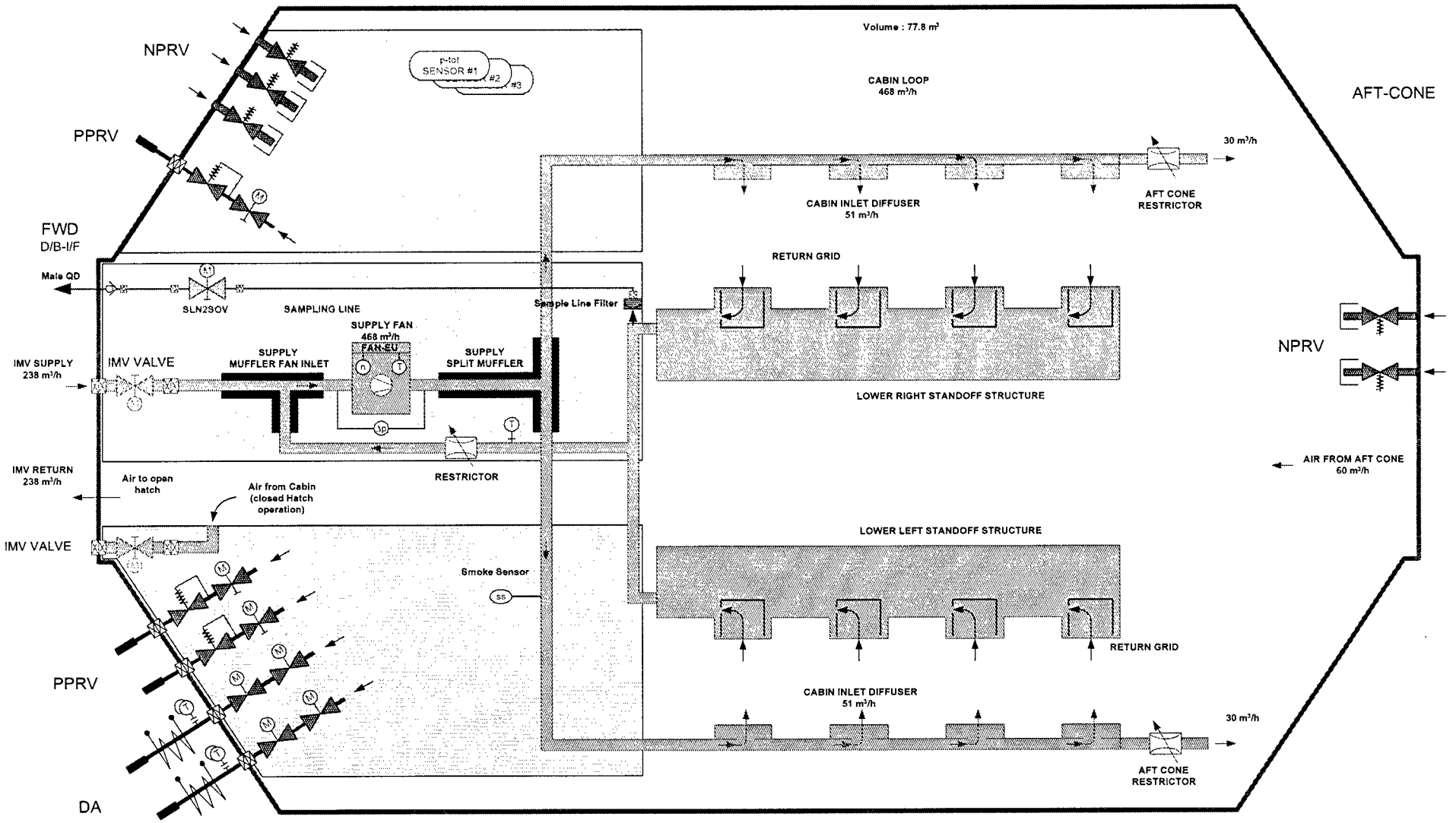


FIGURE 2. MPLM ECLSS SCHEMATIC.

MPLM ATCS

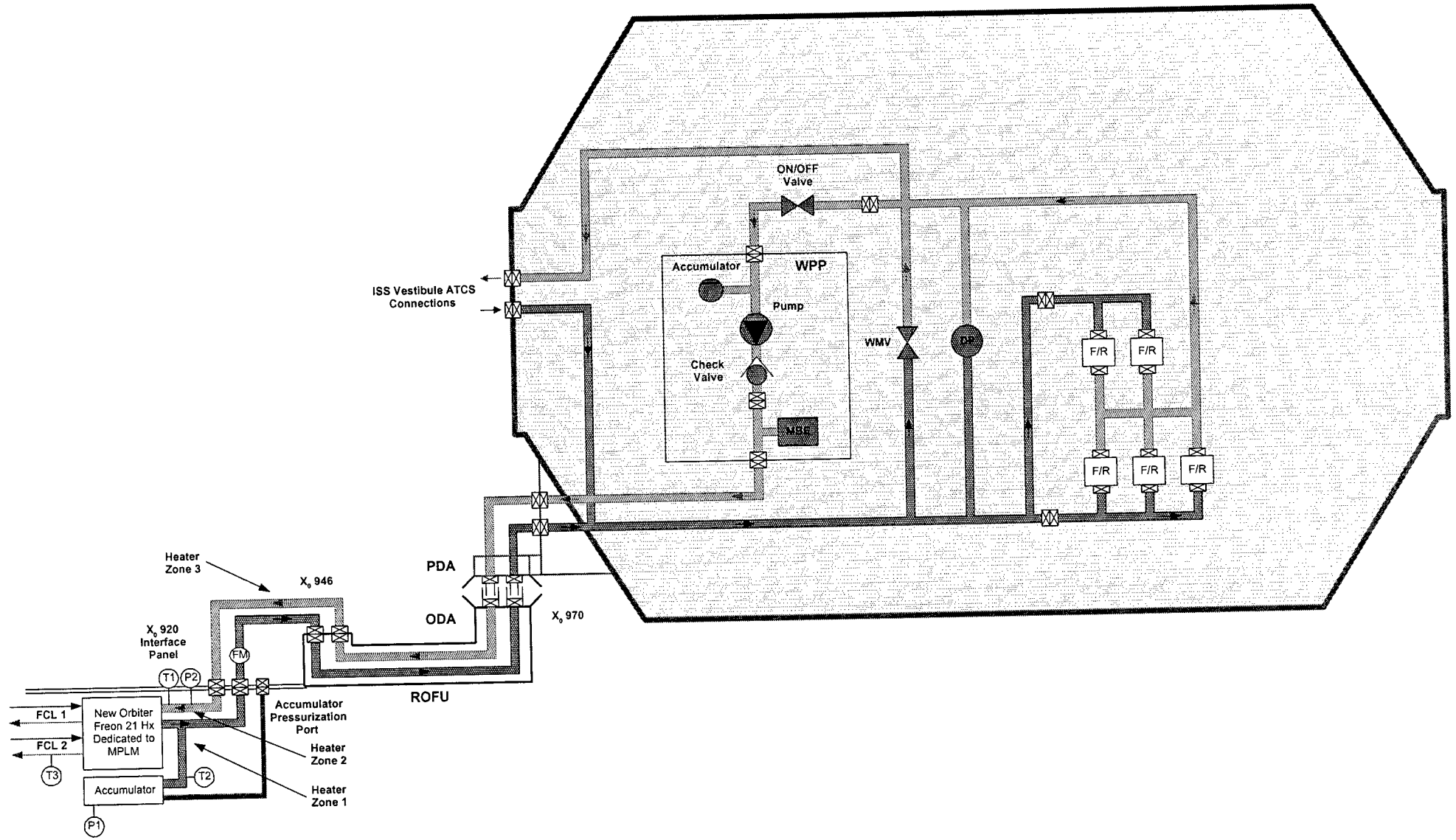


FIGURE 3. MPLM ATCS SCHEMATIC.

MPLM EPDC

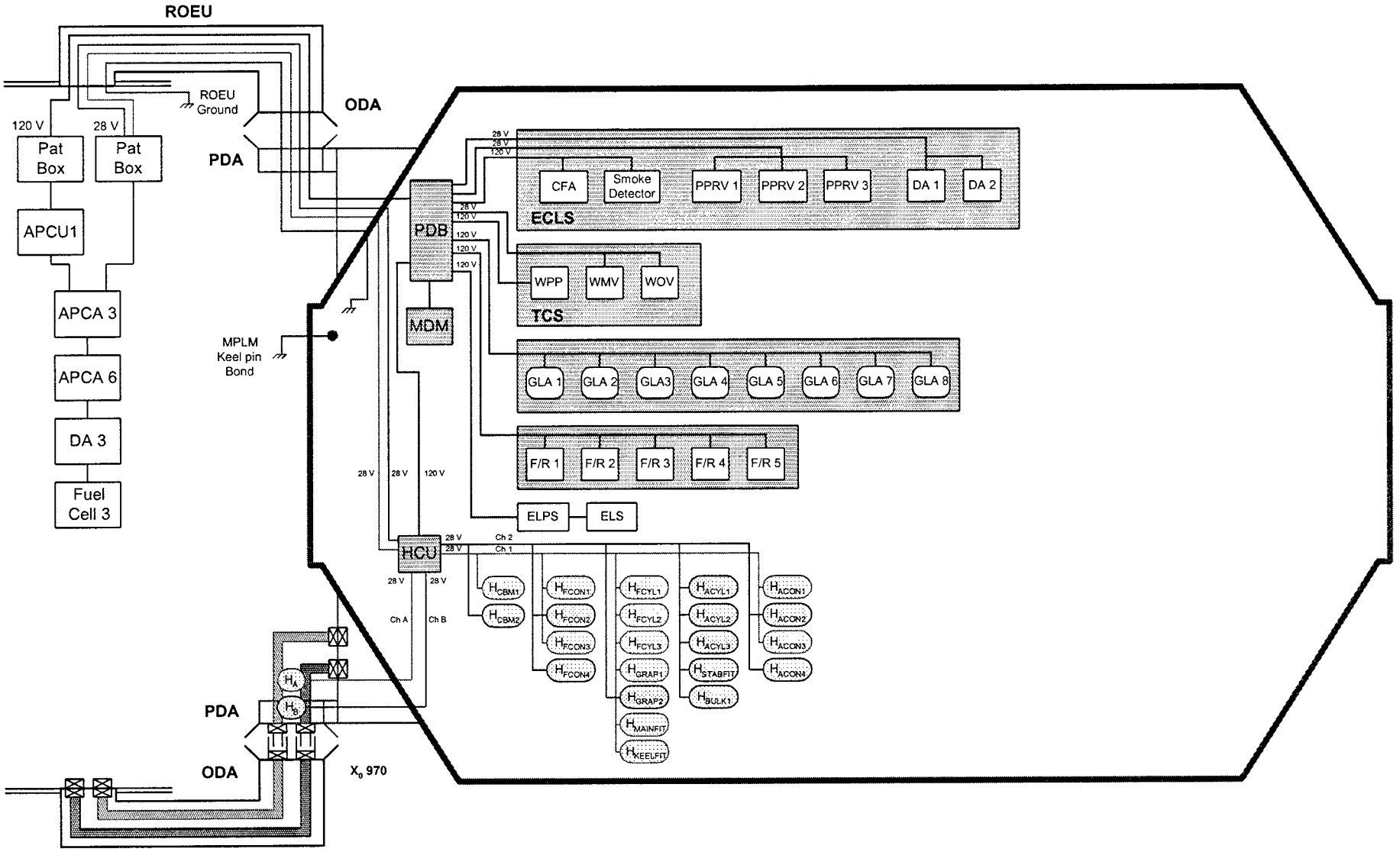
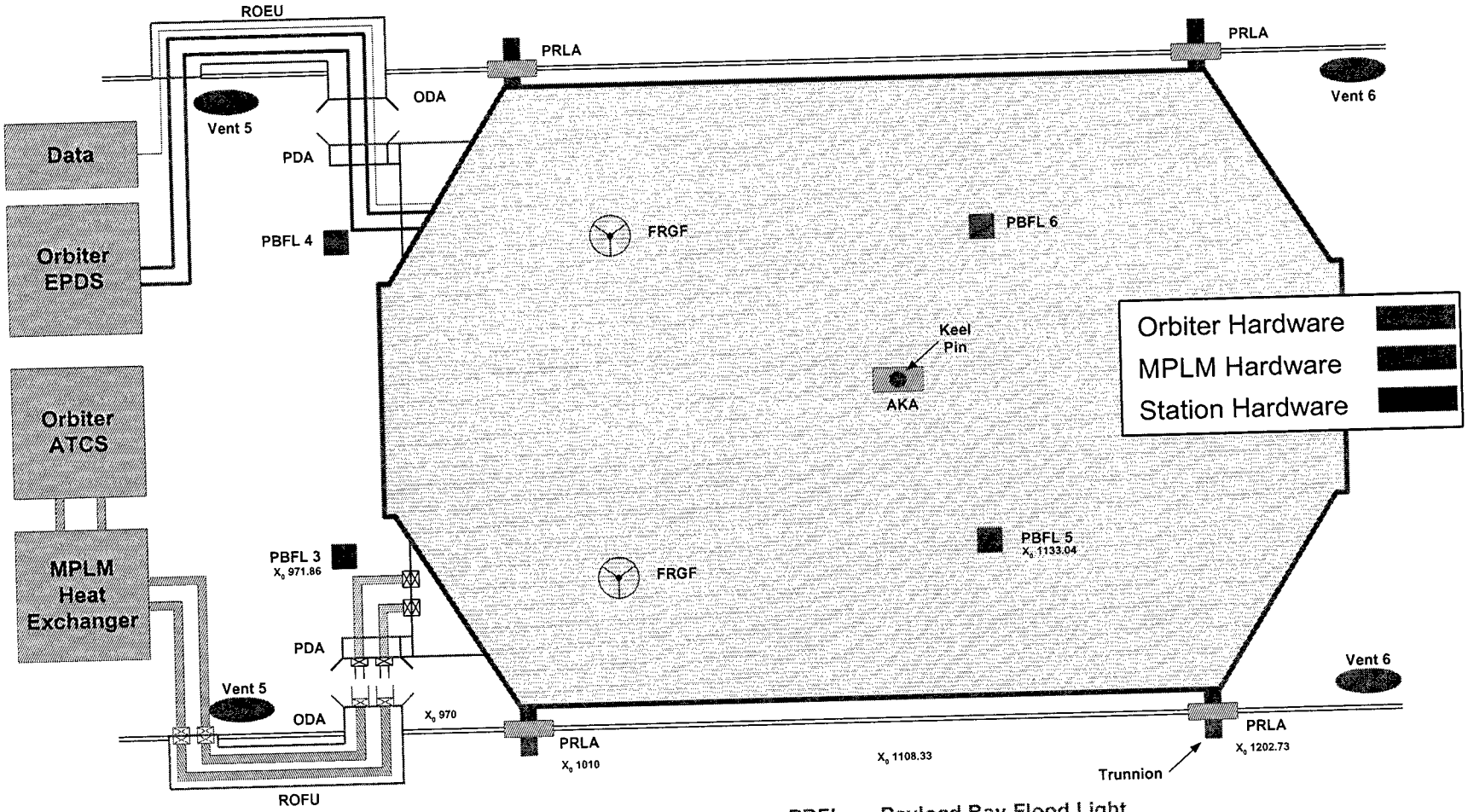


FIGURE 4. MPLM EPDC SCHEMATIC.

MPLM to ORBITER Interfaces



AKA	Active Keel Assembly
ATCS	Active Thermal Control System
EPDS	Electrical Power Distribution System
FRGF	Flight Releasable Grapple Fixture
MPLM	Multi Purpose Logistics Module
ODA	Orbiter Disconnect Assembly

PBFL	Payload Bay Flood Light
PDA	Payload Disconnect Assembly
PRLA	Payload Retention Latch Assembly
ROEU	Remotely Operated Electrical Umbilical
ROFU	Remotely Operated Fluid Umbilical

FIGURE 5. MPLM TO ORBITER INTERFACES.

4.0 HARDWARE DESCRIPTION

4.1 MPLM

The MPLM is a pressurized logistic system that is used in the International Space Station program for the two-way transport of supplies and materials (up to 9,000 kg), including user experiments, between Earth and orbit using the Shuttle. The MPLM is also designed to work attached to the International Space Station (ISS) to support active and passive storage and to provide a habitable environment for two people when in orbit. The configurations studied by Alenia Aerospazio allow transportation of passive cargo only, or a combination of passive and active cargoes utilizing cold cargo functions accommodated in refrigerator/freezer (R/F) racks.

The MPLM provides two major functions. It operates first, as a carrier that can be flown on multiple missions, and second, as a habitable module operating on orbit. To meet these two design goals, the MPLM was built with a complex robust system capable of operating for 25 missions over a period of 10 years. The MPLM is the first space station module designed as an active module in the Shuttle payload bay.

The MPLM is a pressurized cylindrical module measuring 4.6 m in diameter. Including the forward and aft cones, it measures 6.5 m with a total mass of 4,685 kg. The total payload carrying capablity is 9,000 kg. The payloads are accommodated in sixteen tiltable and removable racks called International Standard Payload Racks or ISPRs. Five of these racks can be powered to allowed the transportation of payloads that require conditioning. The habitable volume remaining for the crew after the ISPR installation amounts to 31 m^3 (881 ft^3). The MPLM is designed to carry payloads that require a pressurized environment to and from the ISS. The MPLM is capable of transporting passive racks as well as racks requiring refrigerator or freezer interface services. For the passive missions, the MPLM is capable of carrying 16 racks. For active flights, the MPLM can carry 11 passive racks and 5 Refrigerator/Freezer Racks.

The MPLM external configuration consists of an Aluminum cylindrical shell that is closed at the ends with a forward cone and an aft cone. An external view is shown inFigure 6. The forward cone includes the common berthing mechanism for berthing the MPLM, the hatch, the vent valves, and the NSTS Orbiter umbilical connectors. The forward cone also contains equipment necessary to provide a comfortable working environment once attached to the station. The aft cone is terminated by an 8 foot diameter closure that canbe removed during ground operations to facilitate integration activities.

The module is equipped with two grapple fixtures used to transfer the MPLM between the Orbiter andthe ISS via remote manipulator system arms. The primary shell is covered with a Micrometeoroid Debris Protection System (MDPS) and is thermally isolated using a set of Multilayer Insulation Blankets (MLI). Once attached to the station, the MPLM is designed to function as part of the station for up to 16 days before it is returned to the Orbiter payload bay.

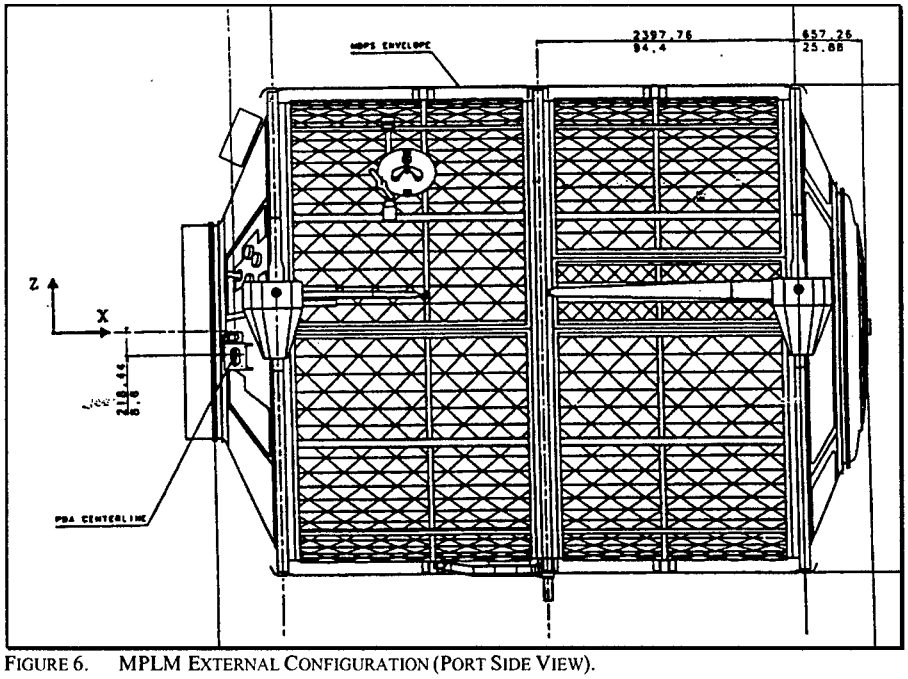


FIGURE 6. MPLM EXTERNAL CONFIGURATION (PORT SIDE VIEW).

4.1.1 STRUCTURE AND MECHANISM.

The MPLM Flight System consists of the primary structure, the secondary structure, and the mechanisms.

4.1.1.1 PRIMARY STRUCTURE.

The MPLM Flight System primary structure is designed to transport a maximum of 20,000 lbs (9,072 kg) of cargo and equipment. The main components of the primary structure are:

- The cylindrical shell, which consists of two sections interfacing through a central ring:
- Three (3) forged rings (two external rings and one central ring) and two (2) machined rings
- (Intermediate rings);
- Sixteen (16) box-shaped longeron assemblies;
- The Forward (FWD) cone shell, which consists of Aluminum alloy waffle panels welded together,
- Plus one Feed-through (F/T) plate;
- The Bulkhead, which includes the penetrations for the utility lines to/from the ISS;
- The Hatch;
- The aft cone shell, formed by waffle panels welded together and one forged ring;
- The Aft Access Closure AAC);
- The flight fittings (two main fittings, two stabilizing fittings and one keel fitting);
- The Rack Attachment Blocks (RAB's), which provide the mechanical interface between the racks and the cylindrical shell longerons.

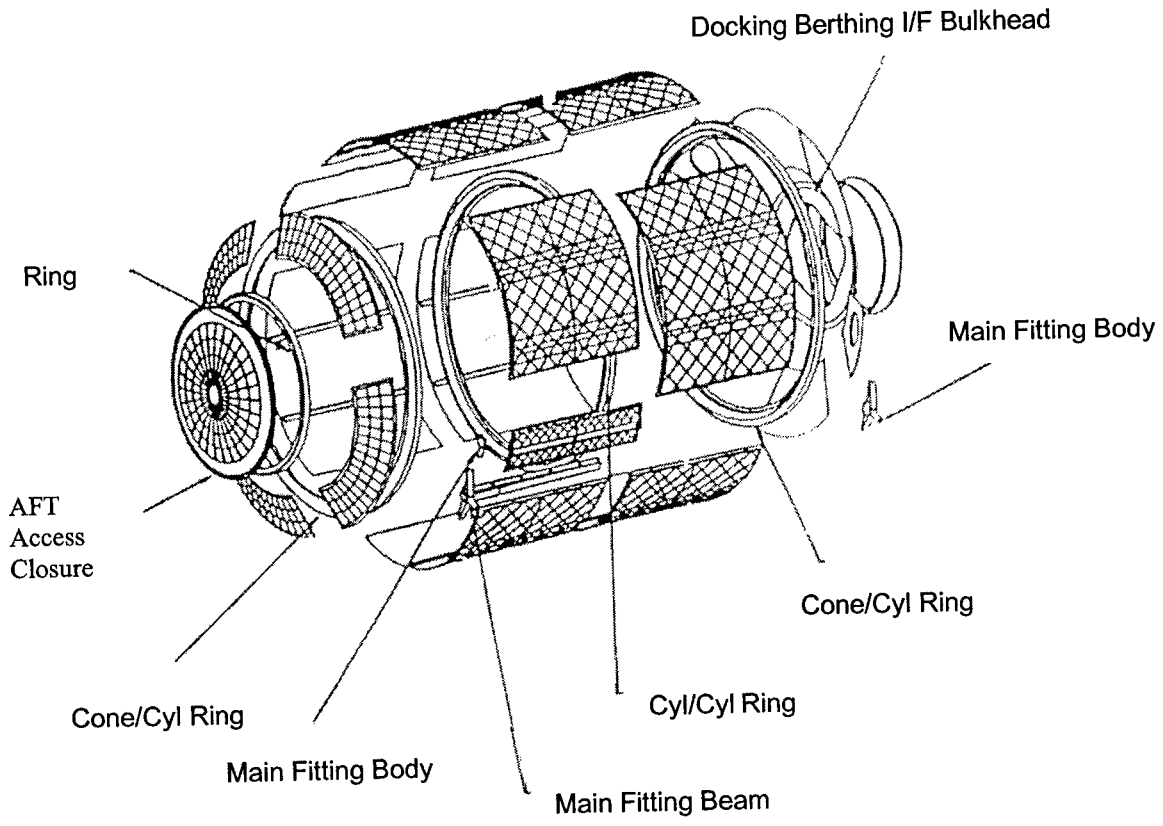


FIGURE 7. MPLM PRIMARY STRUCTURE.

4.1.1.2 SECONDARY STRUCTURE.

The MPLM Flight System secondary structure includes:

- The Meteoroid and Debris Protection System (MDPS), which consists of a single bumper shield, provided with openings in proximity of the Grapple Fixtures, the atmosphere control valves and other hardware arranged externally on the module shell;
- The FWD cone support structure, which includes three independent honeycomb panels connected to the primary structure, used to support most of the MPLM Flight System equipment:
- Four stand-offs, which mainly provide support for diffusers, grids, lights, ducting, piping and electrical harness; the stand-offs also allow rack on-orbit tilting by insertion of dedicated hinge mechanisms; the upper stand-offs are open, while the lower ones are closed by means of light-weight panels for ventilation purposes.
- Close-out panels, to meet Human Factor Engineering requirements, and light-weight panels for fire suppressant containment;
- Bracketry.

4.1.1.2.1 MPLM METEOROID AND DEBRIS PROTECTION SYSTEM (MDPS) DESCRIPTION

The MPLM is protected from the meteoroid and debris environment by means of a single bumper shield 0.031 in (0.8 mm) thick, made of aluminum alloy. The distance between the shell internal surface and the MDPS external surface is 5 in (127.6 mm). The MPLM covering consists of 48 panels on the cylindrical shell, 6 panels on the FWD cone, 6 panels on the aft cone, and 6 panels on the AAC. Openings in the coverings are provided for the attachment of the two FRGFs and in the center of the AAC for the installation of two NPRVs. The exterior surface of the MDPS is chemically treated for passive thermal control.

4.1.1.3 MECHANISMS.

The MPLM Flight System include the following external mechanisms:

- The Passive Common Berthing Mechanism (PCBM), to interface with the Active Common Berthing Mechanism (ACBM) installed on the ISS Node 1 and Node 2 nadir ports;
- Two (2) Flight Releasable Grapple Fixtures (FRGF's), to allow the on-orbit deployment and berthing to the ISS, and the retrieval and the re-insertion into the Orbiter cargo-bay;
- The Remotely Operated Electrical Umbilical (ROEU) and the Remotely Operated Fluid Umbilical (ROFU) Payload Disconnect Assemblies (PDA's).

4.1.1.4 FLIGHT FITTINGS

The flight fittings provide the mechanical interface between the MPLM and the Orbiter. The MPLM flight fittings consist of two primary trunnions reacting to X and Y loads, two stabilizing trunnions reacting to Z loads, and one keel pin that reacts to Y loads. The primary fittings are fixed to the aft external ring along the Y direction. The stabilizing fittings are fixed to the forward external ring along the Y direction. Each primary and secondary fitting consists of:

- A titanium alloy body attached by bolts to the external ring;
- A titanium alloy longitudinal beam fixed to the aft external ring and to the cylindrical shell with hi-lock fasteners;
- An inconel trunnion externally plated with chromium and housed in a dedicated seat drawn into the body;
- An aluminum alloy scuff plate that protects the trunnion from impacts against the orbiter payload bay.
- The keel fitting is fixed to the central ring along the Z direction. Each keel fitting consists of:
- A titanium alloy body attached by bolts to the external ring;
- An inconel trunnion externally plated with chromium and housed in a dedicated seat drawn into the body;
- A beam reacting to the friction induced loads.
- The distance between the trunnion centerlines of the primary and stabilizing fittings is 192.73 in (5895.3 mm). The distance between the keel pin and the primary trunnions is 94.4 in (2397.8 mm) centerline to centerline.

4.1.2 MPLM INTERNAL CONFIGURATION

The MPLM internal structural configuration consists of Rack Attachment Blocks (RAB's), the Forward Cone Structure, and Rack Standoffs, Close out and Light Panels, and support brackets.

The RAB's transfer the loads that are induced by the launch and landing accelerations from the payload racks to the MPLM longeron assembly. The RAB's are Titanium alloy brackets that interface between the cylindrical shell, and both the standoffs, and rack knee brace or lower rack assemblies.

The rack standoffs are constructed from five aluminum frames that are connected together by an I-shaped beam. The MPLM has two upper and two lower standoffs that are designed to allow the unobstructed routing of wire harnesses, air ducting and water piping. These standoffs allow for on-orbit rack tilting with the hinge orbital support equipment.

The Forward Cone Structure consists of three independent honeycomb panels connected to the primary structure through five points. To reduce the risk of crew injury and to avoid loose hardware concerns, close out panels are provided in the Forward Cone Structure. Light panels are provided for fire suppression containment purposes. These panels are constructed of beta cloth.

During launch, landing and on orbit pre-MPLM operational phases, the racks are connected to the MPLM by four attach points. Two upper attach points interface with the rack knee brace assembly. The two lower rear attach points connect to a dedicated MPLM bracket. The upper and lower attach points contain restraint pins that prevent the attach rods from backing out under a launch load environment. Two pivot point attachments are used on orbit to transfer the loads associated with the rack transfer operations to the MPLM Standoffs.

4.1.3 MPLM AVIONICS SYSTEM (AVS)

The MPLM Avionics System provides the electrical power distribution and conditioning, module illumination, and data management functions for the MPLM. The electrical power distribution and conditioning subsystem takes 120 VDC externally supplied power and distributes an internal power supply of 120 VDC and 28 VDC inside the MPLM. The module illumination subsystem provides both general and emergency egress lighting from the MPLM. The Data Management subsystem provides the capabilities to monitor and control the MPLM equipment and the Refrigerator/Freezer Racks (if configured for an active mission). The data management function is performed by one Multiplexer/Demultiplexer that can interface with the Orbiter Interface Unit, the ISS MDM INT ½, and the KSC EGSE.

Table 6 shows the component average power usage based on the Flight 5A.1 mission. Subsequent missions will show a similar table.

The Avionic System (AVS) performs electrical power distribution and conditioning, module illumination, data management and processing. The electrical power distribution equipment includes:

- One (1) Power Distribution Box (PDB), which distributes electrical power to all subsystem equipment (except for the shell heaters) depending on the user interface characteristics;
- One (1) Heater Control Unit (HCU), which distributes electrical power to the shell heaters;
- One (1) Battery, which supplies the ROFU PDA heaters during the transfer phases (when the MPLM is manifested with active cargo).

The module general illumination is accomplished by means of eight (8) General Luminare Assemblies (GLA's), switched on/off by one (1) Remote Control Assembly (RCA). The emergency illumination, which ensures lighting for an emergency egress in the event of loss of power, is provided by the Emergency Egress Lighting (EEL) System, which consists of one (1) Emergency Lighting Strip and one (1) Emergency Lighting Power Supply (ELPS). The ELPS is re-charged on-ground during each turn-around.

The data management and processing provides the capability to monitor and control the MPLM Flight System equipment and the active cargo (when included in the flight manifest). The hardware dedicated to this function is the Multiplexer/Demultiplexer (MDM). Electrical harness (cabling, connectors, backshells, MIL-STD-1553B components) is provided to support power distribution and data transfer.

TABLE 6. MPLM COMPONENT AVERAGE POWER USAGE (BASED ON FLIGHT 5A.1 MISSION).

Subsystem/Equipment	Estimated Power	Margin	Continuous Power
ECLSS			
Depress Assembly #1	0	0	0
Depress Assembly #1 Heater	0	0	0
Depress Assembly #2	0	0	0
Depress Assembly #2 Heater	0	0	0
Positive Pressure Relief Assy #1	0	0	0
Positive Pressure Relief Assy #2	0	0	0
Positive Pressure Relief Assy #3	0	0	0
Pressure Transducer #1	0	0	0
Pressure Transducer #2	0	0	0
Pressure Transducer #3	0	0	0
Sampling Line Shut-Off Valve (SSOV)	0.8	0	0.8
Duct Smoke Detector	0	0	0
Air Temperature Sensor	0	0	0
IMV Shut-Off Valve #1	0	0	0
IMV Shut-Off Valve #2	94	0	94
Cabin Fan Assembly	*95*	*0*	*95*
ECLSS Total Power			
TCS			
Water Pump Package	N/A		N/A
Water On/Off Valve	N/A		N/A
Water Modulating Valve	N/A		N/A
TCS Total Power	*0*		*0*
AVIONICS			
Power Distribution Box	23	0	23
General Luminarie Assembly #1	30	0	30
General Luminarie Assembly #2	30	0	30
General Luminarie Assembly #3	30	0	30
General Luminarie Assembly #4	30	0	30
General Luminarie Assembly #5	30	0	30
General Luminarie Assembly #6	30	0	30
General Luminarie Assembly #7	30	0	30
General Luminarie Assembly #8	5	0	5
Emergency Lighting Power Supply	15.5	0	15.5
Heater Control Unit	56	0	56
MDM	*340*	*0*	*340*
Avionics Total Power			

4.1.4 SOFTWARE.

The Flight Operational Software of the MPLM Flight System, running on the MDM computer, provides the following functions:

- Monitoring and commanding of the active cargo (when included in the flight manifest);
- Monitoring and commanding of the ECS powered equipment and the electrical power distribution equipment;
- Detection and isolation of predefined equipment failures, to prevent catastrophic hazardous events and failure propagation;
- Function status data assessment;
- Detection of potential fire events, by processing monitored data.

4.1.5 DRAG-ON EQUIPMENT.

The equipment accommodated into the MPLM Flight System after berthing to the ISS and removed before re-entry on ground (except in an emergency) is called drag-on equipment. The drag-on equipment includes:

- One (1) Portable Fire Extinguisher (PFE), used as the manual fire suppression system;
- One (1) Portable Breathing Apparatus (PBA), which provides respirable atmosphere for one (1) crew member in the event of a hazardous atmosphere condition;
- Intra-vehicular Activity Restraints and Mobility Aids, used to assist crew operations and work activities.

4.1.6 ACTIVE-TO-PASSIVE RECONFIGURATION.

The MPLM Flight System external active-to-passive reconfiguration is done by removing the ROFU PDA. The battery is also removed (note that the battery is typically removed for charging anyway). Both the ROFU PDA support bracket and the Battery support structure are maintained in the passive configuration. As a consequence of the Battery removal, the MDPS and the MLI are locally reconfigured.

The MPLM Flight System internal active-to-passive reconfiguration is performed by removing the R/F Kit, which includes:

- The Water Pump Package (WPP);
- The On/Off Valve;
- The On/Off Valve Electronics:
- Some ATCS loop hard and flex lines;
- Some Electrical Harness (ELH).

4.1.7 ENVIRONMENTAL CONTROL SYSTEM (ECS)

The ECS includes the Environmental Control and Life Support Subsystem (ECLSS) and the Thermal control Subsystem (TCS). The ECLSS includes the following functions: temperature and humidity control, fire detection and suppression, atmosphere control and supply, and atmosphere revitalization.

4.1.7.1 ENVIRONMENTAL CONTROL AND LIFESUPPORT SUBSYSTEM

Temperature and Humidity Control: a ventilation system including one Cabin Fan, ducting, diffusers, grids and one temperature sensor, ensures the air circulation inside the MPLM Flight System cabin; Inter-module Ventilation (IMV) Lines, each with a dedicated IMV Shut-Off Valve, are provided to supply the module with revitalized air from the ISS and to return heat loaded air to the ISS.

When the MPLM is berthed to the ISS, the temperature, humidity and air circulation is controlled by the ISS ECLSS. When the hatch is opened, circulated air and MPLM generated heat loads are transferred though the hatch opening. During the closed hatch operations, the MPLM Inter-module ventilation will be used for air circulation and MPLM heat rejection. Atmospheric circulation inside the MPLM is accomplished by a cabin air fan and diffuser/ducting system.

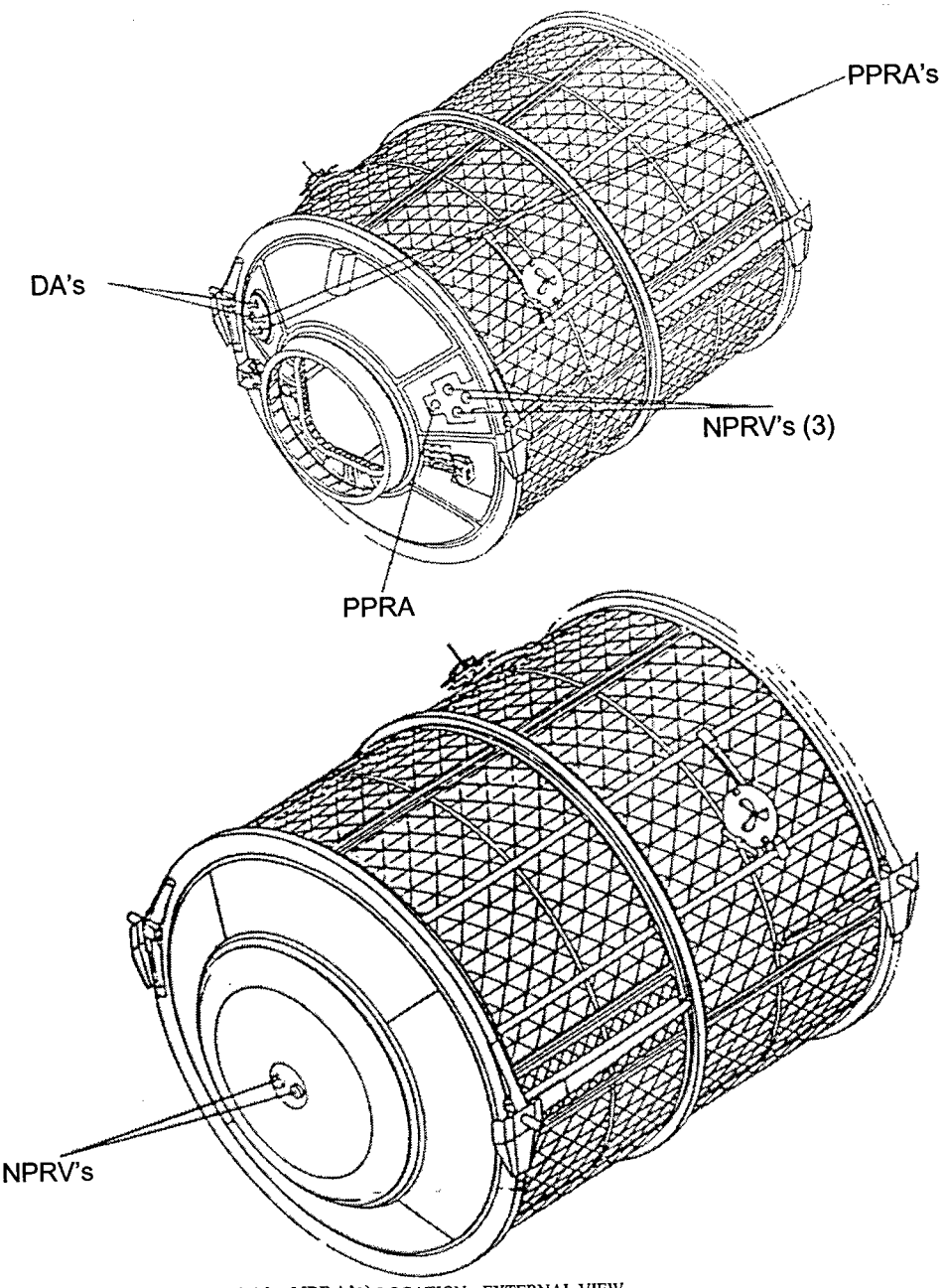


FIGURE 8. ACS EQUIPMENT (PPRA'S, DA'S, NPRA'S) LOCATION - EXTERNAL VIEW.

4.1.7.1.1 FIRE DETECTION AND SUPPRESSION

MPLM smoke detection is limited to the monitoring of the cabin recirculated air. The smoke detector is installed in the air duct downstream of the cabin air fan and is physically located in the Forward Cone port area. The smoke detector is monitored and commanded by the MPLM MDM. Fire suppression is provided by Portable Fire Extinguisher that is brought on the MPLM from the ISS and is removed prior to latch closing.

Fire Detection and Suppression: the implementation of the Fault Detection and Isolation (FDI) criteria allows to limit the fire detection to the cabin recirculated air only, by means of one (1) DuctSmoke Detector; the MPLM Flight System zones containing a credible fire risk are subdivided in three non-hermetically sealed compartments, by means of beta cloth panels: Fire Suppression Ports allow the crew members to discharge the fire suppressant contained in a Portable Fire Extinguisher (PFE) into the compartment affected by the fire event.

4.1.7.1.2 ATMOSPHERE CONTROL AND SUPPLY (ACS)

The ACS provides to the MPLM Depressurization, Positive and Negative Pressure Relief, and ISS/MPLM Equalization functions. Depressurization is used to purge the MPLM in the event a severe contamination is sensed or as secondary method of fire suppression. The depressurization function is performed two depressurization valve assemblies. Each assembly consists of two motorized valves installed in series. The Positive Pressure Relief function is accomplished by three independent Positive Pressure Relief Assemblies (PPRA). Each PPRA is composed of one self-actuating relief valve and one motor operated valve. The Negative Pressure Relief function permits repressurization in the event the MPLM depressurizes during descent. This function is provided by five, independent, self-actuating relief valves. The ISS/MPLM Pressurization Equalization is provided by a manual valve that is located in the lower starboard area of the MPLM latch.

Atmosphere Control and Supply: the hardware dedicated to this function consists of two Depressurization Assemblies (depressurization in the event of internal environment contamination or fire),three Positive Pressure Relief Assemblies (relief in the event of isolated module internal overpressure), five Negative Pressure Relief Valves (automatic relief in the event of a depressurized module return to ground) and three Total Pressure Sensors (module internal pressure monitoring).

4.1.7.1.3 ATMOSPHERIC REVITALIZATION SYSTEM (ARS)

The ARS provides the sampling capability of the internal MPLM atmosphere from the ISS. Atmosphere Revitalization System: a Sampling Line provided with Sampling Line Filter and Sampling Line Shut-Off Valve routes the air sampled inside the MPLM Flight System to the ISS allowing for composition analyses and contaminant substance presence detection.

4.1.7.2 THERMAL CONTROL SUBSYSTEM (TCS).

The Thermal Control Subsystem (TCS) includes the Active Thermal Control Subsystem (ATCS) and the Passive Control Subsystem (PTCS). The TCS provides active and passive thermal control for the MPLM. The TCS ensures suitable environmental conditions. For active flights, the TCS collects therejected heat from the refrigerator freezer racks when the MPLM is in the Orbiter cargo bay and while docked to the ISS.

The ATCS collects the heat loads rejected by the active cargo (when included in the flight manifest) and transfers them to the Orbiter or to the ISS. This function is performed by means of a water loop, which includes one Water Pump Package, one On/Off Valve (that permit manual pressure drop regulation on the ground), one Modulating Valve, one Differential Pressure Sensor, hard and flex lines and Quick Disconnects.

The PTCS protects the MPLM Flight System from the external environment influences, minimizes the heat leakage/gains and prevents condensation inside the MPLM Flight System. The Passive Thermal Control System (PTCS) protects the MPLM from the external environment and prevents condensation inside the MPLM. The PTCS consists of the Thermal Control Coating (TCC), the Multi-Layer Insulation (MLI), anti-condensation insulations and heaters. Anti-condensation insulators will not be discussed since they are only applicable to the active mission.

The TCC is a Chromic Acid Aluminum Anodizing process that was applied to the external surfaces of the Meteoroid and Debris Protection System (MPDS). This coating assures suitable thermo-optical properties that minimize MPLM heat gains and temperature excursions.

The MPLM shell, passive Cargo Berthing Mechanism (PCBM) and the external side of the hatch are covered with MLI. The MLI is composed of 220 blankets that are installed between the shell and the MDPS by Torlon fasteners stuck directly to the shell external surface. Each MLI Blanket is formed of 19 layers of Double Aluminized Kapton (DAK) foils, alternated with spacers of Dacron Net. Each blanket is completed, on both the external and internal sides by a layer of Nomex reinforced DAK. For the MLI blankets located in areas not covered by the MPDS, the external layer of Nomex is replaced by a layer of Beta cloth and the internal layer is Single Aluminized Kapton.

Seventy-six thermofoil heaters are arranged on the module shell external surface to prevent shell internal surface condensation and water loop freezing during active missions. Each heater is provided with two electrical tracks, independently at different voltages, 28 Vdc and 120 Vdc, to respectively support the Orbiter and ISS heating power requirements. The heaters are connected in 22 independent electrical circuits. Each circuit contains no more than six heaters in parallel. Each heater circuit is controlled by one thermostat.

The PTCS equipment includes:

- The Thermal Control Coating (MDPS external surface finish);
- The Multi-Layer Insulation, composed by blankets which cover all the MPLM Flight System shell, including the Hatch and PCBM external/internal surfaces;
- Insulation material, which covers the ATCS equipment;
- Items which reduce (washers) or increase (fillers) the thermal conductivity at the interface level;
- Heaters arranged on the shell external surface, to prevent internal condensation and ATCS loop water freezing;
- Heaters arranged externally on each Depressurization Assembly, to prevent icing inside the Non-Propulsive vent during the depressurization;
- Heaters arranged on the ROFU PDA, to prevent water freezing inside the jumpers.

4.2 ROEU REMOTELY OPERATED ELECTRICAL UMBILICAL

The Remotely Operated Electrical Umbilical (ROEU) provides the electrical and data interfaces between the orbiter and the MPLM. The umbilical can be mated and demated on command from the Aft Flight Deck (AFD) of the Orbiter. The ROEU is designed to accommodate up to a one quarter-standard mixed cargo harness (SMCH) services for deployable payloads. The ROEU accommodates orbiter/payload relative motion as well as a minimal amount of orbiter/payload misalignment during the mate/demate process. The ROEU retracts to clear the payload during deployment and features minimal intrusion into the payload envelope. Although there is dual redundancy in the drive motors, an EVA backup mate/demate capability also exists.

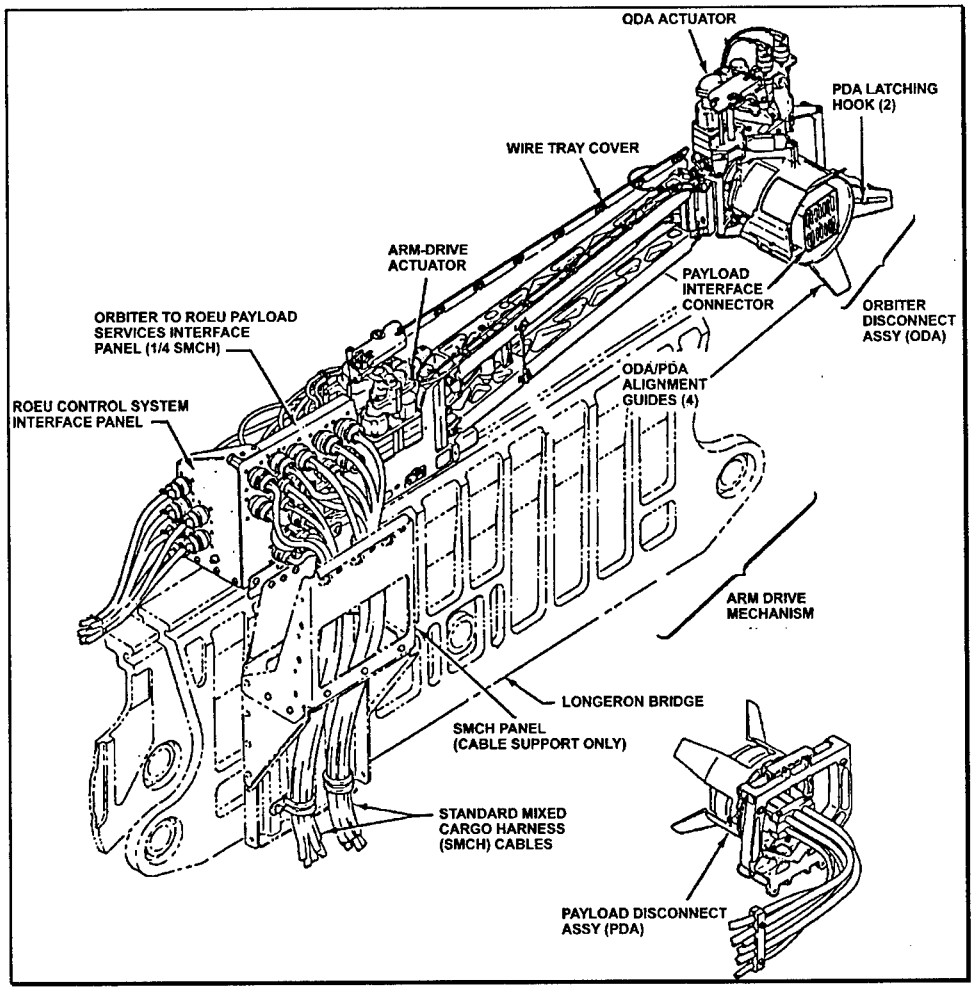


FIGURE 9. TYPICAL ROEU MOUNTED ON A BRIDGE RAIL (DEMATED POSITION), PORT SIDE INSTALLATION.

The primary components of the ROEU system are the orbiter disconnect mechanism (ODM) and the payload disconnect assembly (PDA). The ODM mounts on an orbiter bridge rail oneither the port or starboard side of the payload bay. The ROEU will be mounted on the Starboard side of the payload bay on all MPLM missions. The ODM consists of an arm drive mechanism and an orbiter disconnect assembly (ODA).

The ODA and PDA comprise the two halves of the electrical services connection. The ODA contains the disconnect plug with socket contacts, while the PDA contains a receptacle with pin contacts. The PDA is permanently mounted on the MPLM.

The ROEU contains four drive motors. Two motors with a differential gearbox output provide the driving power for swing arm extension and retraction, and two similarly arranged motors perform mate and demate functions. Limit switches provide control logic signals for end-of-travel, power removal, and position indication signals.

4.4 PAYLOAD RETENTION SYSTEMS

Two types of retention latches secure deployable and non-deployable payloads in the payload bay: longeron latches and keel latches. These latches are provided by the National Space Transportation System (NSTS). Special retention latches may be supplied by the customer, but must comply with Shuttle Orbiter/Cargo Standard Interfaces, ICD 2-19001, which is the controlling document for NSTS-supplied hardware. There are normally three or four longeron latches per payload. Two primary latches are required to take the X and Z-loads, and one or two stabilizing latches are required to take Z-loads. The stabilizing latches float free in the X direction. The latches are driven by dual-redundant motors. A payload may also require a keel latch that takes the side loads. The keel latch centers the payload in the yaw direction in the payload bay when it closes; the keel latch must be closed prior to closing the longeron latches. The keel latch can float plus or minus 2.75 inches in the X direction.

Detailed design requirements for deployable and non-deployable customer-supplied hardware are contained in Interface Definition Document for Standard Payload Accommodations NSTS 21000-IDD-STD. The following sections provide descriptions of both NSTS- and customer-supplied hardware for deployable payloads. Further details, if required, are available in System Description and Design Data - Structures and Mechanics, NSTS 07700, Volume XIV, Appendix 4.

Non-deployable payloads are retained by bolted passive retention devices, and deployable payloads are secured by motor-driven, active retention devices. Payloads are secured in the orbiter payload bay with the payload retention system or are equipped with their own unique retention systems. The orbiter payload retention system provides three-axis support for up to three payloads per flight. The payload retention mechanisms secure the payloads during all mission phases and allow installation and removal of the payloads when the orbiter is either horizontal or vertical. Attachment points in the payload bay are in 3.933-inch increments along the left- and right-side longerons and along the bottom centerline of the bay. Of the potential 172 attach points on the longerons, 48 are unavailable because of the proximity of spacecraft hardware. The remaining 124 may be used for deployable payloads. Along the centerline keel, 89 attach points are available, 75 of which may be used for deployable payloads. Table 7 shows the characteristics of Payload Retention Latches used with the MPLM.

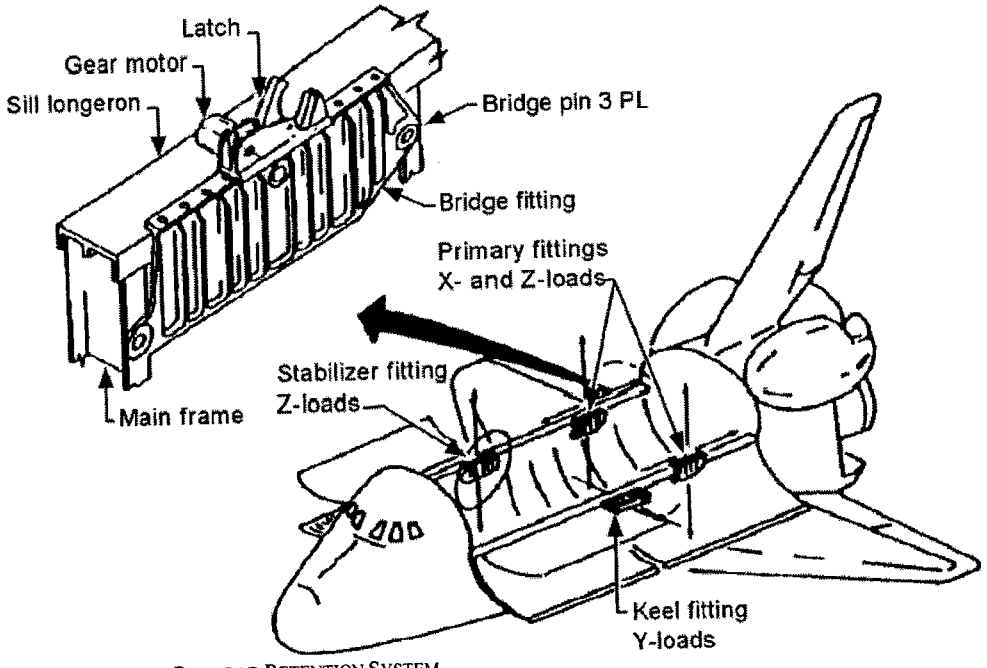


FIGURE 10. ACTIVE PAYLOAD RETENTION SYSTEM.

TABLE 7. CHARACTERISTICS OF THE PAYLOAD RETENTION COMPONENTS USED WITH THE MPLM.

	Standard Weight Longeron Latch (PRLA) V073-544550	**Super Middle Weight Longeron Latch (SMWLL)** V073-544530	**Standard Weight Keel Latch (AKA)** V073-544430 (Possibly V073-544560?)
Limit Load (lbs) (Not simultaneous)	X 121,000 Y 12,100 Z 121,000	X 90,000 Y 9,000 Z 90,000	X 6,800 Y 73,690 Z 7,370
Draw Down Capability	15,000 lbs max	12,000 lbs max	1,000 lbs (2,500 lbs at 0.25 inch or less offset)
Trunnion Accommodation (in dia)	3.250 +0.003 –0.001 inch diameter	3.250 +0.003 –0.001 inch diameter	3.000 +0.004 –0.000 inch diameter
Temperature Range			
Operating	-100 °F to 275 °F	-100 °F to 275 °F	-100 °F to 275 °F
Non-operating	-200 °F to 275 °F	-200 °F to 275 °F	-200 °F to 275 °F
Electrical Power	Redundant 28 (+4, -5) VDC and 115 V 3-ϕ AC	Redundant 28 (+4, -5) VDC and 115 V 3-ϕ AC	Redundant 28 (+4, -5) VDC and 115 V 3-ϕ AC
Motor Drive	Dual AC motor and brake redundant drive differential	Dual AC motor and brake redundant drive differential	Dual AC motor and brake redundant drive differential
Actuation Time	Single Motor 60 sec Dual Motor 30 sec	Single Motor 60 sec Dual Motor 30 sec	Single Motor 60 sec Dual Motor 30 sec
Friction	Refer to ICD 2-19001	Refer to ICD 2-19001	Refer to ICD 2-19001
Free Play	0.005 inch max under 1,000 lbs	0.005 inch max under 1,000 lbs	0.005 inch max under 1,000 lbs
Irreversibility	Irreversible to latched load without reliance on motor-brake	Irreversible to latched load without reliance on motor-brake	Irreversible to latched load without reliance on motor-brake
Material			
Frame	Inconel	Titanium	Inconel
Gearbox	Inconel	Aluminum	Inconel
Gears	Steel	Steel	Steel
Weight (lbs)	113 lbs	55 lbs	80 lbs
EVA Mechanism	Open/Close manual override	Open/Close manual override	None
Ready to Latch Switch Indication	0.82 inch	0.80 inch	None (trunnion in place)
Trunnion ejection	24 lbs max	34 lbs max	None

4.4.1 BRIDGE FITTINGS

Bridge fittings are used to react to the loads imparted to the orbiter structure by the payload and provide a structural interface for both the payload retention latch assemblies (PRLAs) and active keel actuators (AKAs). Bridge fittings fall into standard and lightweight categories, just as the PRLAs and AKAs do, and of course, differ in type when used to interface longeron versus keel latches. The keel bridge has a T-slot that accepts the T-bar fitting of the AKA; the two-mated members are bolted in place. Contrastingly, the longeron bridge fitting incorporates a T-bar rail onto which the PRLA T-slot slides. The standard and lightweight bridge fittings differ both in cross-sectional thickness and material. The standard fittings are made of titanium, and are thicker than their lightweight aluminum counterparts. Bridge fittings, whether they are standard or lightweight, longeron or keel type, are compatible with the hole patterns and wiring routes for a particular bay only. Therefore, each fitting is unique dimensionally for any given bay. There are 13 longeron bridges per side and 12 keel bridges available per flight. Only the bridges required for a particular flight are flown. The bridges are not interchangeable because of mainframe spacing, varying load capability, and sub frame attachments. The longeron bridge fittings are attached to the payload bay frame at the longeron level and at the side of thebay. Keel bridge fittings are attached to the payload bay frame at the bottom of the payload bay.

4.4.2 PAYLOAD RETENTION LATCH ASSEMBLIES

Payload retention latches secure the trunnions of a payload to the orbiter structure. Latches are in the Space Shuttle Program (SSP) inventory and can be used as airborne support equipment (ASE). Allocation of payload retention latches is governed by directive 118A in Book 2 of NSTS 07700, Volume II, Program Structure and Responsibilities. Latches can be classified as either passive or active. Passive latches are fixed, non-electrical structures that cannot be controlled from the crew cabin. Active latch assemblies are electromechanical devices which each employs two 3-phase reversible induction motors and the necessary gearing to drive a latch through a differential. Active latches are controlled and monitored through the payload retention system (PRS) control panel A6L (engineering drawings refer to A6L as A6A1). Active latches can also be monitored by the SM CRT display, SPEC 097. Latch position indications may be down linked. Payload latch selection is made by NASA, and is determined by payload weight and c.g., total payload bay cargo mix, and availability.

All longeron latches currently in use have an extravehicular activity (EVA) manual override mechanism that bypasses the drive train to allow manual operation of the latch. Each active latch assembly contains two 115 volt (V) 400-hertz (Hz) motors. Limit switches for each drive motor sense end-of-travel of the latch, shut off power to the drive motors, and send a latch position indication signal to the PRS control panel. Two additional limit switches sense the payload trunnion position and send a ready-to-latch signal when the trunnion is properly positioned in the latch. Instrumentation and logic for the latch assembly are powered by 28 V direct current (dc) from an orbiter instrumentation bus.

Drive motors are electronically and mechanically arranged so that either or both motors can actuate the latch in both directions. Single-motor control doubles the latch travel time. The drive motors receive power from the orbiter inverters controlled by switches located on the payload retention system control panel in the aft flight deck (AFD). For friction characteristics refer to Shuttle Orbiter/Cargo Standard Interfaces, ICD 2-19001.

- Active payload retention latch mechanisms secure deployable payload trunnions to the orbiter structure or payload cradle. Passive latches are designed for non-deployable payload use only.
- Actuation time for active latches is 60 seconds for a single motor, and 30 seconds for dual motors.
- Longeron latches are designed to react X-axis and Z-axis loads.
- The super middleweight longeron latch (active) has a titanium frame, aluminum gearbox, steel gears, and weighs 55 lbs.

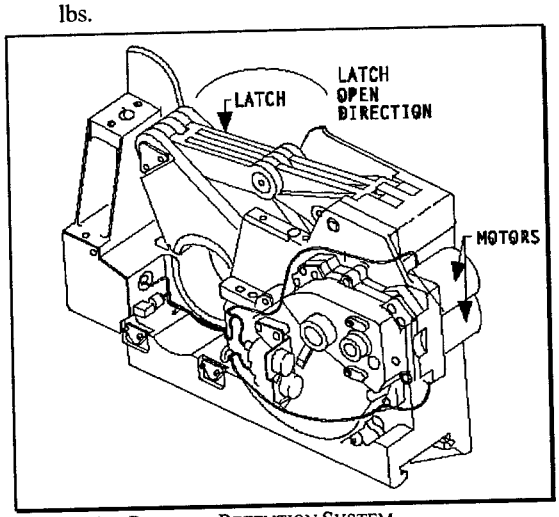


FIGURE 11. PAYLOAD RETENTION SYSTEM.

The standard PRLA is designed to restrain payloads weighing 65,000 pounds (29,484 kg). The PRLA reacts loads through the Orbiter structure in the X-X, Z-Z, and combined X-Z directions. It is a dual-motor-actuated device. Normal opening or closing time is 30 seconds; with one motor failed, the time increases to 60 seconds. The PRLA has a 3.25-inch (8.26-cm) diameter spherical half bearing attached to the claw and linkage that has a 2.0-inch (5.1-cm) pull down capability.

Redundant feedback indications are provided to show when the actuator is open, closed, and when the trunnion is present (ready-to-latch). These indications are displayed on Panel A6U. When unlatched, the ready-to-latch/eject arm imparts a small force (12 lbf or 53 N) to start the payload trunnion out of the latch. The LWLL and MWLL will have the same basic design as the standard PRLA's but have two unique features: (1) these latches have an extravehicular activity (EVA) disconnect mechanism that provides manual open and close capability in the event of a jammed gear mechanism or motor failure; and (2) these latches are designed to be lighter and thus carry less load.

The standard Orbiter active retention system for deployable payloads will include 8-inch (20-cm) guides integral with the active latches to constrain payload motion in the Orbiter X direction (fore and aft). The guides will also ensure adequate visibility/motion cues to the operator during deployment or berthing.

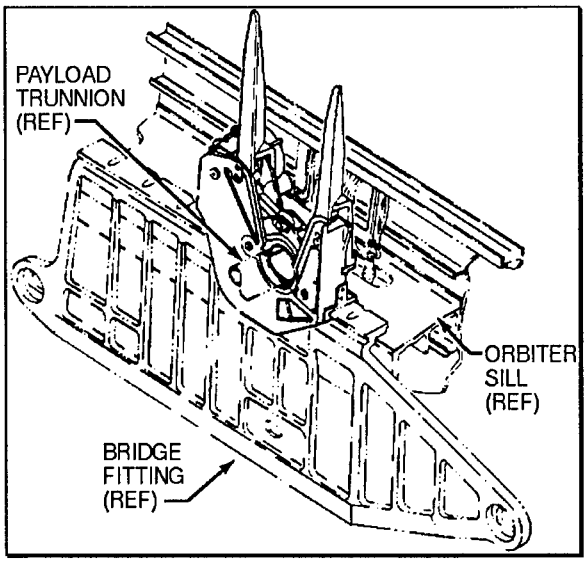


FIGURE 12. MIDDLEWEIGHT LONGERON LATCH WITH TRUNNION GUIDES.

Extended alignment guides are auxiliary equipment attached to either standard, lightweight, or middleweight PRLA's to serve as visual cues during payload berthing and unberthing. The extended alignment guides are 20 to 22 inches (50.8 to 55.9 cm) in length with bright yellow and black markings. The extended alignment guides are mounted to the forward and aft 8-inch integral guide surface of either standard or lightweight latches. The resultant length is 22 and 24 inches (55.9 and 61.0 cm) from the trunnion centerline to the top of the guides. The shorter guide is placed closest to the viewing point to provide payload-positioning cues. Figure 2-15 is an illustration of a standard extended alignment guide.

To prevent undesired contact between the payload and the Orbiter during the initial phase of deployment or the final stages of berthing, the payload must have a surface (i.e., scuff plate) on each trunnion that is perpendicular to the axis of the trunnion, as shown previously inFigure 13. The scuff plates and trunnions will interface with the "V" guides to prevent free motion in the Y and X directions. The scuff plate and skirt, with dimensions and markings, will be attached to the trunnion or the basic payload structure. Payload guides and scuff plates assist in deploying and berthing payloads in the payload bay. The payload is constrained in the X direction by guides and in the Y direction by scuff plates and guides. Bright yellow and black striped markings are painted on the guides to enhance visual cues during payload berthing. The guides are mounted to the inboard side of the payload latches and interface with the payload trunnions and scuff plates. The scuff plates are attached to the payload trunnions and interface with the payload guides. The guides are V-shaped, and one part of the V is 2 inches taller than the other. Parts are available to make either the forward or aft guide taller. This difference enables the operator monitoring the berthing or deployment operations through the aft bulkhead CCTV cameras to better deter-mine when the payload trunnion has entered the guide. The top of the taller portion of the guide is 24 inches above the centerline of the payload trunnion when it is all the way down in the guide. The top of the guide has a 9-inch opening. These guides are mounted to the 8-inch guides that are a part of the longeron payload retention latches.

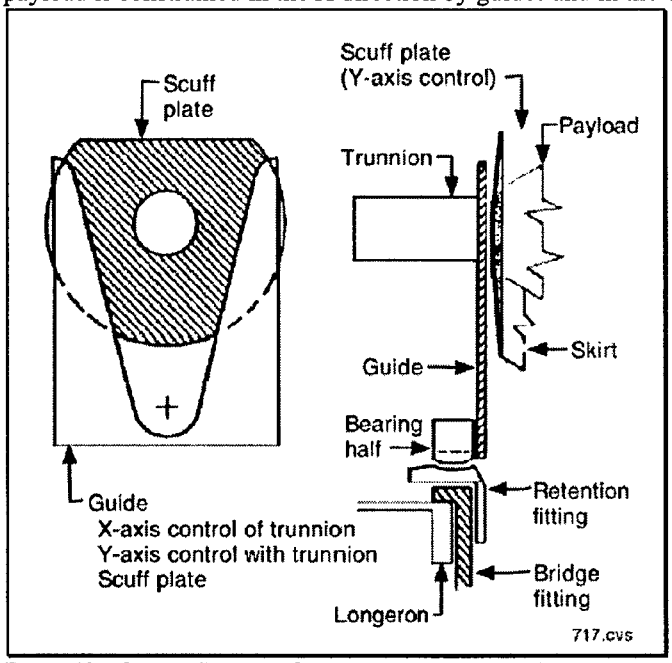


FIGURE 13. ORBITER PAYLOAD GUIDE, ACTIVE RETENTION FITTING.

The payload trunnions are the cylindrical portion of the payload that interfaces with the payload retention system. The trunnions that interface with the longeron are 3.24 inches in diameter and 7 or 8.75 inches long, depending on their position in the payload bay. The keel trunnions are 3 inches in diameter and vary in length from 4 to 11.5 inches, depending on where they fit in the payload bay.

4.4.3 KEEL LATCHES

Keel latches secure non-deployable and deployable payload keel trunnions to the orbiter structure or payload cradle, and feature a trunnion-in-place switch. Keel latches mount to a standard keel bridge fitting. They are designed to react Y-axis loads, but can also provide X-axis load carrying for special cases. The standard weight keel latch has an inconel frame and gearbox, steel gears, and weighs 80 lbs.

The AKA, Figure 14, is the Orbiter Y-direction load-carrying latch. Aside from reacting to Y loads, the AKA also serves as a centering device for both deployable and non-deployable payloads. Although the AKA is called an active keel actuator, it also serves as a passive latch. An active keel latch can be controlled by switches on Panel A6U, and the passive keel latch can only be operated by ground support equipment. No EVA capability exists to open or close any keel actuator.

The standard AKA has a 3-inch (7.6-cm) diameter spherical half bearing that is attached to the static and dynamic halves of the latch. A spring link drives the over center links to the locked position. When the AKA is opened, it produces a 9.5-inch (24.1-cm) diameter opening to accommodate keel trunnion motion during berthing and unberthing.

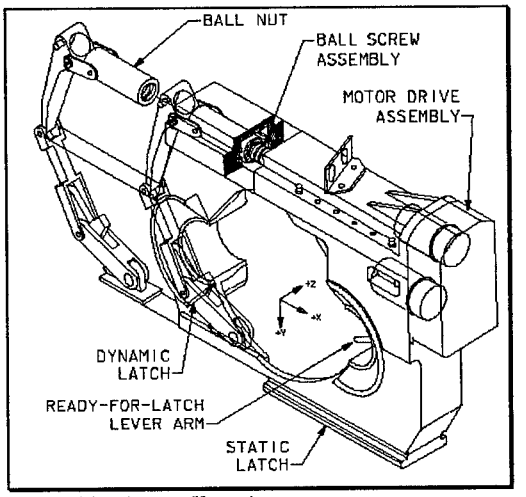


FIGURE 14. ACTIVE KEEL ACTUATOR.

4.5 FLIGHT RELEASE GRAPPLE FIXTURE (FRGF)

The Flight Releasable Grapple Fixture (FRGF) is a space flight device that can be attached to a flight payload to act as a mechanical interface between the Shuttle Remote Manipulator System (SRMS) mounted Standard End Effector (SEE) and the payload. The FRGF assembly includes the following major components: the baseplate, the location cam arm assembly, the grapple shaft assembly, the abutmentplate, the target assembly, the EVA release mechanism, the EVA release rod, and the ground strap.

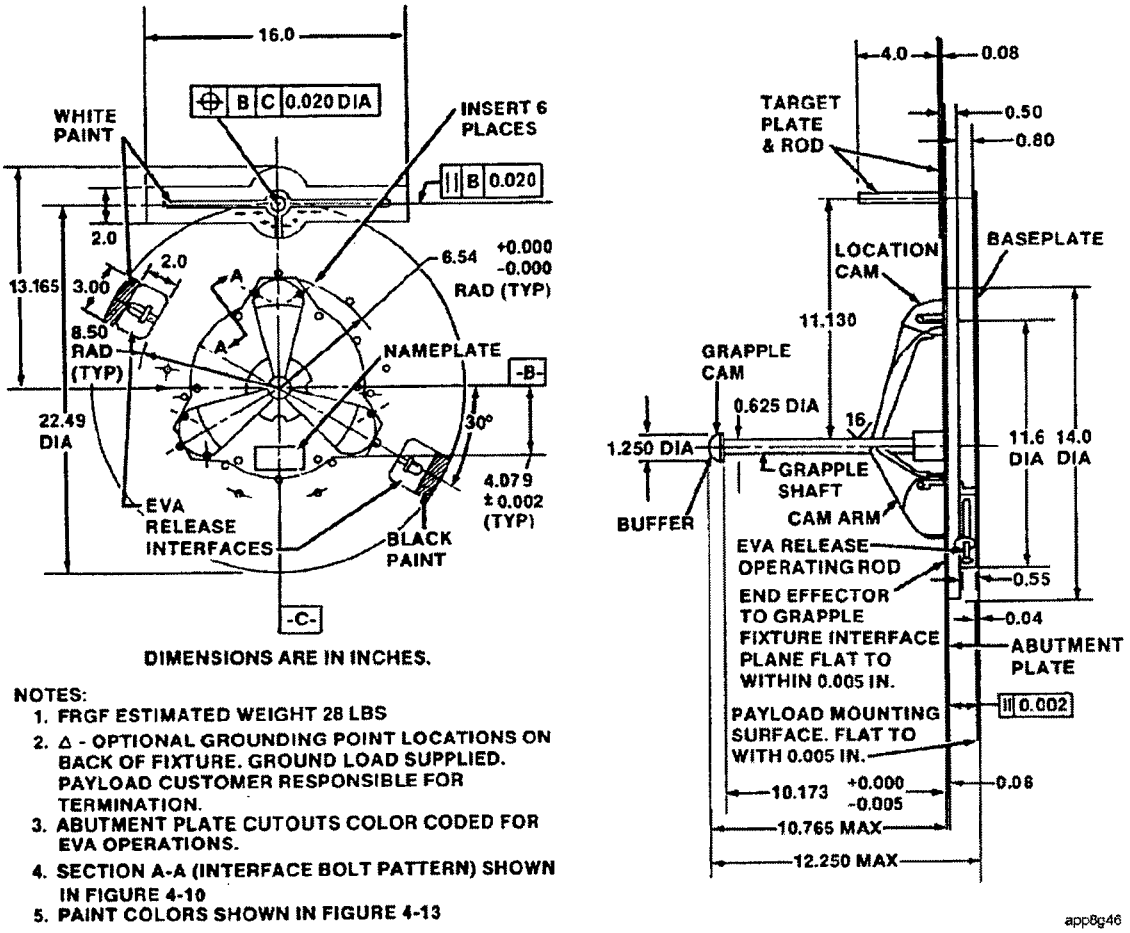


FIGURE 15. FLIGHT RELEASABLE GRAPPLE FIXTURE.

The standard grapple fixture is the flight releasable grapple fixture (FRGF). It includes a camera grapple fixture target used by the SRMS operator to align the SEE with the FRGF before initiating the payload capture sequence. The center grapple shaft of the FRGF is releasable during an EVA by a suited crewmember. A spare shaft may be inserted and locked in place for subsequent handling by the SRMS. NSTS 07700, Volume XIV, Appendix 7 "System Description and Design Data – Extravehicular Activities" contains information about EVA operations with the FRGF.

The FRGF is designed to withstand operational temperatures between –105 °F to 154 °F. It will survive and function after exposure to average structural temperatures between ± 250 °F. The FRGF design is compatible with the –9 configuration of the SEE such that the SEE can capture and rigidize with the FRGF with initial misalignments of their respective axes.

The payload is captured when the snare cables of the SEE close around the grapple shaft of the grapple fixture. This action causes a centering of the grapple shaft within the SEE at the point of cable contact. Once captured, the payload is soft docked and restrained from escape but is not rigidly attached to the mechanical are.

During rigidization, the SEE is being hard docked to the payload grapple fixture. The SEE interface plane and the grapple fixture interface plane are brought into contact during rigidization. The action of the FRGF location cams sliding into mating pockets in the end of the SEE cause rotational torques of up to 50 ft lbf. To be applied to the grapple fixture, thus eliminating roll misalignments. The interface between the SEE and the grapple fixture is loaded by the snare cables that pull on the grapple cam causing a tensile force in the grapple shaft.

During both the capture and rigidization sequences, the grapple shaft does not rotate with respect to the grapple fixture. Upon completion of the full rigidizing sequence, the payload is securely attached to the SEE and may be manipulated by the SRMS.

Two release rods, extending radially from the center of the assembly and mounted at the rear of the FRGF are located at a relative position of 10 O'clock and 4 O'clock and color coded white and black respectively. The operation of the release rod is accomplished by an EVA crew member using either the standard NSTS 0.5 inch manually operated ratcheting box wrench, part number V628-650885-004 or the standard NSTS power tool, part number 10172-20500-01 in conjunction with the NSTS right angle drive, part number 10176-21050-01. In either case, the EVA activity can be accomplished with the EVA crewman located outboard of the FRGF from the abutment plate. Breakout torque and running torque of either rod is less than 240 in lbf and between 3 and 132 in lbf, respectively.

4.6 LIGHTING

Three types of supplemental lighting are generally available during EVA operations: payload bay (PLB) floodlights, RMS end effector (EE) floodlight (if the RMS is manifested), and extravehicular mobility unit (EMU) helmet-mounted lights. These lights enhance crew visibility during nominal operations (payload deployment, docking, RMS operations, etc.) as well as EVA operations. Additional EVA portable lights are available on a flight-specific basis. Intravehicular (IV) lights pointed into the PLB through the aft cabin windows may also provide additional lighting.

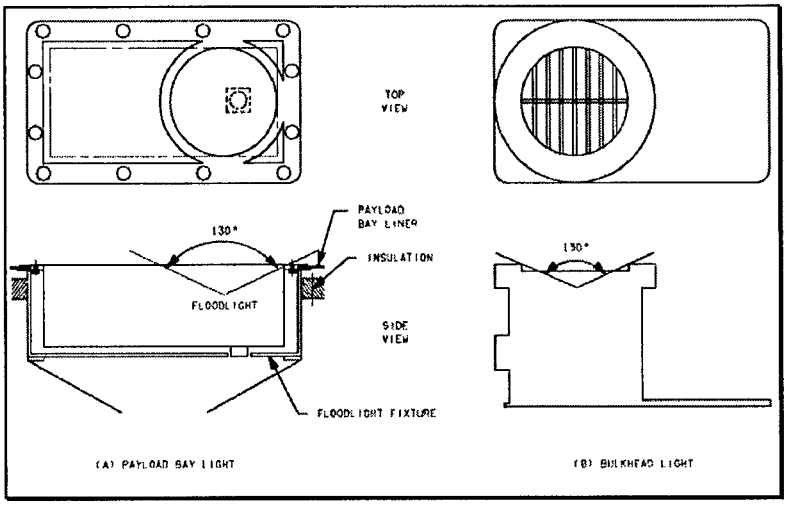


FIGURE 16. PAYLOAD BAY FLOODLIGHTS.

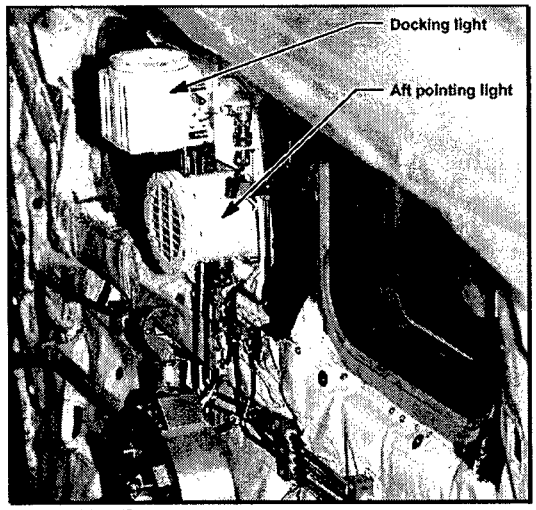


FIGURE 17. FORWARD BULKHEAD LIGHTS.

The exterior floodlights improve visibility for the flight crew during payload bay door operations, EVA operations, RMS operations, and station keeping and docking. The lighting fixtures shown inFigure 16 are metal halide lamps used to illuminate the PLB. Two different fixtures are used with the lamps; one mounts to the forward bulkhead and the others are within the lower PLB envelope. The forward bulkhead light fixture contains two lights: an upward pointing docking light and an aft pointing light (Figure 17). The locations of the floodlights installed in the PLB are shown in Figure 18. The PLB lights provide a minimum of 5 foot-candles (ft-c) power of illumination at the centerline of the PLB. The bulkhead lights should be turned off before an EVA because of high operating temperatures and proximity to the egress path. Use of the other PLB lights may also be limited because of high operating temperatures, proximity to EVA worksites, or temperature-sensitive payloads.

Boeing-North American has performed a thermal assessment to determine the on-orbit operational constraints of the payload bay floodlights. This analysis is based on the floodlight solder joint temperature limit of 350 degrees °F and includes data from STS83-0302A "Generic Payload Bay Floodlight Thermal Analysis" and IL 299-405-BNT-84-043 "Updated Procedure for Determining Payload Bay Floodlight (PBFL) Thermal Operational Constraints". Table 8shows the location of the 6 payload bay floodlight based on orbiter coordinates. Note that floodlights 5 and 6 are the only lights obstructed by the MPLM when berthed in the payload bay. Table 9 shows the rationale for the constraints on the PBFL. Note that the table references IL 299-405-BNT-84-043. Table 10 shows the recommended PBFL On-Orbit thermal operational constraints for the STS-102 mission. A similar set of constraints will be issued by BNA for each mission based on the mission profile. The following paragraph is a more detailed description of these constraints.

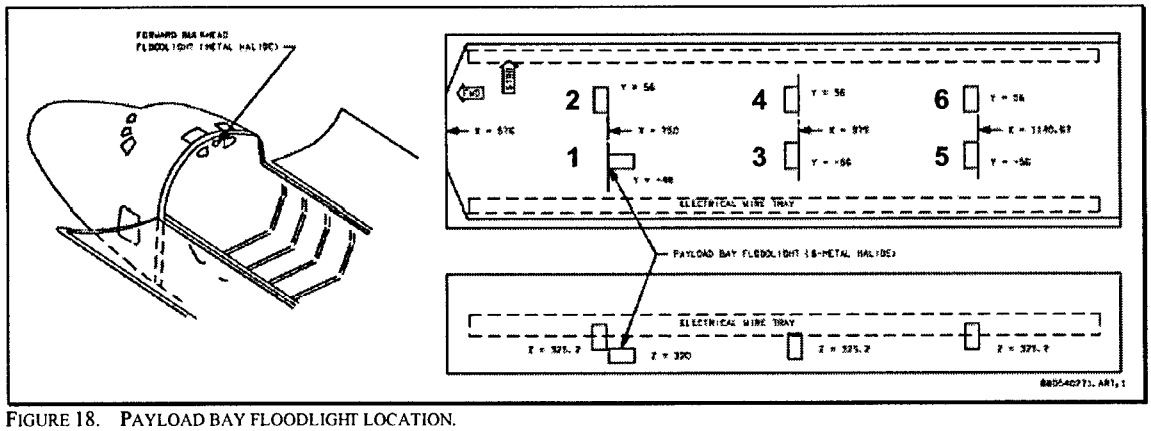


FIGURE 18. PAYLOAD BAY FLOODLIGHT LOCATION.

TABLE 8. PBFL QUARTZ WINDOW LOCATIONS.

PBFL ID Number	Quartz Window Coordinates* X	Y	Z
1	757.70	-48.1	320.3
2	742.36	58.5	326.7
3	971.86	-56.8	325.6
4	971.86	56.8	325.6
5	1133.04	-58.5	326.5
6	1133.04	58.5	326.5

Note: These coordinates are from the center of the PBFL quartz windows.

TABLE 9. RATIONALE FOR THE PBFL THERMAL OPERATIONAL CONSTRAINTS OF THE STS-102 MISSION.

Orbiter Attitude	Parameter [2]	PBFL Location Forward	Mid	Aft
+ZLV (Bay to Earth) or ZLV (bottom to Earth)	On/off constraints (min)	NONE	NONE[2]	OFF NONE[2][3]
	Rationale/Table	Para. 6, Ref. 2 [2]	Para. 3 & 6 Ref. 2	Para. 3, Ref. 2
	View factors to space	NA	NA	NA
	Distance between payloads (in)	NA	50	NA
+ZSI (Bay to Sun) $\|\beta\| = 75°$ max Altitude = 205 NM	Payloads diameter (in)	NA	NA	NA
	On/off constraints (min)	None[2]	20/30	OFF
	Rationale/figure number	Para. 7 Ref. 2	None[2][3] Fig. 6-6, Ref. 2	None[2][3] Fig. 6-2, Ref. 2

Notes:
(1) The above constraints, obtained from Reference 2, are based solely upon PBFL considerations.
(2) Can be ON continuously based on floodlight restrictionsand considerations.
(3) Constraint applies only after MPLM deployment (when MPLM is returned to the payload bay, constraint will not apply).
Reference 2 is IL 299-405-BNT-84-043 "Updated Procedure for Determining Payload Bay Floodlight (PBFL) Thermal Operation Constraints"

TABLE 10. RECOMMENDED PBFL ON-ORBIT THERMAL OPERATIONAL CONSTRAINTS FOR STS-102.

Payloads: Orbiter Docking System (ODS), International Space Station (ISS)Integrated Cargo Carrier (ICC) and Multi-Purpose Logistic Module (MPLM) [1]					
Attitude: +ZLV (Bay to Earth) -ZLV (bottom to Earth)			**Attitude:** +ZSI (Bay to Sun) $\|\beta\| = 75°$ max Altitude = 205 NM		
Floodlight Location			**Floodlight Location**		
Forward	Mid	Aft	Forward	Mid	Aft
NONE [2]	NONE[2]	OFF NONE[2][3]	NONE[2]	**Intermittent Operation:** 20 min. On 30 min. Off NONE[2][3]	OFF NONE[2][3]

Notes:
(1) Constraints imposed by floodlight consideration
(2) No operational constraints - can be "ON" continuously
(3) Constraint applies only after MPLM deployment (when MPLM is returned to the payload bay, constraint will not apply)

Payload Bay Light Constraints:

1. When the Orbiter is in a bay-to-earth or bottom to earth attitude and ISS–ICC and MPLM are in the cargo bay, operation of the forward and mid Payload Bay Floodlights (PBFL) are unconstrained (PBFLs 1, 2, 3 and 4 can be ON continuously). Operation of the aft PBFLs (PBFLs 5 & 6) is constrained to be OFF at all times.
2. When the Orbiter is in a bay-to-sun attitude and ISS–ICC and MPLM are in the cargo bay, operation of the forward PBFLs are unconstrained (PBFLs 1 and 2 can be ON continuously). Operation of the mid PBFLs (PBFL 3 & 4) are constrained to operate no more than 20 minutes ON, followed by at least 30 minutes OFF. Operation of the aft PBFLs (PBFLs 5 & 6) are constrained to be OFF at all times.
3. When the MPLM is not in the bay (deployed), regardless of the Orbiter attitudes, operation of all PBFLs are unconstrained (PBFLs 1,2,3,4,5 and 6 can be ON continuously). However, when the MPLM is returned to the payload bay, depending on the Orbiter attitude, constraints of either paragraph 1 or 2 will apply subsequently.
4. These PBFL operational constraints are based on PBFL system limitations. The contractors have not identified any payload constraints.

4.7 ORBITER ACTIVE VENT SYSTEM

Active Vent Doors provide venting of the unpressurized volumes of the orbiter for therapid pressure change of launch and entry, and control of internal environment of the orbiter by door configuration while in orbit and on the ground. The unpressurized volumes are purged with nitrogen while on the ground to clear them of contaminants, to prevent condensation, and after landing to cool orbiter components. The doors close for reentry to prevent hot plasma from damaging the internal components of the orbiter. The doors are sealed with thermal and pressure barriers. Venting of the unpressurized volumes during launch and landing is required for structural integrity of the vehicle.

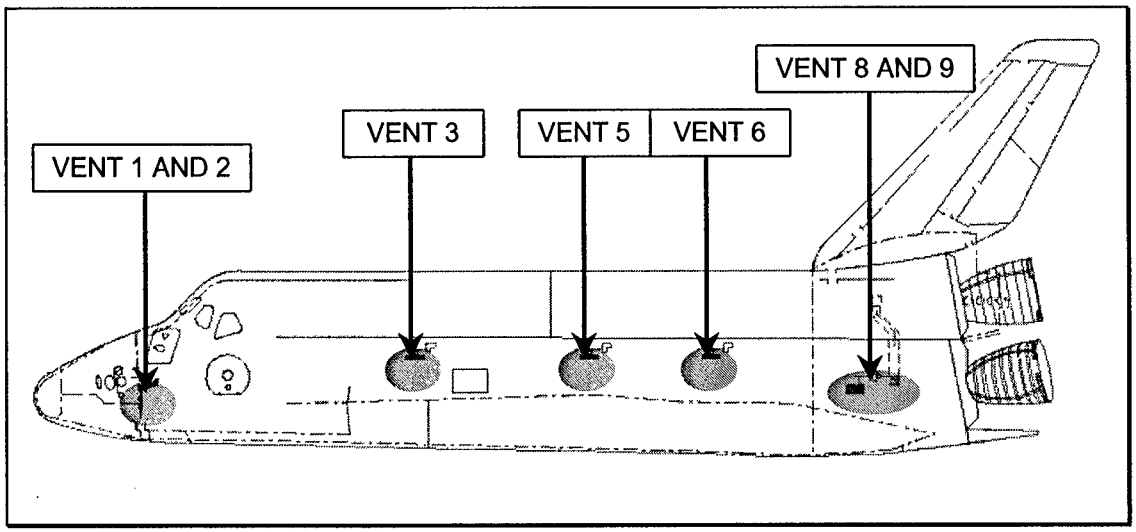


FIGURE 19. ORBITER VENT DOOR DIAGRAM.

Vent doors are driven by dual motor PDUs, one for 1 and 2, one each for 3, 5, and 6, and one for8 and 9. Doors 4 and 7 were removed from all of the orbiters. Right and left hand doors and components are mirror images. Control of the doors is automatic except for the pre entry configuration that is initiated by the crew. A display of the doors' status is available only to the ground, the crew only seeing the last command position of the controlling switches. Figure 19 shows the location of the vent doors on the Orbiter. Figure 20 shows a drawing of a typically Orbiter vent door (in this case vent door number 6).

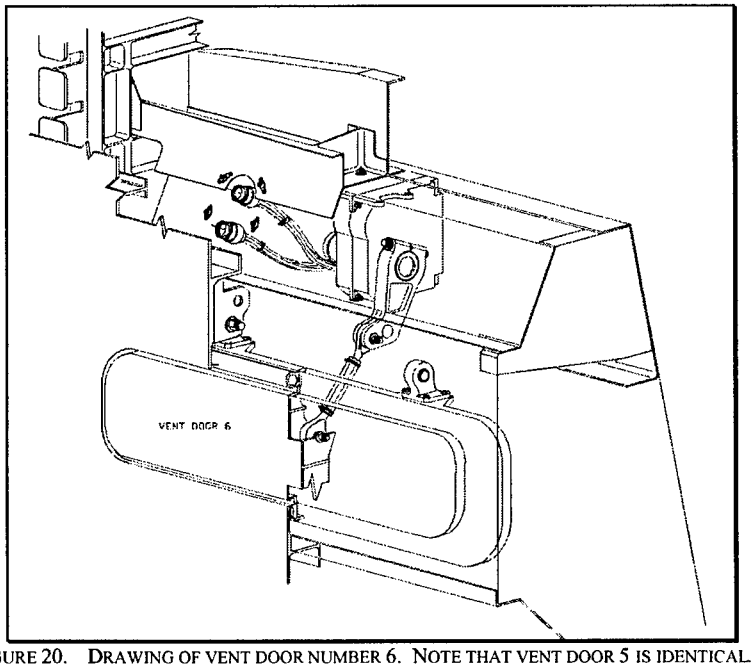


FIGURE 20. DRAWING OF VENT DOOR NUMBER 6. NOTE THAT VENT DOOR 5 IS IDENTICAL

4.10 PREVIOUS FLIGHT HISTORY

The ROEU has flown on at least seven missions prior to the first flight of the MPLM providing electrical power and the capability to be remotely disconnected. The first mission was for the Infrared Background Signature Survey (IBSS). It flew on STS 39 in April of 1991. The second mission was for the Upper Atmosphere Research Satellite (UARS). It flew on STS 48 in September of 1991. The third and fourth missions were for the European Retrievable Carrier (EURECA). EURECA was deployed on STS 46 in August of 1992 and was later retrieved on STS 57 in June of 1993. The ROEU was used with MIR Docking Module (DM) on STS-72 which launched in November of 1995. The next mission for the ROEU was STS-72 in January of 1996. It was used on this mission with the Space Flyer Unit (SFU). The most recent known flightof the ROEU prior to MPLM was on STS-85 in August 1997. This was the flight with the manipulator Flight Demonstration (MFD). Table 11 shows the seven missions with their launch dates in addtion to the two recent MPLM missions.

TABLE 11. SUMMARY OF ROEU PREVIOUS MISSIONS.

PAYLOAD	MISSION	LAUNCH DATE
IBSS	STS 39	April 28, 1991
UARS	STS 48	September 12, 1991
EURECA	STS 46	August 8 1992
EURECA	STS 57	June 21, 1993
SFU	STS-72	January 11, 1996
DM	STS-74	November 12, 1995
MFD	STS-85	August 7, 1997
MPLM FM1	STS-102	March 8, 2001
MPLM FM2	STS-100	April 19, 2001

The PRLAs, the AKA, and the PHX are all considered standard shuttle hardware and have been used on shuttle missions since the shuttle was first declared operational. The PRLAs and the AKA are only manifested on missions with payloads that require that type of structural interface. The basic PRLA selected for use with the MPLM is a heavy weight version that has been modified for EVA use. Flight 5A1 was its first mission. The selected AKA has flown before.

STS-102 (ISS Flight 5A.1) was the first flight of the MPLM system. This mission was launched on March 8, 2001 and carried Leonardo (FM1) to the International Space Station loaded with logistics supplies and system racks for the US Lab. It was attached to the ISS for approximately one week allowing the STS and ISS crew members to transfer equipment to the US Lab and return items back to the MPLM. During the mission, the STS and ISS crew members encountered no anomalies or problems with the MPLM or its subsystems. Feedback from the mission was positive with the STS-102 crew members indicating that the MPLM was clean, had no odors, and was extremely quite compaired the the rest of the ISS. The MPLM also proved to be useful as a source of spare parts for the US Lab. During the mission, the decision was made to replace one of the GLAs onboard the US Lab with an identical unit from the MPLM. This had no affect on the operation of the MPLM. Afterthe mission was over, the MPLM was inspected for damage at KSC. During the inspection, it was discovered that the MPLM debris sheilds were punctured in two places by micro meteroids. The impacts left two small holes in the debris sheilds but caused no damage to the underlying MLI or any of the MPLM systems. KSC found no other damage as a result of the inspection.

STS-100 (ISS Flight 6A) was the second flight of the MPLM system and the first flight of the Rafaello Module (FM2). The use of the MPLM on this flight was identical to the use on the previous mission. The actual mission from the MPLM standpoint proved to be uneventful with no problems or anomalies encountered. This module is still going through the deintegration and inspection process. As ofthis date, the MPLM is unaware of any problems with the Module as a result of this mission.

5.0 MPLM GROUND PROCESSING AND MAINTENANCE ACTIVITIES

The following information was taken primarily from K-SS-09.5.1 "International Space Station Kennedy Space Center Mini Pressurized Logistics Module (MPLM) Ground Processing Plan". Since the Flight 7A.1 mission is a reflight of the MPLM in the passive configuration, information on the initial delivery of the MPLM from Alenia and information on processing an MPLM in the active configuration have not been included. This information can be obtained from K-SS-09.5.1.

5.1 SSPF OPERATIONS OVERVIEW WITH RESPECT TO R&R OPS

The MPLM is prepared for launch in the Space Station Processing Facility (SSPF) located in the Industrial Area at KSC. The MPLM arrives at the SSPF in the Multi-Mission Support Equipment (MMSE), or canister, following an ISS mission. The MPLM is processed into the SSPF through the facility airlock and cleaned for entry into the highbay cleanroom. Once inside the highbay, the MPLM is removed from the canister/container using a 30 ton cab-operated bridge crane and the Cargo Element Lifting Assembly (CELA). The module is then placed in the Element Rotation Stand (ERS) and secured for processing.

For a returning ISS mission, racks that have been returned from orbit are removed from the MPLM following installation in the ERS. If necessary, the MPLM is converted from the passive configuration to the active configuration, or vice versa, by removing or installing the Active Thermal Mission Kit (ATMK).

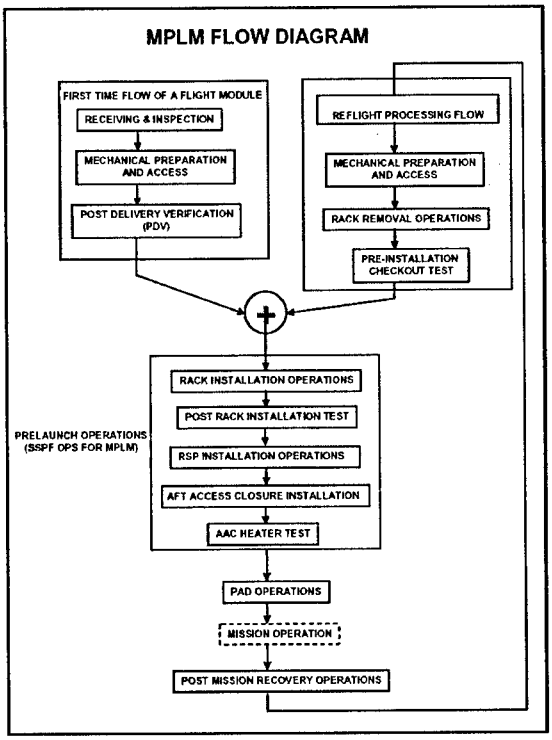


FIGURE 21. MPLM MISSION PROCESSING FLOW.

For all MPLM missions, racks are loaded through the 96-in Aft Access Closure (AAC) using the Rack Insertion Device (RID) and Weight and CG End Effector (W&CG EE). After rack installation, the RSP's are installed, and the MPLM subsystems powered-up and checked out to verify no damage occurred during Rack/RSP installation. The AAC is then installed, an AAC heater test performed, and any required flight software is installed and checked out. Utilization experiment operations are then performed, just prior to MPLM closeouts. The MPLM is then transferred to the Launch Package Integration Stand (LPIS). For active flights, the shell heater battery will be installed and, if required, Cargo Integration Test Equipment (CITE) testing will be performed. The MPLM will then undergo final closeouts. Weight and center of gravity determination will be performed as the MPLM is removed from the LPIS and installed into the canister for transportation to the launch pad and installation into the payload bay of the Orbiter.

After the MPLM is processed in the SSPF, it is transported to the launch pad where it is vertically installed into the Orbiter payload bay. Late Access Operations are performed at the launch pad in the Payload Changeout Room (PCR) with the MPLM powered and the payload bay doors open. Various configurations use both Orbiter and GSE resources and are described herein. MPLM interfaces with the Orbiter in the payload bay are described in NSTS-21000-IDD-ISS, SSP 21350 Active MPLM and in SSP 21351 Passive MPLM.

MPLM Ground Processing is subject to the KSC requirements outlined in KHB 1700.7, Space Shuttle Payload Ground Safety Handbook and with NSTS 1700.7, Safety Policy and Requirements for Payloads using the STS. The MPLM Mission Processing Flow summarizing the SSPF and Orbiter facilities Processing Overviews is shown in Figure 21. The MPLM test matrix is shown in Table 12. The matrix is divided into two areas: First flight of an MPLM (i.e., first mission for each serial number); and Re-Flights. The second column identifies the MPLM flight configuration as either passive or active and addresses the four possible configuration changes (e.g. passive to active).

TABLE 12. MPLM TEST MATRIX.

MPLM Test Matrix						
First Flight or Reflight	MPLM Passive/Active	PDV[1]	PICO[2,5]	PRIT[3,5]	CITE[4]	Orbiter IVT
First Flight	Passive MPLM (6A, UF-1)	Yes (fluids will be tested in later mission tests)	No	No	No	Yes (limited to Orbiter ROEU to MPLM HCU I/F)
Reflight	Active MPLM (UF-3)	Yes	No	Yes	Yes	Yes
	Passive to Active (e.g., UF1/UF-5)	N/A	Yes	Yes	Yes (one per S/N MPLM)[4]	Yes
	Active to Active (e.g., UF-5, 6, 19A)	N/A	Yes	Yes	No	Yes
	Passive to Passive (UF-2, 17A)	N/A	Yes	Yes	No	Yes (limited to Orbiter ROEU to MPLM HCU I/F)
	Active to Passive	N/A	Yes	No	No	Yes (limited to Orbiter ROEU to MPLM HCU I/F)

Note:
1) PDV includes Node and NSTS interfaces
2) Pre-Installation Checkout (PICO) includes Node and NSTS interfaces. Would be a sub-set of the PDV testing and any maintenance or servicing needed between flows.
3) Post-Rack Installation Test (PRIT) verifies active rack to MPLM interfaces, but includes both NSTS and Node interfaces
4) CITE testing includes NSTS Launch Processing System (LPS) format. Current KSC budget only supports one CITE test on UF-3.
5) An evaluation will be made on a mission-by-mission basis to determine if one of these tests can be eliminated.

5.2 FLOW OVERVIEW

This section describes the ground processing flow of the MPLM starting from the Pre-Installation Check-Out (PICO) to transportation out to the launch pad. Additionally, this section is written from the perspective that the MPLM was previously processed at KSC and flown at least one time.

5.2.1 MISSION RECONFIGURATION

5.2.1.1 PRE-INSTALLATION CHECKOUT (PICO).

The PICO is a functional/interface checkout that is performed at approximately L-5 months on MPLM reflight flows before the racks are installed. The purpose of this test is to verify MPLM subsystems while the hardware is most accessible and permits subsystem anomalies to be resolved while access to subsystem components is still possible. This checkout is almost identical to the PDV test, but is performed after the maintenance, reconfiguration, and storage activities of the MPLM have been completed and focuses on only the interfaces and services to be used on the upcoming mission. Copper paths not used in the upcomingflight are not included as part of this test. See Figure 22 for PICO Configuration (Passive). A description of the PDV test has been provided in the following paragraphs since the PICO test is based on it.

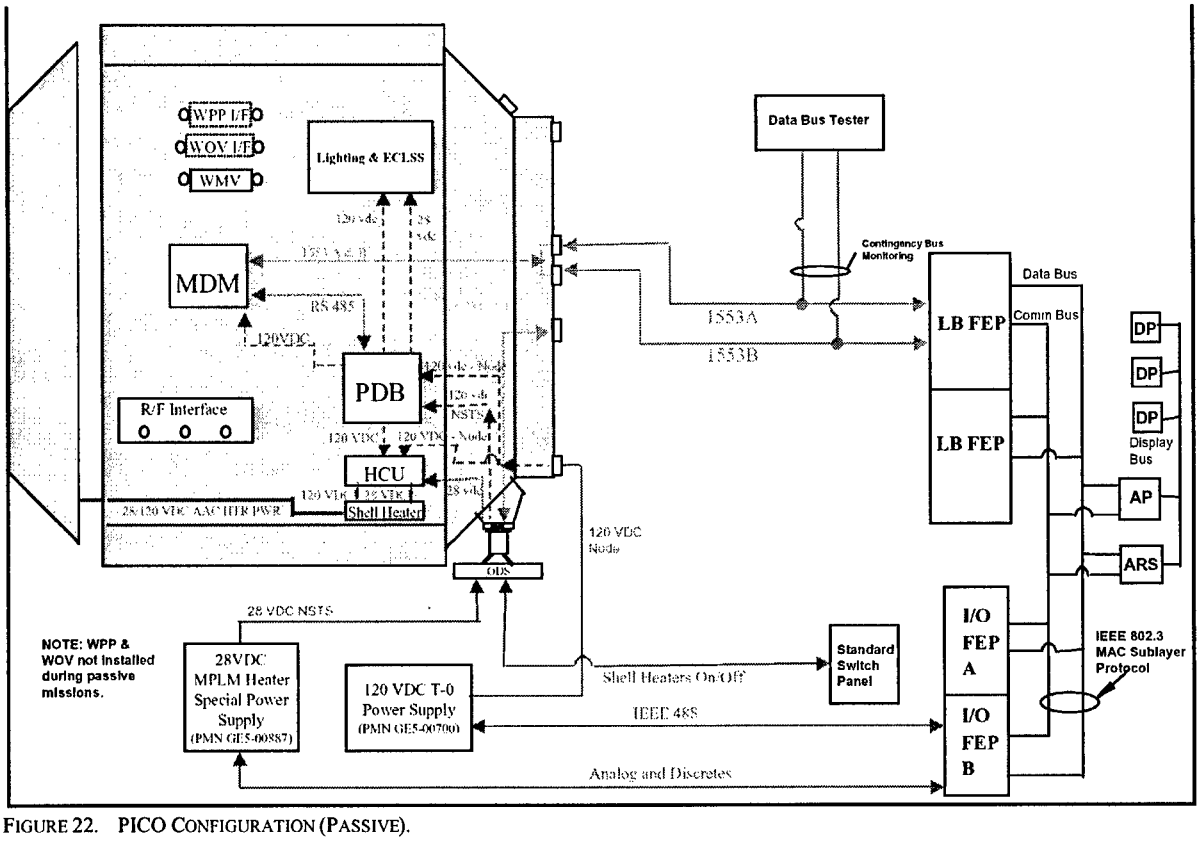


FIGURE 22. PICO CONFIGURATION (PASSIVE).

5.2.1.2 POST-DELIVERY VERIFICATION (PDV)

The purpose of the PDV test is: to verify that no damage occurred to the MPLM subsystems during transportation to KSC, to check the copper paths among all the MPLM subsystems (even if the path will not be used during the upcoming mission), to test the external interfaces and to correct baseline test data for each MPLM. It is only performed upon initial delivery of each MPLM. SeeFigure 23 for PDV Test Configuration. Test details include the following:

- Power on and perform functional checkout of MPLM subsystems (e.g. verify shell heater to Heater Control Unit (HCU), MDM to Remote Terminals, PDB to Active Rack Location Channelization, etc.)
- Check installed interfaces for both National Space Transportation System (NSTS) and Node interfaces. If the MPLM is shipped to KSC in the passive configuration, testing of the Active Thermal Control System (ATCS) will be deferred until subsequent testing/mission flows.

The PDV test is designed to check the copper paths among all the MPLM subsystems and the external interfaces and verify the correct MPLM functionality after transportation to KSC. Specifically, all the module copper paths will be tested upon initial delivery even if the path will not be used during the upcoming mission. During PDV, the MPLM flight systems and relevant GSE are commanded, controlled and monitored by TCMS.

The PDV will be performed in two main parts, based on the interface used to power and command the MPLM. The two main interfaces, resulting in the two main test sequences are:

- NSTS Interface (ROEU)
- USOS Interface (CBM (Common Berthing Mechanism))

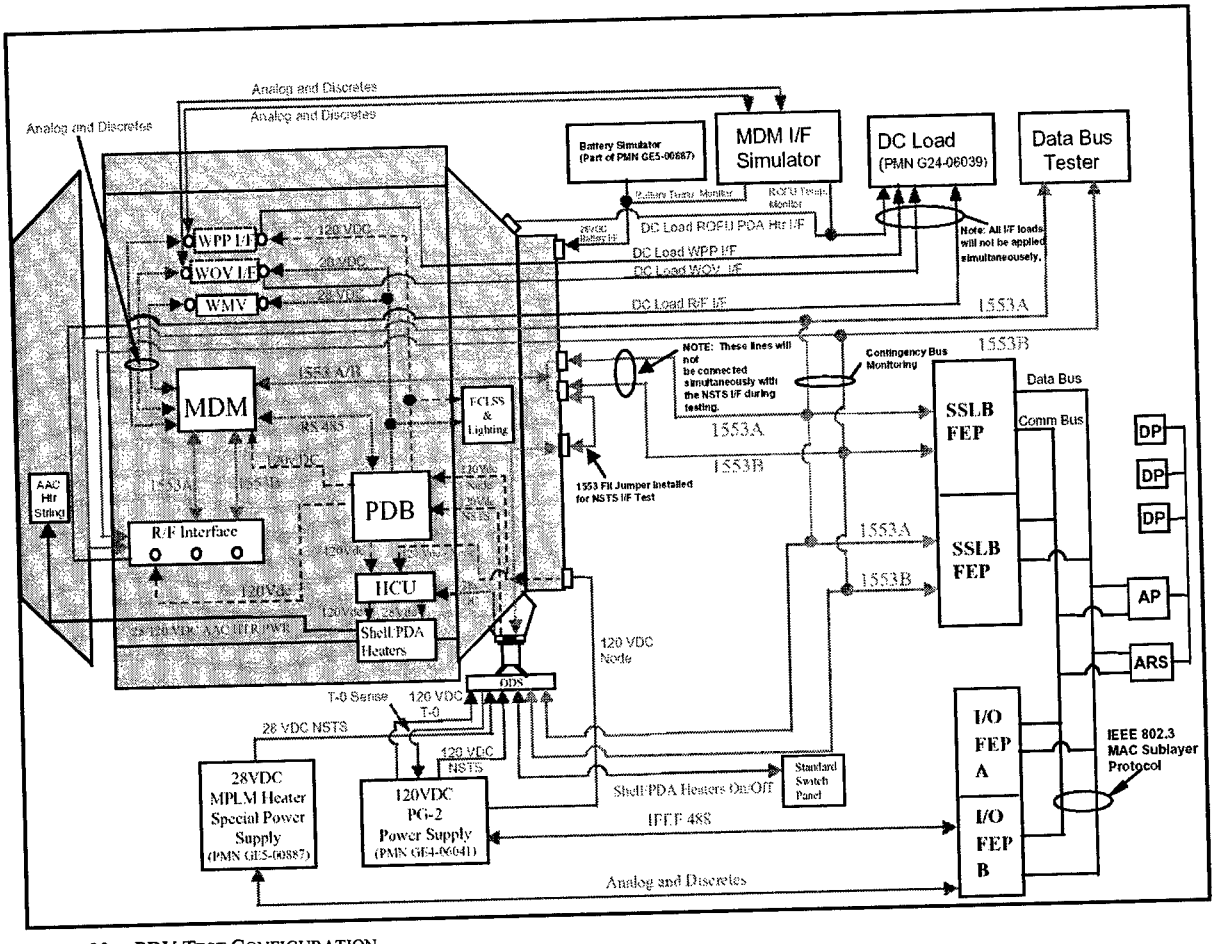


FIGURE 23. PDV TEST CONFIGURATION.

5.2.1.2.1 NSTS INTERFACE CHECKOUT.

The tests performed via NSTS interfaces include:

- MPLM nominal activation via NSTS interfaces. (Nominal Activation includes application of 120VDC to PDB, and MDM, Cabin Fan, and Fire Detector activation.)
- Water Pump Package (WPP) and Water On/Off Valve (WOV) checkout for active flights and WPP copper path test for passive flights.
- ATCS loop on/off and modulating valves check-out and positioning for flight
- Check of R/F power and data interface copper paths
- Heater Checkout (includes battery feed).
- MPLM nominal deactivation via NSTS interfaces.
- ROEU copper path tests of redundant power feeds. (This may require brief additional power ups.)

Specific support for this test is described in the subparagraphs below.

5.2.1.2.1.1 Fluid Pre-Operations.

For active configured MPLM's, the FGSE is activated and verified ready to support. The FGSE is then mated to the MPLM via the NSTS ROFU PDA interface to support MPLM PDV. At this time, proper configuration of flight ATCS jumpers are verified and FGSE is powered in "internal circulation" mode. For passive configured MPLM's, no FGSE is used.

5.2.1.2.1.2 Electrical Pre-Operations.

Electrical GSE will be activated and validated prior to use in the PDV. About a week prior to PDV, EGSE will be positioned and connected to facility power. TCMS control and monitor links will be connected to the applicable EGSE and verified. Electrical interfaces will be mated via the ROEU PDA. The ODS will be mated to the MPLM PDA. From this the various EGSE are connected to the MPLM. Isolation and bonding checks will be performed prior to mating of power supplies to MPLM. Power equipment includes: 120 VDC PG2 Power Supply (6A only), MPLM T-0 Power Source (after 6A), 28 VDC MPLM Heater Special Power Supply, DC Load, Interface Breakout Boxes/Cables-MPLM, and Interface Cables. The DC Load will be connected as required to simulate on board MPLM loads C&DH equipment used to support the PDV for the passive configuration will simulate the sensor and effector data corresponding to the WPP, WOV, and battery and ROFU PDA temperature sensors. A data bus tester will also be used to simulate RT's for the 1553B user bus at the R/FR locations. This equipment will be activated and validated prior to use in PDV using the MATE-3, and the MPLM MDM FEU.

C&DH Test Tools will be used to simulate missing internal MPLM subsystem data interfaces including WPP and WOV sensors and effectors in the forward end cone. Both TCMS and C&DH Test Tool interfaces will be validated prior to connection to the flight element. The Common Berthing Mechanism (CBM) interface 1553 flight jumper connector will be installed prior to the test to complete the circuit between the ROEU interface and the MPLM MDM.

5.2.1.2.1.3 MPLM Systems Checkout (NSTS Interface).

The MPLM will be powered via the NSTS interface at the ROEU PDA connection using the 120 VDC PG-2 Power Supply (6A), and the MPLM T-0 Power Source for the rest. During the power-up sequence, power is applied to the PDB. RPC#1 is preset to ON and automatically feeds the MDM power. The MDM initializes at this point. TCMS will be used to control and monitor the MPLM via the ROEU Payload Disconnect Assembly (PDA). After application of 120 VDC to the MPLM MDM, TCMS will initiate 1553 data bus communication and verify MDM POST/BIT results. The MPLM activation sequence will be performed and MDM memory will be loaded, if necessary. MDM memory will be dumped to establish the delivered software load baseline. For passive MPLMs, valves and ambient sensors will now be checked. For active MPLM's, MPLM status check for active flights will be verified. This involves checking the status of the Depress Assemblies (DA) and the Positive Pressure Relief Assemblies (PPRA's). Also for an active configured MPLM, FGSE temperatures are stabilized before MPLM power-up. The FGSE is then reconfigured to flow cooling water through the flight ATCS loop. Visual leak checks are then performed.

Power will be fed to the ECLSS subsystems (Fire Detection and Cabin Fan), as needed, to support each subsystem's checkout requirements. MDM and power interfaces to WPP and WOV will be verified using C&DH Test Tools and a DC Load to simulate these end items for modules delivered in the passive configuration. For active configured MPLM's, the TCS will be activated and checked out. All R/FR power and C&DH interfaces will be checked with C&DH test tools and the use of the dc load bank mentioned above. All MPLM lighting will be activated and verified for nominal operation.

Cooling support for active configured MPLM's will continue until all powered operations are complete. Note: during both phases of PDV, all commands sending power from RPC's to an ATCS component will be performed by Electrical Power System (EPS) engineering at TCS engineering request.

For the Shell and AAC heater test the 28 VDC MPLM Heater Special Power Supply will be activated to provide power to the 28 Vdc NSTS feed to the HCU as well as to simulate the MPLM battery. The HCU will then be commanded to activate the shell heaters. The shell heaters will be monitored by TCMS via the MDM for nominal operation. The PDA/ROFU heater interface, powered via the MPLM battery simulator, will be verified. The 28 VDC Power Supply will be deactivated. The NSTS PDA/ROFU CH2 interface will be verified. Due to recent changes in thermostat design settings, heater testing plans are subject to change. After all interfaces have been successfully checked and verified, the MPLM subsystems are deactivated starting with the cabin fan, then Fire Detection, and then finally the MPLM.

5.2.1.2.1.4 Post Operations.

At the conclusion of the NSTS configuration test, the MPLM deactivation sequence will be performed and 120 Vdc power removed. TCMS will be disconnected from the PDA interface, C&DH Test Tools will be disconnected from the WPP/WOV locations and the CBM interface 1553 flight jumper connector will be demated. After all powered operations are complete; the ATCS is configured for safe shutdown and disconnection. Power and TCMS will be reconfigured to support the USOS interface checkout. This will involve disconnecting GSE from the ROEU interface and connecting it to the USOS interface.

5.2.1.2.2 USOS INTERFACE CHECKOUT.

While powered through the USOS interface, more specific testing will occur on certain LRU's; whereas when powered through the ROEU, these LRU's are utilized to test other systems. The tests performed via the USOS interface include:

- Nominal activation and check of the MPLM avionics items:
  - Power Distribution Box (PDB)
  - Multiplexer/Demultiplexer (MDM)
  - General Luminary Assemblies (GLA's)
  - Emergency Egress Lights (EEL)
- Check:
  - Depressurization Assembly (DA) valves
  - Positive Pressure Relief Assembly (PPRA)
  - Sample Line Shut-off Valve (SSOV)
  - Air Circulation (AC)
  - Fire Detection (FD)
- Heater Checkout
- Nominal Deactivation of MPLM

Specific support for this test is described in the subparagraphs below.

5.2.1.2.2.1 Fluid Pre-Operations.

For active configured MPLM's, the USOS NSTS Thermal Service (UNTS) is demated from the ROFU PDA, and the Water Servicer Kit (WSK) is mated to the MPLM Node fluid interface. The UNTS and the WSK together comprise the FGSE. At this time, proper configuration of flight ATCS jumpers are verified, and the WSK is activated. For clarification purposes, the WSK is the water pump in the USOS configuration where the MPLM Water Pump Package (WPP) is the water pump in the NSTS configuration. For passive configured MPLM's, no FGSE is used.

5.2.1.2.2.2 Electrical Pre Operations.

Electrical GSE will be activated and validated prior to use in the PDV. About a week prior to PDV, EGSE will be positioned and connected to facility power. TCMS control and monitor links will be connected to the applicable EGSE. EGSE will be connected to the USOS interface of the MPLM (CBM interface). Isolation and bonding checks will be performed prior to mate of power supplies to the MPLM. Power equipment includes 120 VDC PG2 Power Supply (6A only), MPLM T-0 Power Source (after 6A), 28 VDC MPLM Heater Special Power Supply, DC Load, Interface Breakout Boxes/Cables-MPLM, and Interface Cables. The DC Load will be connected as required to simulated on board MPLM loads. C&DH equipment used to support the PDV for the passive configuration will simulate the sensor and effector data correspondingto the WPP, WOV, and battery and ROFU PDA temperature sensors. A data bus tester will also be used to simulate RT's for the 1553B user bus at the R/FR locations. This equipment will be activated and validated prior to use in PDV using the MATE-3 and the MPLM MDM FEU.

5.2.1.2.2.3 MPLM Systems Checkout (USOS Interface).

During the PDV USOS interface test, TCMS will be used to control and monitor the MPLM via the USOS 1553 data bus interface at the Passive CBM bulkhead. C&DH Test Tools will be used to simulate missing internal MPLM data interfaces, including R/Fs at each rack location. Both TCMS and C&DH Test Tool interfaces will be validated prior to connection to the flight element. The Passive CBM interface 1553 flight jumper connector will be demated prior to this test.

The MPLM will be powered via the MPLM T-0 Power Source. Upon application of 120VDC power to the MPLM power bus, RPC#1 in the PDB (preset to ON), will power up the MDM. TCMS will be used to control and monitor the MPLM via the USOS interface. After application of 120 Vdc to the MPLM MDM, TCMS will initiate 1553 data bus communication and verify MDM POST/BIT results. The MPLM activation sequence will be performed and MDM memory will be loaded, if necessary USOS power interface verification will consist of verifying power to the PDB and checking out the 120V shell heater and PDA/ROFU heater strings. MDM interfaces to MPLM subsystems will be verified as part of individual subsystem tests. From this point, EPS activities are a support function until C&DH and Fluids testing are completed.

For passive MPLM's, valves and ambient sensors will now be checked. For active configured MPLM, the Water On-Off Valve (WOV) is configured for USOS operation and the FGSE is activated and configured for USOS operation. Next all ECLSS subsystems and General Luminary Assemblies (GLA's) are checked and verified. MDM and power interfaces to WPP and WOV will be verified using C&DH Test Tools and a DC Load to simulate these end items for modules delivered in the passive configuration. MDM interfaces to R/Fs will be verified using C&DH Test Tools to simulate these end items. For active configured MPLM's, the FGSE is deactivated.

5.2.1.2.2.4 Post-Operations.

At the conclusion of the USOS configuration test, the MPLM deactivation sequence will be performed and 120 Vdc power removed from the MPLM. The TCMS will be disconnected from the ROEU PDA in preparation for module rotation and rack installation. The ROEU Support Assembly and the ROFU Support Assembly will be removed from the ERS prior to rotation. C&DH Test Tools and the DC load bank will be disconnected from the MPLM Utility standoff R/F interfaces. The CBM interface 1553 data bus flight jumper will be remated for flight. The jumper installation will be verified during the Post Rack Installation and AAC Heater tests prior to MPLM transfer to pad. For passive missions, this jumper is not used operationally, and will be removed after the MPLM is installed on the USOS on orbit. For active missions, this jumper is required to support 1553 communications via ROEU during late access operations at the pad, and in the orbiter PLB on orbit.

For active missions, the FGSE will be disconnected from the USOS interface. Post test data reduction and analysis will be performed as required to satisfy OMRS requirements and to support anomaly resolution.

5.2.1.3 RACK INSTALLATION.

This section provides an overview of Rack processing. Details of cargo installation in Racks can be found in the KSC Resupply and Return Cargo Ground Processing Plan, K-SS-09.5.3. Any prepacked stowage trays will be received, stored in the SSPF rack integration room (SSPF 1489) and installed in appropriate racks.

The PAF/Lightweight Floor will be removed, the MPLM rotated 90 degrees (keel starboard) for floor and ceiling rack installation, and the PAF/Lightweight Floor re-installed. The RID and Weight and CG end effector will be configured to remove racks from the Rack Handling Adapter (RHA), perform rack weight and CG determination and install racks into the MPLM. After all floor and ceiling racks are installed, the PAF will be removed, the MPLM rotated back to keel down and the PAF re-installed. The RID and end effector will then be used to remove racks from RHA's, perform weight and CG and install port and starboard racks.

The Post Rack Installation Test (PRIT) test is performed after rack installation and prior to AAC installation on both active and passive module flows. The primary purpose of the PRIT is to verify active rack interfaces to the MPLM including proper operation of MPLM to R/F software after update. This test includes the R/F activation via Node interface, a checkout of the R/Fs and a final deactivation. The secondary purpose is to verify that no damage occurred to module subsystems during rack installation. See Figure 24 for PRIT Configuration. This test is performed prior to installing the AAC for flight in the event that a R/F rack(s) would need to be removed due to failure or to gain access to the module subsystems in the event of required maintenance or repair. For passive module missions, the PRIT is identical to that of the active configuration with the exception of no fluid interfaces and no R/F rack–to–MPLM interface checkout.

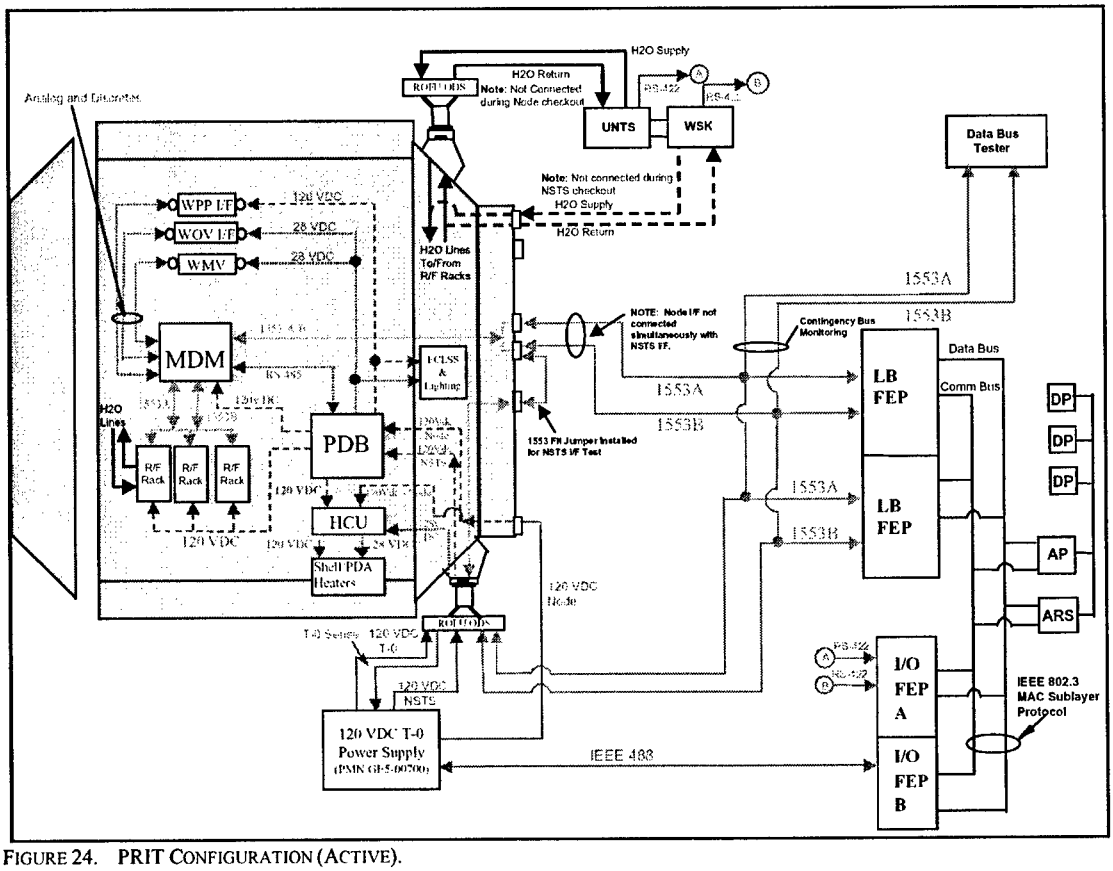


FIGURE 24. PRIT CONFIGURATION (ACTIVE).

5.2.2 UTILIZATION EXPERIMENT OPERATIONS (MPLM IN ERS).

For racks in the MPLM, an opportunity exists approximately two and one-half months prior to launch for time critical payload installation, stowage, servicing and closeouts operations in the SSPF. The UIPT and LSu IPT each maintains responsibility for the installation, servicing, and closeout operations for their assigned hardware. Since stowage is the responsibility of both UIPT and Launch Support, responsibility for the stowage of a time critical item belongs to the group with responsibility for that tray, regardless of which group has rack/item responsibility.

5.2.3 FLIGHT SOFTWARE (FSW) INSTALLATION.

If required, the final prelaunch MPLM MDM FSW load will be installed and the installation verified during the Post Rack Installation Test (PRIT). In addition, the compatibility of the final FSW with the MPLM hardware will be validated. TCMS will be used to load the FSW binary executable into the MDM EPROM, dump the loaded memory addresses, and compare the dump data contents to the load file contents. Power will be cycled to the MDM and the MDM rebooted. A DRAM dump will be performed to validate that the installed software booted properly. A subset of subsystem commands will be issued and measurements monitored to validate hardware/software compatibility.

5.2.4 AAC INSTALLATION

The RID with Weight & CG end effector will be attached to the AAC box frame holding the AAC. The assembly will be removed from the support fixture and the AAC installed on the MPLM. The AAC box frame will be disconnected from the AAC and placed on the support fixture for storage. The Weight & CG end effector will be placed on its storage stand and disconnected from the RID.

5.2.5 AAC HEATER TEST

This test is performed after the AAC installation and verifies the AAC Heater interfaces to the MPLM Heater Control Unit (HCU). This test verifies the connection of the final flight cabling between the HCU and the AAC shell heaters. The AAC will be locally cooled in order to electrically close the thermostats to verify those interfaces. Power, data, and cooling interfaces to the module for this test are the same as those used in the PICO and PRIT tests. See Figure 25 for the AAC Heater Test Configuration.

At the end of this test, MPLM subsystems will be configured for flight (passive missions) or for late access ops (active missions) prior to MPLM transfer to the LPIS for SSPF powered-off closeouts. This represents the last opportunity on passive missions to verify the operability of the MPLM subsystems before installation into the Orbiter.

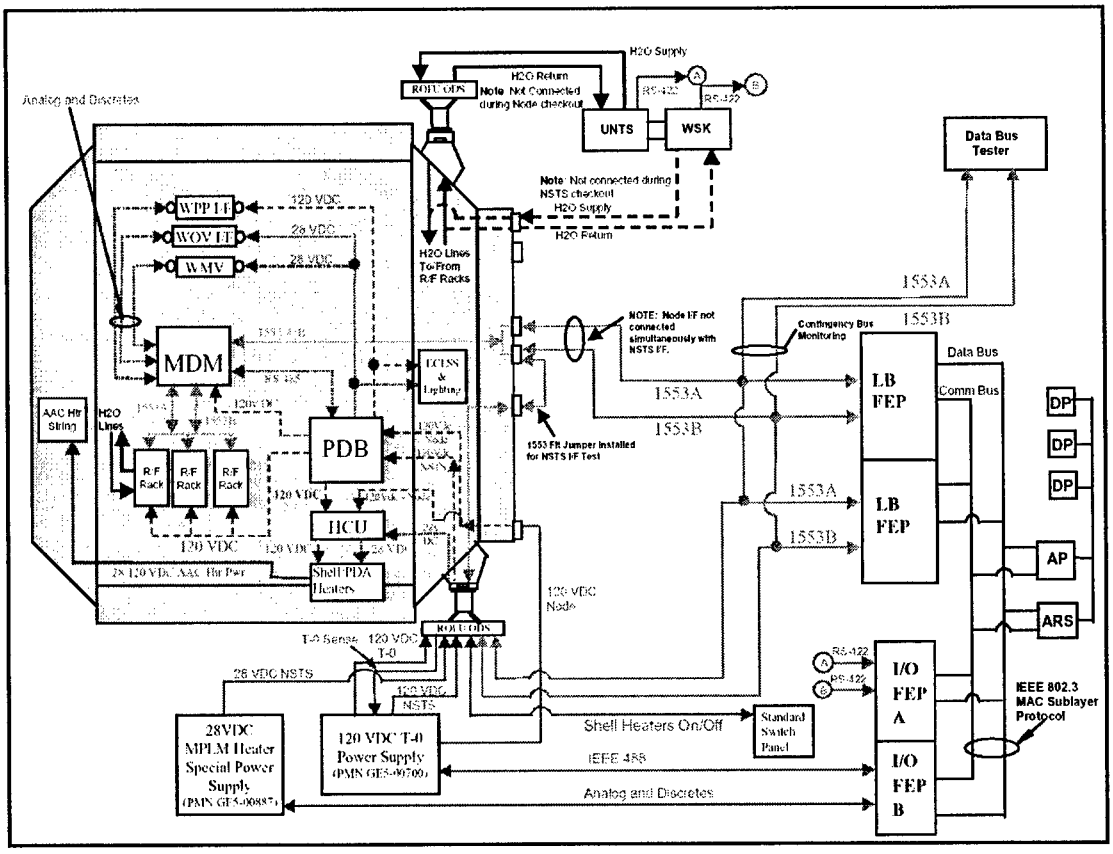


FIGURE 25. AAC HEATER TEST CONFIGURATION.

5.2.6 MPLM ERS CLOSE-OUTS.

After all powered testing is complete, the FGSE, EPS GSE, and TCMS interfaces are disconnected from the MPLM, the AAC-to-aft end cone gask-o-seal will be leak tested, the AAC MLI and MDPS will be installed, and the MPLM exterior will be inspected and cleaned, if required.

5.2.7 LPIS OPERATIONS

5.2.7.1 MPLM TRANSFER TO LAUNCH PACKAGE INTEGRATION STAND (LPIS).

Four payload fittings will be installed and aligned (utilizing alignment equipment) on the LPIS to support MPLM longeron trunnions. Four payload weight and balance fittingswill also be installed on the LPIS. The ERS upper ring assembly will be removed. The CELA will be configured and utilized to transfer the MPLM from the ERS to the LPIS. The Removable End Access Platform (REAP) and Removable Overhead Access Platform (ROAP) will be positioned to aid access.

5.2.7.2 CARGO INTEGRATION TEST EQUIPMENT (CITE) IVT.

Only the first Active MPLM is planned to have a CITE IVT. The Orbiter-to-MPLM data interfaces tested during CITE IVT for active missions include the OIU-to-MPLM MDM, TCMS T-0 to MPLM MDM and the SSP-to-MPLM HCU. All data interfaces are mated via Orbiter ROEU simulator connection to the MPLM PDA. The CBM interface 1553 flight jumper will be installed for this test.

Orbiter physical and functional interfaces will be simulated during the thermal portions of CITE testing. The Orbiter Disconnect Simulator will simulate the physical interface and connect the MPLM to its GSE heat sink. The GSE heat sink, the USOS/NSTS Thermal Simulator (UNTS), will simulate fluid and thermal performance of the NSTS payload integration hardware. No testing of the actual ROFU mechanism is planned in CITE.

Prior to the ROEU simulator mate, TCMS T-0 1553 interfaces to ROEU connectors will be verified using C&DH Test Tools. Orbiter Interface Unit (OIU) 1553 and SSP interfaces to ROEU connectors will be verified by CITE personnel. The ROEU simulator will then be mated to the MPLM.

After the ROEU simulator is mated to the MPLM, Orbiter avionics data interfaces to the MPLM MDM will be verified using control and monitor capabilities of the MCDS and CITE control rooms. The Aft Flight Deck (AFD) OIU data bus switch will be configured to OIU and 120 Vdc power from the CITE APCU simulator will be directed to the MPLM MDM via the MPLM Power Distribution Box (PDB). The OIU-to-MPLM MDM 1553 bus communication will be initiated and MDM POST/BIT results will be verified. The MPLM activation sequence will then be performed and Orbiter communications with MPLM subsystems will be verified. SSP interfaces to the HCU will be verified using the CITE SSP. At the conclusion of the Orbiter avionics interface test, the MPLM deactivation sequence will be effected and 120 Vdc power will be removed from the MPLM MDM. Finally, interfaces from TCMS to the MPLM MDM using the CITE T-0 system will be verified. The AFD OIU data bus switch will be configured to T-0 and 120 Vdc power will be conducted from the T-0 Power Supply GSE. TCMS-to-MPLM MDM communications will be affected and MDM POST/BIT results will be verified. The MPLM activation sequence will be performed and TCMS T-0 communication with MPLM subsystems will be verified. At the conclusion of the T-0 test, the MPLM deactivation sequence will be initiated and the 120 Vdc power removed from the MPLM MDM. The CBM interface 1553 flight jumper will remain mated through launch.

5.2.7.3 UTILIZATION EXPERIMENT OPERATIONS (LPIS).

For Utilization Experiments, a final opportunity exists while the MPLM is in the LPIS for time critical payload installation, stowage, servicing and closeouts operations in the SSPF.

5.2.7.4 SPACE VISION SYSTEM (SVS) SURVEY.

The SVS target final installation and survey will be completed in the LPIS. The survey may require the Cargo Element Extension Kit (CEEK) with Payload Fittings be installed on the LPIS. The survey will be performed on both the first flight processing of an MPLM and on reflight MPLM flows due to removal/installation of the MDPS and AAC.

5.2.7.5 SSPF CLOSEOUTS IN LPIS.

After any CITE tests and Utilization experiment operations, internal inspections and closeouts will be performed and PAF removed. The hatch restraint fixture will be removed and hatch closed using the hatch operations kit. The forward hatch seal will be leak tested using the Leak Check Kit and Leak Rate Test Interface. On active missions the forward end cone battery will be installed. The MPLM final SSPF external inspection, cleaning and closeouts will be performed.

A leak test of the Common Berthing Mechanism (CBM) will be performed. The CBM Simulator in its storage stand will be positioned near the LPIS. All protective covers will be removed from the CBM and the seal surface cleaned as required. Utilizing overhead crane, hydro-set and the CBM Lift Sling, the simulator will be hoisted and mated to CBM. The CBM simulator load cells will be connected and powered, simulator attached to the CBM and the sling disconnected and stowed. The CBM seal leak check will then be performed using the Leak Check Kit and Leak Rate Test Interface Hardware. The simulator will be demated from the CBM and placed on its storage stand. The CBM will be cleaned and closeouts performed, as required.

5.2.8 CANISTER OPERATIONS.

The MMSE canister will be configured, cleaned and positioned in the SSPF high bay with the doors open, ready for MPLM installation. The REAP, ROAP, and other access platforms will be removed from around the MPLM. The CELA will be utilized to lift the MPLM out of payload fittings and place it on weight and balance fittings on the LPIS for MPLM weighing (three times). The MPLM will be transferred to the MMSE and the CELA will be returned to storage.

At this time any other mission cargo element (i.e., Spacelab Logistic Pallet, MBS, etc.) will be weighed as required and installed into the canister. Canister closeouts will be performed and the doors closed. The canister will be transferred to the Canister Rotation and Cleaning Facility (CRCF), rotated to vertical and placed on a transporter, transferred to the pad and hoisted in place on the Payload Changeout Room (PCR).

The PCR doors will be opened, the MPLM transferred to the Payload Ground Handling Mechanism (PGHM), the PGHM retracted and the PCR doors closed. The canister will then be lowered onto the transporter and returned to the CRCF for storage or reconfiguration.

5.3 PRE-LAUNCH OPERATIONS – LC-39 OPS

5.3.1 PREPERATIONS FOR ORBITER IVT

The TCMS is used to control and monitor the MPLM and associated GSE during Orbiter IVT T-0 interface verification and also during late access operations at the pad. Because the samples located inside the MPLM represent a significant scientific investment, whenever a powered operation of the MPLM involves items in the R/F's, the GSE and procedures used will provide an operational redundancy to protect the flight hardware and samples.

The Phase II TCMS pad support configuration consists of a CMU that provides both front-end interface and application/display processing functions. The CMU communicates via Ethernet and FDDI links with the Archival Processor and Display Processor terminals located in the SSPF. Pad data systems set-up and operational readiness checks for mission processing are performed in stages. First, TCMS system software, applications and the databank are configured in the SSPF. The TCMS software configuration is validated using MPLM flight software in an MDM Flight Equivalent Unit (FEU) in the SSPF.

Prior to MLP rollout from the Vehicle Assembly Building (VAB), the validated test configuration software is loaded into the TCMS equipment in the MLP via a TBD interface. TCMS-to-GSE and T-0 interface cable patching is performed. TCMS equipment in the MLP is initialized, configured and verified using local (portable) user interface terminals. Cable interfaces from the CMU to Orbiter T-0 (TSM) connections, GSE and SSPF remote connections on the MLP are verified using the C&DH Test Tools and commercial test equipment. Communication with the Power Supply GSE in MLP 10A is verified after the GSE is installed for each mission.

After MLP rollout to the Pad, TCMS interfaces to Fluids GSE on the pad surface are verified using local user interface terminals. TCMS links to the SSPF are then initialized and software updates downloaded, if required. End-to-end communications between the SSPF TCMS control room and the MLP Power/Fluids GSE are verified. The MPLM CBM interface 1553 flight jumper remains mated through launch. OIU 1553 and SSP interfaces to ROEU connectors will have been verified by SFOC personnel prior to MPLM arrival at the pad. Prior to MPLM installation in the Orbiter, for active MPLM missions, all T-0 interfaces to the MPLM, via the ROEU, will be verified using the Payload Disconnect Simulator (PDS) connected to the flight Orbiter Disconnect Assembly (ODA). This will be performed with access provided by PGHM platforms with the PGHM in the forward position. The TCMS T-0 1553 interfaces to ROEU connectors are verified using C&DH Test Tools.

The Shuttle LPS is used during Orbiter IVT to support OIU-to-MPLM MDM interface verification. The LPS configuration consists of front-end processors with interfaces to the Orbiter GPC Launch Data Bus for commands and to Orbiter Pulse Code Modulation Master Unit (PCMMU) operational downlink for telemetry. LPS payload application software and payload databank are configured and validated using the CITE system in the SSPF. The payload software configurations are delivered to SFOC for inclusion in the Shuttle LPS Test Configuration Identifier Build (TCID) for the mission. SFOC personnel are responsible for the operational readiness of LPS and Orbiter systems to support pad testing.

5.3.1.1 PAYLOAD INSTALLATION IN ORBITER.

The PCR will be rotated to mate with the Orbiter, doors opened, PGHM moved into Orbiter bay and MPLM transferred from PGHM to Orbiter. Required access for Orbiter IVT will be installed. BB and PGOC personnel will assist SFOC personnel during this activity.

5.3.1.2 ROEU MATE FOR FLIGHT.

After MPLM installation into the Orbiter and prior to MPLM IVT, a Mate/Demate test of the ROEU will be performed. This test provides final verification that the ROEU motor drives can successfully latch and unlatch both halves of the flight ROEU. It involves commanding the motors to drive the ODA arm closed, verify talkback of the latch indicators and drive the ODA arm open. The final ROEU mate for flight is then performed in the same manner. At this point the MPLM is ready for IVT.

5.3.2 ORBITER IVT

All MPLM missions will require an Orbiter IVT. This test is performed at approximately L-4 weeks, and its purpose is to verify/ensure that MPLM STS interfaces are ready for flight. For the passive MPLM's this test is limited to the Standard Switch Panel (SSP) to Heater Control Unit (HCU) test. For active MPLM missions, additional Orbiter-to-MPLM power, data, and cooling interfaces are tested. These include both Orbiter systems and T-0 interfaces. All power and data interfaces are connected via the Orbiter ROEU to MPLM PDA. The cooling interface is connected via the Orbiter ROFU to the MPLM PDA.

For passive missions (6A, UF-1 and UF-2), the IVT is performed to check the Orbiter-to-MPLM interfaces (SSP to HCU) used on the mission. Orbiter 28V will be fed directly to the HCU through the ROEU connection via the Orbiter SSP. The test will consist of commanding four relay closures in the HCU and verifying the associated talkbacks at the SSP.

5.4 SECTION 6 POST-LANDING OPERATIONS

An MPLM passive mission supports the Space Station with non-refrigerated racks carrying supplies to and from orbit. Orbiter operation and the recovery of the MPLM for passive missions are typical of a Space Lab mission were recover of the Lab module occurs within the OPF. Upon touchdown of the Space Shuttle the Convoy provides all necessary support to both the MPLM and the Orbiter without the PSV. The Orbiter is met on the SLF and Orbiter Coolant and Purge are connected at T-0 interfaces once the aft safety assessment is complete. Upon completion of the Orbiter support services the Crew exits and Mid-Deck experiments are removed. After which, the Towing to a predetermined OPF High Bay will commence. Upon arrival at the OPF High Bay the Orbiter is jacked and leveled, safety devices installed platforms configured and the Payload bay doors opened.

The correctly configured MMSE canister and the Payload Strongback System on a transporter will be transported into the OPF. The canister doors will be opened. The strongback will be utilized to remove the MPLM (and any other Cargo Element) from the Orbiter and place in the canister. The canister doors will be closed and the canister and strongback returned to the SSPF. The ERS upper ring assembly will be removed and stored to ready ERS for MPLM installation. The keel pin, trunnion fittings and work platforms will be prepared to receive the MPLM.

The MMSE canister and strongback will be cleaned and brought into SSPF high bay. The strongback would be stored and the CELA configured for returned element removal. The canister doors will be opened and CELA used to transfer MPLM from canister to ERS. The CELA would also remove any other Cargo Element (i.e. SLP) from canister to workstand. The CELA will be deconfigured and stored. The canister will complete its closeout, close doors and transport to CRCF.

5.5 POST-MISSION/TURNAROUND OPERATIONS

5.5.1 MISSION DECONFIGURATION (I.E. POST-MISSION OPS)

Further details of post-mission deconfiguration can be found in the KSC Resupply and Return Cargo Ground Processing Plan, K-SS-0.9.5.3.

Prior to MPLM delivery to KSC, the Element Rotation Stand (ERS) will be set up in the SSPF high bay footprint. The keel pin, trunnion fittings, upper ring assembly, and work platforms will be prepared to receive the MPLM. The Ground Air Cooling Unit (GACU) will be positioned in the MPLM footprint, hoses routed and connected, checked out and validated to provide conditioned air for ground crew comfort in the MPLM.

The MPLM will be delivered to the SSPF in the MMSE, cleaned and positioned in the SSPF airlock. An electric tow vehicle will be attached to the transport container. The airlock will be brought to class 100,000 and the door to the high bay will be opened. The transport container will be towed into the high bay and positioned next to the ERS footprint. The CELA will be used to remove the container cover.

After inspection of the MPLM exterior, the CELA will be configured and used to remove the MPLM from the MMSE and install it into the ERS. Access platforms will be positioned. The MDPS will be removed from the AAC and stored in the MDPS handling kit. The AAC Multilayer Insulation (MLI) will be removed and stored in the MLI Storage Container. The RID, Weight and CG end effector and AAC box frame will be configured and used to remove the AAC from the MPLM, then the AAC and AAC box frame will be stored on the AAC support fixture until AAC re-installation, which occurs after rack installation.

The Alenia Lightweight Floor and PG-3 Personnel Access Floor (PAF) will be installed and the MPLM interior inspected. The hatch will be opened and restrained using the Hatch Operations (HOK) and Hatch Restraint Fixture.

The Alenia lightweight floor, when required, and Personnel Access Floor (PAF will be installed and MPLM interior inspection accomplished. The hatch will be opened and restrained utilizing the Hatch Operations Kit 1G and the Hatch Restraint Fixture.

When required, RSP(s) will be removed utilizing the RID and Weight and CG end effector soft packs or ORU's are installed on the aisle side of an RSP, they will be removed manually or with ORU end effector and RID prior to RSP removal. The RSP(s) will be placed on a Rack Handling Adapter and taken to RSP deintegration area (I-Bay or SSPF room 1489).

When required, port and starboard Rack(s) will be removed utilizing the RID and Weight and CG end effector. The Rack(s) will be placed on Rack Handling Adapter(s). If floor and/or ceiling racks are returned, the PAF will be removed, ERS access platforms configured for ERS rotation, the ERS rotated 90 degrees (keel starboard), the PAF installed and floor and ceiling racks removed. The PAF will again be removed, ERS panels configured, the MPLM rotated back to keel down and the PAF installed. Resupply Stowage Racks will be taken to the rack deintegration area (SSPF room 1489). Other racks (Payload, R/F, etc.) will be transferred to Utilization.

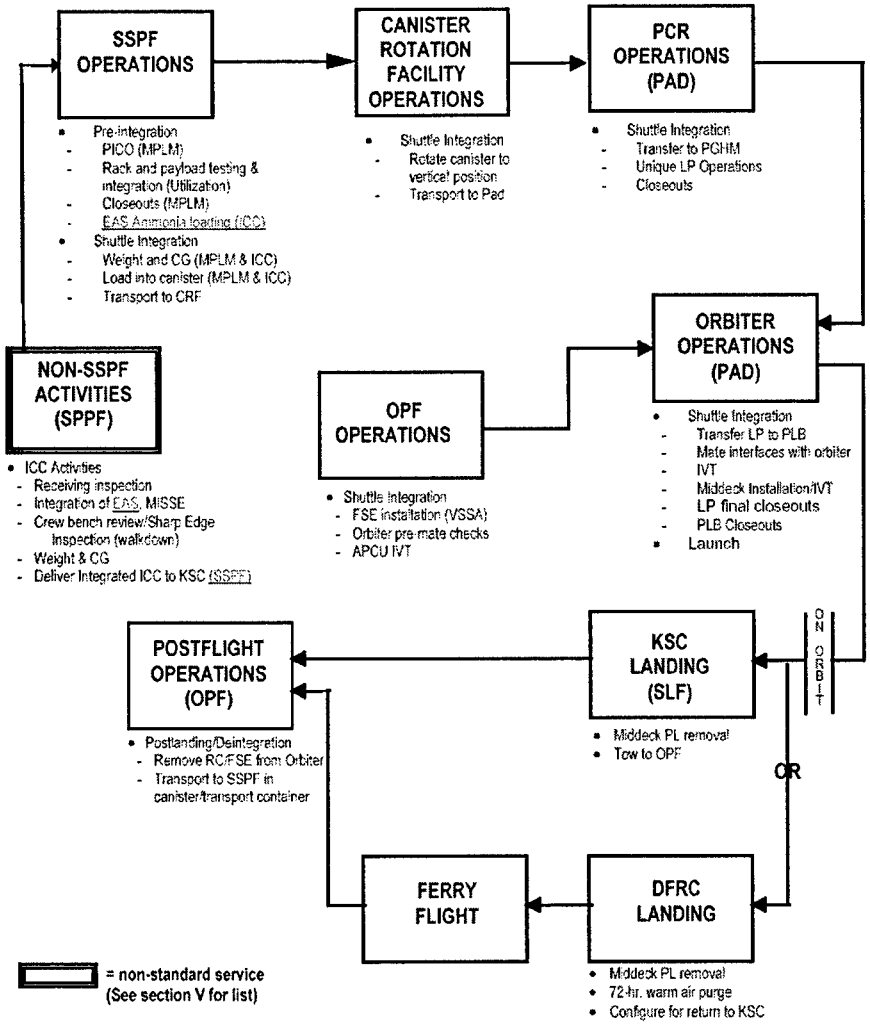


FIGURE 26. LAUNCH PACKAGE GROUND PROCESSING FLOW FOR ISS FLIGHT 7A.1 TAKEN FROM K-PSM-11.510-ISS-7A.1-BL-CHG1 "INTERNATIONAL SPACE STATION PROGRAM SPACE STATION ASSEMBLY FLIGHT (ISS-7A.1) MISSION INTEGRATION PLAN (NSTS 21438) ANNEX 8".

6.0 ON-ORBIT OPERATIONS

Flight 7A.1 is scheduled to be an eleven-day shuttle mission to the International Space Station. Rendezvous with the ISS is scheduled to occur at 210 nautical miles on flight day 3. Flight 7A.1 is the first reflight of the Leonardo (FM1) MPLM module and the third flight of the MPLM system. This particular mission will not have the refrigerator/freezer installed in the MPLM so it is considered a passive mission. Flight UF-3 and subsequent missions are expected to use the refrigerator/freezer racks and will be considered active missions. Table 13 shows a summary of the mission activities for Flight 7A.1. Operations involving the MPLM are bolded. Please note that this list contains activity highlights based on preliminary flight timelines and does not represent the final approved flight time line.

TABLE 13. MISSION SUMMARY.

FLIGHT DAY	ACTIVITY
Flight Day 1	Launch Standard FD1 activities **APCU 2 is activated to support MPLM Environment Checks.** **Activate MPLM Shell Heaters** Crew sleep is seven hours after luanch in preparation for docking on FD3.
Flight Day 2	SRMS Checkout Cargo Visual Inspection with SRMS Setup for Water Transfer to ISS Fill 2 CWCs with Orbiter fuel cell water Activate/Checkout OSVS Setup/Activate PCS Machine Activate/Checkout OIU 1 **Check Status of MPLM Environment (partial activation to confirm internal temperature and pressure integrity)** ODS Ring Extension Centerline Camera Installation/Checkout
Flight Day 3	**MPLM Environment Check** Rendezvous with ISS Dock Orbiter to PMA2 on LAB (Fwd port) Pressurize and checkout PMA2 ODS Ingress Preparation Ingress Station Transfer Activities EVA equipment transfer Transfer 3 CWC's
Flight Day 4	Checkout Port and Nadir CBMs Power up SRMS **Install MPLM on Node nadir CBM** **Maneuver SRMS to MPLM pre-grapple position** **Grapple MPLM with SRMS** **Prep MPLM for unberthing from PLB** **Deactivate shell heaters** **Disconnect ROEU** **Release PRLAs and AKA** **Unberth MPLM with SRMS** **Install MPLM on Node** **Configure MPLM for ISS Ops** **Pressurize Node-to-MPLM Vestibule** **Ingress Node-to-MPLM Vestibule** **Node-to-MPLM Vestibule Prep for Activation** **Activate MPLM** **Ungrapple MPLM and maneuver SRMS clear** Power down SRMS Prep IELK for transfer to ISS. Begin transfer Middeck Items (APCF, CGBA, DCPCG-V, and CPCG-H)
Flight Day 5	Prep for rack transfers **MPLM Ingress** **Transfer logistics from 4 Resupply Stowage Platforms (RSPs)** **Transfer logistics from 6 Resupply Stowage Racks (RSRs)**
Flight Day 6	Assemble EMU from parts on ISS EMU Checkout ISS Airlock preperation for EVA 1 **Transfer MPLM Express Rack 4** **Transfer MPLM Express Rack 5** **Continue MPLM logistics transfers** EVA 1 Preparation
Flight Day 7	EVA 1 **Continue MPLM logistics transfers**

FLIGHT DAY	ACTIVITY
Flight Day 8	EVA 2 preparation **Continue MPLM logistics transfers** Prep CBM for MPLM uninstall
Flight Day 9	EVA 2 **Egress MPLM** **Deactivate MPLM** **Node-to-MPLM vestibule Prep for Unberthing** **Depressurize Node-to-MPLM Vestibule** Activate/Checkout Node nadir CBM Power up SRMS/OSVS **Demate MPLM from Node nadir CBM and return to PLB** **Maneuver SRMS to MPLM pre-grapple position** **Grapple MPLM with SRMS** **Demate MPLM from Node nadir CBM and unberth using SRMS** **Maneuver MPLM to low hover position** **Berth MPLM into PLB** **Secure MPLM in PLB** **Latch PRLAs and AKA** **Connect ROEU** **Activate MPLM Shell Heaters** **Ungrapple MPLM and maneuver SRMS clear** Power down SRMS/OSVSTransfer Activities **Deactivate MPLM Shell Heaters**
Flight Day 10	Close station hatch ODS leak check Undock Fly around **MPLM environment check**
Flight Day 11	Deploy Simplesat Cabin Stow activities
Flight Day 12	Deorbit Preparation Landing

6.1 EVA CONTIGENCIES

There are four EVA operations planned in the event of a mishap in relation to the MPLM and its support equipment. These operations are listed as contingency operations in the hazard analysis of ISS-MPLM-DOC-002 since they are only used in the event of hardware failure. The FRGF and PRLA release scenarios are both documented in the EVA Contingency Operations Training Workbook (CONT OPS 2102) andare listed by JSC EVA office as unscheduled EVAs. The ROEU and ROFU release scenarios are still being evaluated by the JSC EVA office. All four operations are based on information from the JSC EVA office and are summarized in section 5.1 of ISS-MPLM-DOC-002.

7.0 HAZARD SAFETY ASSESSMENT

The MPLM to Orbiter interface hazard reports are summarized in Table 14. The corresponding hazard reports are contained in appendix A of ISS-MPLM-DOC-002. Additional information is also contained in the textual description of ISS-MPLM-DOC-002.

TABLE 14. MPLM/ORBITER INTEGRATED FLIGHT ASSEMBLY HAZARD REPORT SUMMARY.

Number	Title
MOI-1	Structural Failure fo the Cargo Element causes damage to the Orbiter
MOI-2	Payload Bay Contamination
MOI-3	Ignition of Payload Bay Materials/Atmosphere
MOI-4	Collision/Contact of payload with Orbiter
MOI-5	EMC/EMI/Corona Effect
MOI-6	Inability to configure for safe descent
MOI-7	EVA Hazards
MOI-8	Improper operation of payload to Orbiter interfacing functions

APPENDIX A – MPLM TO ORBITER REFLIGHT ASSESSMENT

REFLIGHT/SERIES HARDWARE ASSESSMENT

FLIGHT 7A.1 MPLM/ORBITER INTEGRATED
International Space Station

1. IDENTIFICATION OF ALL REFLOWN EQUIPMENT AND BASELINE SAFETY ANALYSIS.

Hardware	Doc. No.	Title	Organization
MPLM	MLM-RP-AI00055	System Hazard Analysis for Flight OP's	Alenia
ROEU	STS89-0819	Remotely Operated Electrical Umbilical Safety Analysis Report PDR/CDR	Boeing RSS
FRGF	JSC-37965	Safety Analysis Report on the Flight Releasable Grapple Fixture	JSC
Orbiter/ Cargo Interfaces (PRLAs, AKA)	RSS99D0518	Cargo Integration Risk Assessment Report (CIRAR) STS-102	Boeing RSS

This assessment covers the interfaces between the Multi Purpose Logistics Module (MPLM) and the Orbiter for Flight 7A.1. It references the Multi Purpose Logistics Module (MPLM)/Orbiter Integrated Phase III Flight Safety Data Package (ISS-MPLM-DOC-002) written in November, 2000 as its baseline hazard analysis. This is one of three unique safety assessments performed for each MPLM module for each mission. The second reflight assessment is provided by Alenia and addresses the MPLM module itself. Their assessment uses MLM-RP-AI-0055 "System Hazard Analysis for Flight Ops" as its baseline hazard analysis. The third assessment is the hazard analysis written specifically each flight by JSC to address the fully loaded MPLM with its cargo. JSC has the responsibility of Cargo Element Integration for all MPLM flights includingFlight 7A.1. For Flight 7A.1, the International Space Station (ISS) Safety Review Panel (SRP) has the responsibility for reviewing and approving both reflight assessments. The Payload Safety Review Panel has the responsibility for reviewing and approving the Flight 7A.1 Cargo Element Integration hazard analysis.

The Flight 7A.1 mission will be the first reflight of the MPLM flight module 1 (FM1) otherwise known as the Leonardo module.

2. ASSESSMENT OF EACH PIECE OF REFLOWN EQUIPMENT TO INDICATE THE PROPOSED USE IS THE SAME AS THAT ANALYZED AND DOCUMENTED.

The MPLM is a pressurized carrier that supports ISS logistics operations by providing for the capability of transporting cargo to and from the International Space Station without the need for Extravehicular Activity (EVA). The MPLM was originally baselined for Flight 5A.1 in the passive configuration. In this configuration, the MPLM is attached to the orbiter at its structural interfaces and receives power through the ROEU in order to operate the shell heaters. These heaters are only powered while the MPLM is on orbit. During the launch and landing phases of the mission, the MPLM is unpowered. The MPLM has no active cooling capability in the passive configuration.

The use of the MPLM on Flight 7A.1 is exactly the same as that of the currently approved use for Flight 5A.1. For any given MPLM mission, the Orbiter carries the MPLM and its interfacing hardware. This hardware consists of the Payload Retention Latch Assemblies (PRLAs), the Active Keel Assembly (AKA), and the Remotely Operated Electrical Umbilical (ROEU). The ROEU is attached to the Starboard side of the Orbiter payload bay and provides electrical power to the MPLM through a connector called the Payload Disconnect Assembly (PDA). The MPLM is structurally attached to the Orbiter through the Payload Retention System (PRS). This system is made up of the PRLAs and the Active Keel Assembly (AKA). There are 4 PRLAs and 1 AKA holding the MPLM in position when in the Orbiter payload bay. The PRLAs, ROEU and AKA are all Orbiter provided hardware. The flight fittings of the MPLM (main trunnions, stabilizing trunnions, and keel pin) are designed and built to interface with the Orbiter PRLAs and AKA per the requirements of ICD-2-19001, "Shuttle Orbiter/Cargo Standard Interfaces" as implemented by ICD-A-21350 "Shuttle Orbiter/MPLM Cargo Element Interfaces".

The United Space Alliance (USA) currently has the responsibility for certifying Orbiter provided hardware through the Space Shuttle integration process. Since this is the case, this hardware has been mentioned for information purposes but has not been reassessed in this document. More detailed information on this hardware can be obtained from USA in their Cargo Integration Risk Assessment Report (CIRAR) for STS 105.

On flight 7A.1 MPLM, Rafaello will carry two Expedite the Processing of Experiments to Space Station (EXPRESS) Racks, six Resupply Stowage Racks (RSRs), and four Resupply Stowage Platforms (RSPs). Analysis of the individual racks willbe covered in JSC's Cargo Element Integration (CEI) hazard analysis. Once the Orbiter has docked with the ISS, the MPLM is removed from the Orbiter and attached to Node 1. The MPLM cargo is then transferred by STS and ISS crewmembers to the US Lab for installation and activation. The MPLM is then prepared with return cargo and transferred back to the Orbiter payload bay for subsequent transport back to KSC.

3. NEW OR REVISED HAZARD REPORTS, ADDITIONAL DATA, AND IDENTIFICATION OF DELETED HR'S. IDENTIFICATION AND ASSESSMENT OF CHANGES IN HARDWARE/SOFTWARE AND OPERATIONS THAT HAVE A SAFETY IMPACT.

There are no new or revised hazard reports or additional data for the reflight application of the MPLM for Flight 7A.1. All of the hazard reports from the baseline document (ISS-MPLM-DOC-002, "Multi-Purpose Logistics Module (MPLM)/Orbiter Integrated Phase III Safety Data Package") for the passive configuration are still applicable. No changes in hardware/software and operations have been made that would have any safety impact, including on-orbit verification/reverification of hazard controls.

4. AN ASSESSMENT OF THE SAFETY VERIFICATION METHODS CONTAINED IN THE BASELINE SAFETY ANALYSIS TO DETERMINE WHICH VERIFICATIONS MUST BE REACCOMPLISHED.

The Safety Verification Tracking Log for the Multi Purpose Logistics Module (MPLM)/Orbiter Integrated Phase III Safety Data Package is contained in Appendix E. As of the printing of this document, there have been no new verifications or verification reopened for Flight 7A.1. All of the safety verifications related to the MPLM module itself have been closed by Alenia for MPLM Flight Modules 1 and 2. (Leonardo and Rafeallo) Verifications for MPLM Flight Module 3 (Donatello) are still open and are expected to be closed well before its first mission.

The SVTL in Appendix E shows several categories of safety verifications for MPLM FM1. The majority of the MPLM verifications deal with first time use of the MPLM system and were closed out as a part of acceptance testing. Verifications relating to all of the checks made as part of MPLM ground processing have been closed out to the appropriate OMRS requirements. (These are referenced in the SVTL) During ground processing, KSC carefully tracks the status of the MPLM and checks off the appropriate OMRS requirements as they are completed. Any problems that occur during this process are immediately reported to the MSFC MPLM project and Alenia. MPLM verifications related to on orbit procedures were processed through MOD by Alenia during previous reviews. These rules were written for the MPLM for all missions. Subsequent changes made to on orbit procedures during the review of ISS-MPLM-DOC-002 were submitted to MOD as OCADs for Flight 5A.1 and all subsequent missions. All verifications related to the MPLM in the active configuration have been listed as not applicable in the SVTL since Flight 7A.1 is a passive mission.

All of the verifications related to Orbiter interfacing hardware areconsidered closed and are not actively tracked as part of this assessment. These verifications were originally taken from the Cargo Integration Risk Assessment Report (CIRAR) for STS-102 and were closed by USA as part of normal Shuttle Program operations. A similar assessment is performed every mission as part of standard mission integration. Although the actual wording of these verifications may change, their content is the same. The United Space Alliance is responsible for assessing and closing out these verifications for each mission. (See attachment)

5. A LIST AND DESCRIPTION OF SAFETY NONCOMPLIANCES INCLUIDNG THE ACCEPTANCE RATIONALE FOR EACH.

There are no safety noncompliances for the MPLM/Orbiter Interfacing Hardware.

6. ASSESSMENT OF LIMITED LIFE ITEMS FOR REFLOWN HARDWARE.

The current reference for limited life items is the MPLM System Limited Life Items List (MLMLI-AI-0071). This list is currently undergoing revision at KSC with help from Alenia and the MSFC MPLM project. The current list has been provided in appendix C. All three MPLMs were designed for 25 missions. MPLM FM1 is currently on its second mission and its components are considered to be well within their rated life.

Limited Life items for the Orbiter interfacing hardware havenot been addressed in this document. The United Space Alliance (USA) is currently under contract to track and assess the life of each item as part of normal Shuttle operations.

7. DESCRIPTION OF MAINTENANCE, STRUCTURAL INSPECTIONS, AND REFURBISHMENT OF REFLOWN HARDWARE AND ASSESSMENT OF SAFETY IMPACT.

Section 5.0 in the textual description gives a detailed description of all of the normal maintenance activities that occur at KSC during MPLM processing. The only additional activity needed for this missionwas the replacement of one of the General Luminaire Assemblies (GLAs) inside the MPLM. On the Flight 5A.1 mission, the decision was made to replace a bad GLA in the US Lab with one from the MPLM. Since that mission, a new GLA has been installed in the MPLM. There have been no safety impacts as a result of MPLM processing.

8. ASSESSMENT OF ALL FAILURES AND ANOMALIES DURING PREVIOUS USAGE OF THE SIMILAR/REFLOWN ELEMENT WITH CORRECTIVE ACTION TAKEN AND RATINALE FOR EXTENDED USE.

There have been no anomalies or failures of the MPLM during the previous flight of MPLM FM1. The closest thing the project has had to an anomaly or failure was damage done to the Micro Meteoroid Debris Shields during the first mission of the MPLM on Flight 5A.1. While on orbit, the MMOD shields were penetrated by two micrometeoroids. Both holes are extremely small and were inspected as part of normal MPLM processing at KSC. Ground crews were unable to find any evidence of damage to the MLI or the MPLM pressure shell as a result of the impacts. Because of the small size of the holes, the Space Station program has made the decision not to repair the damage to the MMOD shields since it is highly unlikely that any subsequent hits will occur in exactly the same spot and at exactly the same angle. Appendix B contains an attachment showing an article in spaceref.com on the subject with accompanying photographs.

The MPLM project is currently unaware of any failures or anomalies related to the Orbiter interfacing hardware. The United Space Alliance (USA) is under contract to evaluate any failures/anomalies in this hardware as they occur and to provide a course of corrective action.

9. VERIFICATION THAT EACH FLIGHT SYSTEM PRESSURE VESSEL HAS A PRESSURE VESSEL LOGBOOK SHOWING PRESSURIZATION, HISTORY, FLUID EXPOSURE, AND OTHER APPLICABLE DATA.

The MPLM is not considered a pressure vessel and contains no pressure vessels in any of its systems in the active configuration. Any pressure vessels transported in the MPLM have to meet this requirement. Verification of this requirement for pressure vessels as cargo is under the responsibility of the Cargo Element Integrator at JSC.

10. A LIST OF ALL PYROTECHNIC INITIATORS INSTALLED OR TO BE INSTALLED. THE LIST IDENTIFIES, FOR EACH INITIATOR, THE FUNCTION TO BE PERFORMED, THE PART NUMBER, THE LOT NUMBER, AND THE SERIAL NUMBER.

The MPLM contains no pyrotechnic initiators of any kind and is not expected to carry any as cargo for any mission in the foreseeable future.

11. IONIZING RADIATION DATA SHEET FOR EACH SOURCE (JSC FORM 44) AS APPLICABLE.

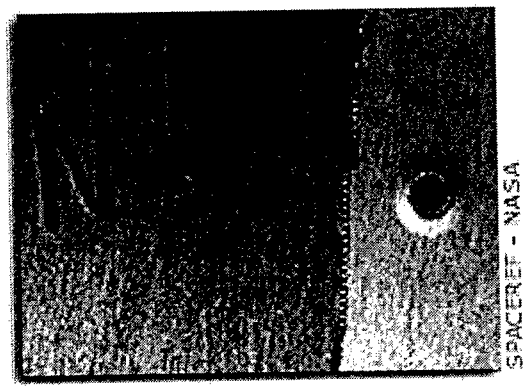
The MPLM contains no radioactive materials or sources of ionizing radiation in any of its systems. The Cargo Element Integrator at JSC has the responsibility for documenting any potential sources as part of the CEI assessment. The MPLM project is currently unaware of any sources carried as a payload.

APPENDIX B – REFLIGHT ASSESSMENT ATTACHMENTS.

ATTACHMENT 2. SPACEREF.COM ARTICLE ON MPLM MMOD IMPACTS.
(note: This article has been reformatted to fit on this page.)

Photos of Two Minor Debris Impacts Leonardo MPLM Suffered on its Inaugural Mission

Keith Cowing <mailto:keith@spaceref.com>
Monday, April 23, 2001



These pictures were taken of the Leonardo MPLM (Multi-Purpose Logistics Module) at NASA KSC after it returned to Earth from its first mission. Leonardo is one of three MPLM's provided by Italy and was flown to the International Space Station last month on mission STS-102/ISS-5A.1.

These photos show micrometeoroid damage to a micrometeoroid/orbital debris (MMOD) shield panel from MPLM FM1 (Leonardo). The panel was penetrated in two spots (the small pinholes in the photos), but did not damage the multi-layer insulating blanket beneath. This module was in space for about a week.

The strike damage to Leonardo's MDPS (micrometeorite protection system) is characteristic of other impacts that have been seen on spacecraft. However, the size of particle that penetrated the shield was a bit larger than average and was estimated to be traveling rather fast - at least 10 kilometers/second - when it struck Leonardo.

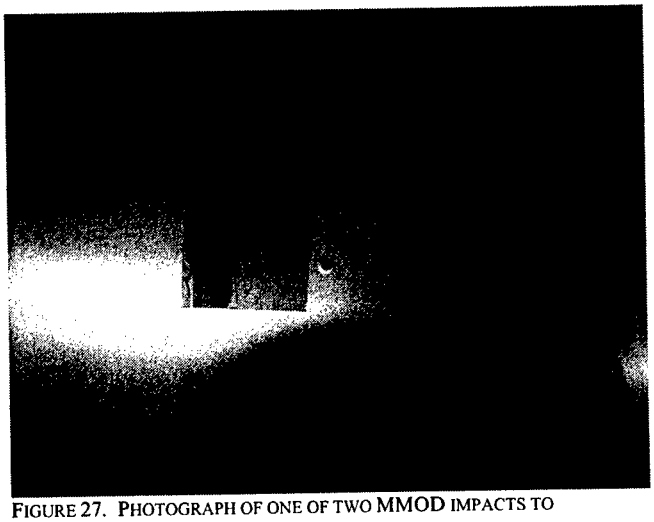


FIGURE 27. PHOTOGRAPH OF ONE OF TWO MMOD IMPACTS TO LEONARDO (FM1)

To put this impact into perspective, had this piece of space debris hit a Space Shuttle window it would have left a crater approximately 1 inch (2.5 cm) in diameter. If it had hit a someone wearing an EVA spacesuit it would have gone partially through the suit and left a bruise on the person wearing the suit.

Impacts such as these two are routine for any spacecraft in Earth orbit. The Long Duration Exposure Facility (LDEF) which spent 5.7 years in Earth orbit had been struck more than 20,000 times by the time its was brought back to Earth. The Hubble Space Telescope had nearly 800 impacts by the time it was repaired in 1997.

How much debris a spacecraft can expect to collide with - the orbital debris flux - is a function of mission duration, the size and orientation of the spacecraft (how big of a target it is), the orbital inclination, altitude, and the level of solar activity.

Components of the International Space Station are provided with shielding so as to reduce the annual risk that impact with a space debris could cause a critical failure to less than 0.5% This shielding is also sized to last through the expected 15 year operational lifetime of the ISS.

Last year, it was discovered that the Service Module did not have sufficient shielding to meet requirements levied upon it by the ISS program. As such, additional shielding panels will be delivered and installed on the exterior of the Service Module.

ATTACHMENT 1. EMAIL ON ORBITER INTERFACING HARDWARE.

Thanks for the information.

Gordon DeRamus
Payload Safety Engineer
Hernandez Engineering Inc. (HEI)
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(256) 544-0624
Gordon.DeRamus.III@msfc.nasa.gov

-----Original Message-----
From: Maltby, Harry A [mailto:Harry.A.Maltby@USAHQ.UnitedSpaceAlliance.com]
Sent: Wednesday, February 14, 2001 5:14 PM
To: 'Deramus, Gordon III'; Maltby, Harry A
Cc: Reagan, Shawn; Ise, Carl; Gedies, Robert W; Vongsouthy Cami (Email); 'Nguyen Anh T' (E-mail)
Subject: RE: Payload Retention Hardware for STS-102

<< File: NSTS16979ActiveLatch.doc >> << File: 16979.doc >> Gordon,

Our Active Latches are two fault tolerant for Must Work and against Inadvertent operation and our CoFR has no issues to report in the functional discipline areas!

Yes, each piece of hardware gets looked at, in that the hardware such as the latches have been essentially integrated into our nominal thermal and structural math models; and the program has marching orders to not except negative numbers unless a specific Change Request is authorized by the program at the PRCB level. FEMA/CILs were performed on this hardware and fault tolerance capability documented in NSTS 16979. Payloads normally can use this fault tolerance evaluation and build a hazard report. For example, this design haselect. dual drive with EVA manual override capability as explained in the portion I cut and provided here as NSTS16979ActiveLatches.doc (attached). It is located about 2/3 of the way through the 16979.doc document (attached).
I think the Safety panel and MOD are attempting in their own way address the subject of consumables related to EVA work on Station flights and want you to document an analysis with pulls together if one latch was not securely holding the MPLM because they are looking at the potential of eliminating the flight rule associated with protecting the consumables associated with what is normally assumed to be the third control. i.e. going EVA to secure or throw away the payload. The CIL was just updated to show that all of the Active Latches have this EVA override capability which was authorized per NSTS 22206 but now may not be acceptable to the way Station needs to do business. I think we are hearing the same story on the ROEU and ROFU.
Orbiter will not agree that the numbers show that weare OK with one latch in a mid-stroke configuration nor a ROEU/ROFU at a mid-stroke point. Back to the CoFR. The roll up does include all hardware including GFE, however it is done on a kind of "need to know" basis. In other words, if I say "Go" and my management knows what I am responsible for that he can assume I have covered all the aspects documented in our procedures and desktop instructions which have been audited by middle management and ISO9000 personnel. We did present the STS-102 CoFR to LSFR with no issues in this area and are about to present to the FRR (Bob Gedies integrates and book keeps this for us). Our analysis includes the normal loads and thermal modeling we always go through. I would bet that the safety panel is looking for someout of the box thinking which includes the ware and tear of the MPLM going in and out of the cargo bay, especially if some of the controls laid into my documentation is being strained because of potential loss of consumables which are needed to accomplishthose task. As a suggestion, if I am right that this is the area that is festering then potentially agreeing that an EVA coming across from Station vs. the inability of utilizing consumables from Orbiter could potentially be an acceptable method of closing or opening the latches and/or ROEU/ROFU, and may be what the doctor ordered. You definitely do not need to check on us doing our job. We have successfully preformed many analysis to make sure our hardware will holdup for a flight and I can guarantee that this is not what is bothering the safety panel. It must be something to do with the way you potentially will be violating our built in assumptions.

Hope this helps,
Probably not but most of the time I have a 6th sense about these kind of things.
Harry Maltby
USA, Cargo Integration (PSRP and SRP Rep.)

-----Original Message-----
From: Deramus, Gordon III [mailto:Gordon.Deramus.III@msfc.nasa.gov]
Sent: Wednesday, February 14, 2001 7:39 AM
To: 'harry.a.maltby@usahq.unitedspacealliance.com'
Cc: Reagan, Shawn; Ise, Carl
Subject: Payload Retention Hardware for STS-102

When I started working on this project, I was told that every piece of shuttle hardware flown is covered under the COFR process. I'm not sure exactly how this process works but as I understandit, a COFR is basically a certification of that hardware that says that the shuttle program has approved it and that there are no problems with flying it. When I wrote the MPLM/Orbiter Integrated hazard analysis, I was hoping to find a shuttle hazard analysis that covered the payload retention system (PRLAs and AKA). I was not able to find one. So I used the CIRAR for STS 102 to show that the fault tolerance for this hardware has been documented and verified and I added an additional control. This control says that the PRLAs and AKA used on this flight are considered standard approved shuttle hardware and have been chosen for use with the MPLM by the Shuttle Program. I figured the only way to document (verify) this approval was to show that a COFR hasbeen signed for the hardware. I don't know whether each piece of hardware has its own COFR of if the COFR is signed for the vehicle as a whole (or maybe one segment of the vehicle). All I am looking for is something that says the shuttle program has looked at this hardware and has certified it for use on this flight.

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APPENDIX C – LIST OF LIMITED LIFE ITEMS.

DCN 0126

L I S T

TITLE : **MPLM SYSTEM LIMITED LIFE ITEMS LIST**

D.R.D. No : SSP 50125 Para 3.8.4

---------- SIGNATURES AND APPROVALS ON ORIGINAL ----------

PREPARED : A. SALIMBETI

CHECKED : A. SALIMBETI

APPROVED : G. CANEPA

AUTHORIZED :

APPROVALS :

CONFIGURATION CONTROL M. MARCHI

SYSTEM ENGINEERING E. ALLAIS

PROGRAM MANAGER S. BRONDOLO

RQA 270799

---------- DOCUMENT CHANGE RECORD ----------

ISSUE	DATE	REASON FOR CHANGE	AFFECTED PARAGRAPHS
01	25/JAN/96	INITIAL ISSUE	
02	25/NOV/96	GENERAL UPDATING FOR SYSTEM CDR	ALL
03	25/MAR/97	GENERAL UPDATING	ALL
04	30/OCT/97	UPDATING	4.1 4.2 4.3 4.4
05	05/MAY/98	UPDATING	ALL
06	01/OCT/98	UPDATING DUE TO FAR COMMENTS	ALL
07	16/FEB/99	UPDATING TO RESPOND	4.2, 4.3, 4.5
08	19/MAY/99	UPDATING TO CLOSE-OUT FAR 1 ISSUE 8 AF 015	PAG. 14, 16, 17, 39
09	21/JUL/99	ADDITIONAL OF IMV CLAMP	PAG. 9

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03

\\1.0 SCOPE.

The purpose of this document is to provide information about limited life items present in MPLM design.
This document will be the main reference for ALENIA AEROSPAZIO certification program to assume that the limited life parts of MPLM do not have pass the estimated life or cycles.

This information will also be used for maintenance and replacements activities and reference for related inspection programme planning. .
This document will not contain the parts life accrual data whom will be identified in each relevant module delivery Acceptance Data Package in sections relevant to Operating Hardware Log and Mate/Demate Log, according to A.D.1).

\\2.0 03

APPLICABLE DOCUMENTS.

A.D. 1) MLM-PL-AI-0010
Product Assurance Plan.

A.D. 2) SSP 50125
NASA/ASI Bi-Lateral Data Exchange Agreements, Lists and Schedules.

\\3.0 03

DEFINITIONS.

Limited life/items are intended as materials or parts which, due to potential deterioration with operation (time and/or cycles), are subjected to continuing surveillance and control to ensure that they are not used after expiration of their useful life.

In the format are reported to declared life parameter (operative cycles, operative hours, age life) which are intended as the maximum cycles, hours or life time affecting the items.

\\4.0 06

LIMITED LIFE ITEMS LIST.

The following sections contain all pertinent information about limited life items, subdivided by subsystems/equipments, reported in format according to A.D. 1).
These information are intended to reply also to requirements set forth in A.D. 2) in conjunction with information provided with each MPLM delivery Acceptance Data Package.

The information here contained are based on available information and design maturity for various equipments.
This document shall need to be fully updated before final MPLM system delivery in order to provide limited life items certification in a program manner.
The complete traceability of cycles/operating hours for the units or components (when applicable) is maintained in dedicated sections of system Log-book.
The cycles or hours indicate in these sections are comprensive of those performed at s/s level or before the system acceptance.
The following units/components are taken under cycles/hours control:

S/S Structure; on pannel -y +y -z the structural inserts for units or brackets; on stand off the structural insert for ECLSS diffuser/grid and GLA; on Feedthrough plate the structural insert for PPRV, DA and plate fixation bolt; on Feedthrough panel the structural insert for PPRV, NPRV; on AAE the fixation bolt and the structural inserts for NPRV.

S/S ATCS; all quick disconnect, operating time for WMV, WMVE, WOV, WOVVE, DPS.

S/S Avionic; operating time for MDM, PDB, EEL, RCA, GLA, HCU.

S/S ELCS; operating time for DA, PPRV, TPS, Cabin Fan, ISOV, SSOV, DSD, WPP.

S/S Harness; all electrical connectors.

\\4.1 06

STRUCTURE & MECHANISM.

LIMITED LIFE ITEM LIST

C.I. Number: M20000F
UNIT/EQUIPMENT: Structure

SUBSYSTEM: Structure

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
MS21074L3 L4	Anchor nut	X		15			N/A	MIL-B-87114
NAS1773C6M	Anchor nut	X		15			N/A	MIL-N-25027
NAS577C7D	Barrel nut	X		15			N/A	MIL-N-25027
NAS1832A3-4M	Insert	X		15			N/A	MIL-N-25027
NAS1791C4-1	Anchor nut	X		15			N/A	MIL-N-25027
MS21209F1-15L 10L 20L (hingher struct. S/S P/N 1000P001-803)	Hell-coil-insert (structural junction elements)	X		15			N/A	MIL-I-8946

LIMITED LIFE ITEM LIST

SUBSYSTEM: Structure

C.I. Number: M20000F
UNIT/EQUIPMENT: Structure

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
MS21209F4-15L	Hell-coil-insert	X		15			N/A	MIL-I-8846
MS51830CA202 201	Hell-coil-insert	X		15			N/A	
MS21076L3N	Anchor nut	X		15			N/A	MIL-B-87114
NAS1291C3M 4M 10M	Self locking nut	X		15			N/A	MIL-N-25027
MS21076L08N	Anchor nut	X		15			N/A	
SPS 76279 (higher struct. S/S P/N 1000P001-803)	Bolt (structural junction elements)	X			12 Flight *			* Due to fracture mechanical analysis
MS27115-21R	Inter Module Ventilation (IMV) clamp	X		1**				**To be changed out every flight according to int. memo SITC/PP/99/S0270

LIMITED LIFE ITEM LIST

C.I. Number: M20000F
UNIT/EQUIPMENT: Structure

SUBSYSTEM: Structure

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
61170M-428 -820 -524 -720	Self Lockinh nut	X		15			N/A	MIL-N-25027
74179-4-A11	Bolt	X		15			N/A	
EWSB1126-7-16 -7A-14	Bolt	X		15			N/A	
NAS6303U12 U5 U6 U7 U9 (higher struct. S/S P/N 1000P001-803)	Bolt (structural junction elements)	X		15			N/A	

LIMITED LIFE ITEM LIST

SUBSYSTEM: Structure

C.I. Number: M20000F
UNIT/EQUIPMENT: Structure

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
TJB40155-5-14 -7-20	Bolt	X		15			N/A	
NAS6304U13 U16 U288 U11 U7 U10	Bolt	X		15			N/A	
TJB40149	Trunnion Bolt	X		15			N/A	
BACB30PU5025	Bolt	X		15			N/A	
EWSB1126-7A-24	Shear Bolt	X		15			N/A	
NAS6303US	Bolt	X		15			N/A	
EWB0420-4-12	Bolt	X		15			N/A	
76279-8-18	Bolt (MP15a)	X		15			N/A	
TJB40150-1	Nut	X		15			N/A	
(higher struct. S/S P/N 1000P001-803)	(structural junction elements)							

LIMITED LIFE ITEM LIST

C.I. Number: M20000f
UNIT/EQUIPMENT: Structure

SUBSYSTEM: Structure

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
MS9358-13 -10	Nut	X		15			N/A	
MS9363-10 -13	Nut	X		15			N/A	
NAS578C7A	Barrel nut retainer	X		15			N/A	
NAS1291C3N	Nut	X		15			N/A	
MS20995C32	Wire safety lock	X		1			N/A	replace after each disassembly
ALS P/N 1510P059	Insert	X		15			N/A	
SL 30093-3-15.9	Insert	X		15			N/A	
SL 30093-3-19.1/ SL 90215-Z	Insert	X		15			N/A	
SL 30093-6-15.1/ SL 90215-Z (higher struct. S/S P/N 1000P001-803)	Insert (structural junction elements)	X		15			N/A	

\\4.2 07

THERMAL CONTROL.

LIMITED LIFE ITEM LIST

C.I. Number: M52000F
UNIT/EQUIPMENT: MLI PTC

SUBSYSTEM: TCS

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
S12-803-A01-001	Ball fastener torlon 42072		X	20		NONE	N/A	LCM SM EATA SG-SP-AI-019
S12-803-A01-002	Ball fastener torlon 42072		X	20			N/A	SG-SP-AI-019
S12-803-A01-003	Ball fastener torlon 42072		X	20			N/A	SG-SP-AI-019
Hi-Air velcro Type 1 Class 2	Hi-Air Velcro Hook		X	1000			N/A	MIL-F-21840 SG-SP-AI-133
Hi-Air Velcro Type 2 Class 2	Hi-Air Velcro Loop		X	1000			N/A	MIL-F-21840 SG-SP-AI-133
(hither PTC S/S P/N 3100P001-803) ALS 3401	(MLI junction elements) Jiffy Junction		X	100			N/A	To be intended mate/demate

LIMITED LIFE ITEM LIST

SUBSYSTEM: TCS

C.I. Number: M51000F
UNIT/EQUIPMENT: ATCS Loop

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
2000-A08C-T06B	Self Sealing Quick Disconnects Female Line Supply	X		250				Reference spec. 684-16348 the cycles are intended as coupled/decoupled
2000/A08C-T06C	Self sealing Q.D. female Line Return	X		250				"
2000-A12C-T05A	Self sealing Q.D. Female Line Supply	X		250				"
2000-A12C-T05B	Self sealing Q.D. Female Line Return	X		250				"
2000-M10C-T06B	Self sealing Q.D. female Line Supply	X		250				"
2000-M10-C-T06C	Self sealing Q.D. female Line Return	X		250				"
(higher ATCS S/S P/N 2000P001)	(water line junction Q.D.)							

LIMITED LIFE ITEM LIST

C.I. Number: M51000F
UNIT/EQUIPMENT: ACTS LOOP

SUBSYSTEM: TCS

PART No.	ITEM / NOMENCLATURE FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
505001-PN-248	Self sealing Q.D. male Line Supply	X		250				Ref. Spec. 684-16348 the cycles are intended as couples/ oncoupled
505001-PN-249	Self sealing Q.D. male Line Return (water line junction Q.D.)	X		250				" " " "
VSF 1015 (higher ATCS S/S P/N 2000P001)	Conical Seal (water line seal)	X		1*				* is intended to be changed every time the relevant line junction is disconneted
MC 252	Conical Seal (water lines)	X		1*				* As above

LIMITED LIFE ITEM LIST

SUBSYSTEM: TCS

C.I. Number: M51110F
UNIT/EQUIPMENT: W.O.V.

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
2002-A08C-T05A	Self sealing Q.D. male Bulkhead Supply	X		250				Ref. Spec. 684-16348 the cycles are intended as coupled/ de coupled
2002-A08C-T05B	Self sealing Q.D. male Bulkhead Supply	X		250				"
2002-A08C-T06B	Self sealing Q.D. male FTD Cone Supply	X		250				"
2002-A08C-T06C	Self sealing Q.D. male WTD Cone Return	X		250				"
2001-A08C-T06B	Self sealing Q.D. male	X		250				"
2001-A08C-T06C	Self sealing Q.D. male (water line junction Q.D.)	X		250				"
NMC data sheet	Isotherm C-1 (water line thermal isolation) foam (deleted item; here for reference only)					X		Deleted from the list being the opeing cut results acceptable t show programme life requirements be met.

LIMITED LIFE ITEM LIST

C.I. Number: M51110F
UNIT/EQUIPMENT: W.O.V

SUBSYSTEM: TCS

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
6012-10-AA	Water on/off valve (water line opening/closure)	X		4080* 500**				* Start/stop cycles electrical actuati LCN SME4TB A.I.C.A. ** manual actuation
	WOV inlet/outlet tube fitting			100				
34105 60113-15-19PN	Connector E box			250				
34105 60113-09-35SN	Connector E box			250				
34105 60113-09-35SB	Connector E box			250				
34105 60113-09-35SA	Connector E box			250				
34105 60113-09-35PA	Connector E box			250				
34105 60113-09-35PN (higher ATCS S/S P/N 2000P001)	Connector E box			250				

LIMITED LIFE ITEM LIST

SUBSYSTEM: TCS

C.I. Number: M51110F
UNIT/EQUIPMENT: W.O.V

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
6012-10-AA	Water Modulating Valve (water line regolation)	X		4080* 500**				Start/stop cycles * electrical actuati ** manual actuation
34105 60113-15-19PN	Connector E box			250				
34105 60113-09-35SN	Connector E box			250				
34105 60113-09-35SB	Connector E box			250				
34105 60113-09-35SA	Connector E box			250				
34105 60113-09-35PA	Connector E box			250				
34105 60113-09-35PN (higher ATCS S/S P/N 2000P001)	Connector E box			250				

LIMITED LIFE ITEM LIST

C.I. Number: M51060F
UNIT/EQUIPMENT: W.P.P.

SUBSYSTEM: TCS

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
SV 819560-1	Pump motor	X		500				Start/stop cycles LCN SME3TC
	(water circolation)			25				Full ext. cycles
AI 51020-1A	Accumulator 9MTSA 3349)	X		100				Full comp. cycles
125997-C	Filter water	X		200 *	5000 *	10 years *		Installation removal LCN SME3TBTB
SV 809938-1	Filter particulate	X		200 *	5000 *	10 years *		Installation removal LCN SME3TBTB
60513-068531 60513-068573 60513-068574	Connectors	X		250				
(higher WPP unit P/N C151300-1B)	Gas connector	X		250				
	Capture solt	X		25				* start date at assembly complete

LIMITED LIFE ITEM LIST

SUBSYSTEM: TCS

C.I. Number: M51130F/M51120F
UNIT/EQUIPMENT: DPS MBE

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
6091-10AA	DPS Inlet / outlet tube fitting	X		100				
460526B31051 (higher MBE unit P/N 460526B3105A00)	MBE Inlet / outlet tube fitting (To recover ATCS water expansion during on orbit phase)	X		100				

\\4.3 ENVIRONMENTAL CONTROL LIFE SUPPORT EQUIPMENT (ECLS). 07

LIMITED LIFE ITEM LIST

SUBSYSTEM: ECLS

C.I. Number:
UNIT/EQUIPMENT: cfa

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
SV819591-2	Cabin FAN assembly (air circulation)	X		3670	88.000	12 years		SVHSER17320
MAT C 00T11N35PN MAT C 00T17N6 PN (higher CFA unit P/N SV819591-2)	Connectors	X		250				

LIMITED LIFE ITEM LIST

C.I. Number: M34060F
UNIT/EQUIPMENT: ISOV

SUBSYSTEM: ECLS

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
B 40482-1	Intermodule ventilation shut off valve (air flow beween module/ station)	X		4000 *				Open/close LCN SME1GA SME4GB PSB41202-1 MLM-CTI-RP-0004
B 40978-11 (higher ISOV unit P/N B40482-1)	Silicone seal		X			20 years manufact. date 5/97		* based on predicted number of cycles during acceptance integration and flight (i.e. about 400) there is no need to mantain the acount of actual operating cycles

LIMITED LIFE ITEM LIST

SUBSYSTEM: ECLS

C.I. Number: M33040F
UNIT/EQUIPMENT: NPRA

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
840483-1	Negative Pressure Relief Assembly (Module pressure equalization)	X		2000*				Open/close LCN SME4KA LCN SME4KB LCN SME4KC LCN SME5KA LCN SME5KB PSB41202-1 MLM-CTI-RP-0004
841081-11 (higher NPRA unit P/N 840483-1)	Silicone seal		X			20 years manufact. date 9/97		

* based on predicted number of cycles during acceptance integration and flight (i.e. about 400) there is no need to mantain the acount of actual operating cycles

LIMITED LIFE ITEM LIST

SUBSYSTEM: ECLS

C.I. Number: M36020F/M36030F
UNIT/EQUIPMENT: SSOV

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
C11949-001	Sampling Line Shut-off Valve (air flow sampling)	X		8.000	125			Oper/close LCN SME3EC MR-M-8496 the valve will require a minimum of 2 oper/close cycles at intervals not exceed 6 month through the 20 years total life time
1246590 (higher SSOV unit P/N C11949-001)	Sampling Line Filter	X			18 flight			LCN SME3ED MLM-RIBRE-TN-0008 Issue 1A The filter has to be exanged at list afte 18 flight. Hovewer visual inspection of filter before every flight is recomended.

LIMITED LIFE ITEM LIST

SUBSYSTEM: ECLS

C.I. Number: M33030F
UNIT/EQUIPMENT: P.P.R.A.

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
B40484-1	Positive Pressure Relief Assembly (Module pressure equalization)	X		4000*				Open/close LCN SME1KC LCN SME1KD LCN SME4KD PSB41202-1
B41065-11 (higher PPRA unit P/N B40484-1)	Silicone seal		X			20 years manufcat. date 1/98		MLM-CTI-RP-0004 * based on predicted number of cycles during acceptance integration and flight (i.e. about 400) there is no need to mantain th acount of actual operating cycles

LIMITED LIFE ITEM LIST

C.I. Number: M33020F
UNIT/EQUIPMENT: D.A.

SUBSYSTEM: ECLS

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
B40481-1	Cabin Depress Assembly (Module pressure equalization)	X		4000*				Open/close LCN SME1KA LCN SME1KB PSB41202-1
B41127-1 (higher DA unit S/S B40481-1)	Silicone seal		X			20 years manufact date 1/98		MLM-CTI-RP-0004 * based on predicted number of cycles during acceptance integration and flight (i.e. about 400) there is no need to mantain the acount of actual operating cycles

LIMITED LIFE ITEM LIST

SUBSYSTEM: ECLS

C.I. Number: M33050F
UNIT/EQUIPMENT: TPS

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
SV 822093-11	TPS (Module pressure control)	X		1200 *				electrical on/off cycles * based on predicted number of cycles during acceptance integration and flight (i.e. about 300) there is no need to mantain the acount of actual operating cycles

\\4.4 06

AVIONICS.

LIMITED LIFE ITEM LIST

SUBSYSTEM: Avionics

C.I. Number: M42080F
UNIT/EQUIPMENT: Battery

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
19XCR40DC-3	Rechargeable Manually Activated Silver Zinc Battery (Electrical power to RUFU/PDA heaters)	X		10 charge / discharge cycles (10 flight)		12 months * 10 years ** storage		LCN SNEAPA A.L.C. A * wet life (activate battery) at storage conditio temp -20F++110F (in charged or discharged state) for further detail see doc. O.P. 502/4 "operating istructi **Dry condition (unactivated batter at storage conditio temp.-40F++40F

LIMITED LIFE ITEM LIST

SUBSYSTEM: Avionics

C.I. Number: M41020F
UNIT/EQUIPMENT: MDM

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
8259842-422	MDM EE FROM 28C010 (On board date handling)		X	10^4 write cycles per byte		10 years *	Honeywell doc. MD 701 (ALS PA013)	Integrated circuit * Chip manufacturing
4020653-002	HEX NUT	X		1			"	
NAS 1352N04-LE12	CAP SCREW	X		10			"	
8262972-105	FLAT HEAD SCREW	X		1			"	
8267848-106	SOCKET HEAD SCREW	X		1			"	
8263620-001	SOCKET HEAD CAPTIVE SCREW	X		5			"	
	(Structural box junction elements							
	CONNECTORS	X		250				
(higher MDM unit P/N 8266726-901)								

LIMITED LIFE ITEM LIST

SUBSYSTEM: Avionics

C.I. Number: M42070F
UNIT/EQUIPMENT: HCU

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
	(Pronde power for heaters chane)							
SS-4-CMM2-1/3	Relief Value	X		111				
	(Press/depres flow rate equalization)							
J01 340105601B00-23-35PN	Connector	X		250				
J02 340105601B00-23-35PN	Connector	X		250				
J03 340105601B00-17-08PN	Connector	X		250				
J04 340105601B00-17-06PN	Connector	X		250				
J05 340105601B00-25-07PN	Connector	X		250				
J06 340105601B00-25-61SNL	Connector	X		250				
J07 NAT COOT25N45N5N	Connector	X		250				

LIMITED LIFE ITEM LIST

C.I. Number: M42070F
UNIT/EQUIPMENT: HCU

SUBSYSTEM: Avionics

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
340105601B00-25-07PN	Connector	X		250			N/A	
340105601B00-25-24PN	Connector	X		250			N/A	
340105601B00-21-11SN	Connector	X		250			N/A	
340105601B00-25-43SN	Connector	X		250			N/A	
340105601B00-15-19SN	Connector	X		250			N/A	
340105601B00-19-32SN	Connector	X		250			N/A	
340105601B00-19-35SN	Connector	X		250			N/A	
340105601B00-19-35PA	Connector	X		250			N/A	
340105601B00-25-07SN (higher HCU unit P/N 02-HCU-00.000)	Connector	X		250			N/A	

LIMITED LIFE ITEM LIST

SUBSYSTEM: Avionics

C.I. Number: M42050F
UNIT/EQUIPMENT: GLA

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
217350	Fluorescent Lamp (Module illumination)		X		9000		N/A	Ref. Doc. PDS 1001 Rev. J
219003	GLA assy	X		19 missions				is intended to be qualified for 19 flight only ref. qualif.test 2/98 ILC
219010	Lamp Hossing Assy		X		14000			
219011	Bellasy Baseplate Assy	X			270000			
NATCOOTISN35PN	Connector	X		250				
NATCOOTISN35SA (higher GLA unit P/N 219003)	Connector	X		250				

LIMITED LIFE ITEM LIST

C.I. Number: M42010F
UNIT/EQUIPMENT: PDB

SUBSYSTEM: Avionics

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
	(Pronde power for all units)							
340105601B00-2507PNL	Connector	X		250				
-2524PNL	"	X		250				
-2111SNL	"	X		250				
-2543SNL	"	X		250				
-1519SNL	"	X		250				
-1932SNL	"	X		250				
-1935SNL	"	X		250				
-1935PAL	"	X		250				
-2507SNL	"	X		250				
(higher PDB unit P/N 658470)								

LIMITED LIFE ITEM LIST

SUBSYSTEM: Avionics

C.I. Number: M42020F
UNIT/EQUIPMENT: EEL

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
950106-1	Emergency Egress Light Strip (Self exploing)				25 missions	10 years		Periodically check t be defined, will be performed Ref. doc. 683-26007 issue C
950161-1	Power Supply (Self exploing)				25 missions	10 years		Periodically check t be defined, will be performed Ref. doc. 683-26007 issue C
NATC0661 3N4PN	Led strip connector	X		250				
NATCOOT13N4588	LPS connector	X		250				
NATCOOT13N45PA	LPS connector	X		250				
NATCOOT13N45PN (higher EEL unit P/N 683-26007-2)	LPS connector	X		250				

LIMITED LIFE ITEM LIST

C.I. Number: M42040F
UNIT/EQUIPMENT: RCA

SUBSYSTEM: Avionics

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
219076	ON/OFF Remote control (Light on/off switch)	X			54.900.000 *			* based on predicted operating hours during acceptance integration and flight there is no need to maintain the acount of actual opertaing hours
518952	RCA connector P52128-02	X		250				
NATCOOT13N4PN	RCA connector	X		250				(Some component as common hardware for ISSA)
NATCOOUN35SN (higher RCA unit P/N 219006-1)	RCA connector	X		250				

LIMITED LIFE ITEM LIST

SUBSYSTEM: Avionics

C.I. Number: M43000F
UNIT/EQUIPMENT: Harness

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
340105601B06G15-35PAL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-15-35SAL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G25-35SCL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-13-04SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G15-5PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G17-08PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G11-98SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G09-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G11-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G13-98SNL	Circular connector	X		250			N/A	SCC 3401/056
NATC77H25N29PPN	Circular connector F.T.	X		250			N/A	SSQ21635
ALS 3401	Jiffy Junction		X	100			N/A	To be intended mate/demate

LIMITED LIFE ITEM LIST

C.I. Number: M43000F
UNIT/EQUIPMENT: Harness

SUBSYSTEM: Avionics

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
340105601B07-15-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G25-35PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-25-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G25-35PAL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-25-35SAL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-17-08SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-13-98SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G13-98PNL	Circular connector	X		250			N/A	SCC 3401/056
NATC77H25N19PPN	Circular connector F.T.	X		250			N/A	SSQ21635
NATC77H25LN7PPA	Circular connector F.T.	X		250			N/A	SSQ21635
NATC77H25LN7PPN	Circular connector F.T.	X		250			N/A	SSQ21635

LIMITED LIFE ITEM LIST

SUBSYSTEM: Avionics

C.I. Number: M43000F
UNIT/EQUIPMENT: Harness

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
NATC77H25N24PPN	Circular connector F.T.	X		250			N/A	SSQ21635
NATC77H25N35PPA	Circular connector F.T.	X		250			N/A	SSQ21635
NATC77H25N35PPC	Circular connector F.T.	X		250			N/A	SSQ21635
NATC77H25N35PPN	Circular connector F.T.	X		250			N/A	SSQ21635
NATC77H25N4PPA	Circular connector F.T.	X		250			N/A	SSQ21635
NATC77H25N4PPN	Circular connector F.T.	X		250			N/A	SSQ21635
NRP6E1-A107SF	Rack & Panel Conn.	X		250			N/A	SSQ21636
NRP6E1-A116SA	Rack & Panel Conn.	X		250			N/A	SSQ21636
NRP6E1-A116SB	Rack & Panel Conn.	X		250			N/A	SSQ21636
NRP6E1-A116SC	Rack & Panel Conn.	X		250			N/A	SSQ21636
NRP6E1-A122SD	Rack & Panel Conn.	X		250			N/A	SSQ21636
NRP6E1-A122SE	Rack & Panel Conn.	X		250			N/A	SSQ21636

LIMITED LIFE ITEM LIST

C.I. Number: M43000F
UNIT/EQUIPMENT: Harness

SUBSYSTEM: Avionics

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
340105601B06G15-19PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-15-19SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G17-08SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G17-06SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G17-35PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-17-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G19-32PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G19-35SAL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G19-35PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-19-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G21-11PNL	Circular connector	X		250			N/A	SCC 3401/056

LIMITED LIFE ITEM LIST

SUBSYSTEM: Avionics

C.I. Number: M43000F
UNIT/EQUIPMENT: Harness

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
340105601B07-21-11SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G21-11SAL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-21-11PAL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G23-35SAL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G23-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G25-07SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G25-07PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G25-24SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G25-51PNL	Circular connector	X		250			N/A	SCC 3401/056
NATC06G25N4PN	Circular connector	X		250			N/A	SSQ21635
NATC07T25N4SN	Circular connector	X		250			N/A	SSQ21635

LIMITED LIFE ITEM LIST

C.I. Number: M43000F
UNIT/EQUIPMENT: Harness

SUBSYSTEM: Avionics

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
NATC06G25N4SN	Circular connector	X		250			N/A	SSQ21635
NATC07T25N4PN	Circular connector	X		250			N/A	SSQ21635
340105601B06G25-43PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-25-43SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-11-35SAL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-11-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-25-3SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G13-35PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-13-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G13-35PAL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-13-35SAL	Circular connector	X		250			N/A	SCC 3401/056

LIMITED LIFE ITEM LIST

SUBSYSTEM: Avionics

C.I. Number: M43000F
UNIT/EQUIPMENT: Harness

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
340105601B06G13-04SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G15-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G25-29SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B66G25-29SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B66G25-19SNL	Circular connector	X		250			N/A	SCC 3401/57
340105601B66G25-35SCL	Circular connector	X		250			N/A	SCC 3401/58
340105601B66G25-07SNL	Circular connector	X		250			N/A	SCC 3401/59
340105601B66G25-35SNL	Circular connector	X		250			N/A	SCC 3401/60
340105601B06G25-35SNL	Circular connector	X		250			N/A	SCC 3401/61
340105601B66G25-35SAL	Circular connector	X		250			N/A	SCC 3401/62
340105601B06G25-35SAL	Circular connector	X		250			N/A	SCC 3401/63

LIMITED LIFE ITEM LIST

C.I. Number: M43000F
UNIT/EQUIPMENT: Harness

SUBSYSTEM: Avionics

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
340105601B66G25-24SNL	Circular connector	X		250			N/A	SCC 3401/64
340105601B66G25-07SAL	Circular connector	X		250			N/A	SCC 3401/65
340105601B06G25-07SAL	Circular connector	X		250			N/A	SCC 3401/66
NATC66G25N4SN	Circular connector	X		250			N/A	SSQ21635
NATC66G25N4SA	Circular connector	X		250			N/A	SSQ21635
NATC06G25N4SA	Circular connector	X		250			N/A	SSQ21635
340105601B07-17-26SNL	Circular connector	X		250			N/A	SSC 3401/056
340105601B06-17-26SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-13-35PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G13-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-19-11PNL	Circular connector	X		250			N/A	SCC 3401/056

LIMITED LIFE ITEM LIST

SUBSYSTEM: Avionics

C.I. Number: M43000F
UNIT/EQUIPMENT: Harness

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
340105601B06G19-11SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-25-07PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-09-35SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G09-35PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G23-53PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-23-53SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G23-53SNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B07-23-53PNL	Circular connector	X		250			N/A	SCC 3401/056
340105601B06G15-35PNL	Circular connector	X		250			N/A	SCC 3401/056
JUNCT. DEV. KJ-M1620 (higher HRS S/S P/N 5000P001-803)	3 X AWG 20	X		10			N/A	40M39589 LCN SME1HA

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FLUIDIC GROUND SUPPORT EQUIPMENT (FGSE).

LIMITED LIFE ITEM LIST

SUBSYSTEM: FGSE

C.I. Number: M3T020G
UNIT/EQUIPMENT: UNTS

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE (*)		
	Fittings Gaskets		X			15 years		MLM-RP-MT-0008 RQ 920
8AB8LJ-5561AD	Elect. pneum. valves							
	Connector o-ring		X			15 years		MLM-RP-MT-0008 RQ 920
	retainer seal		X			15 years		MLM-RP-MT-0008 RQ 920
	seal		X			15 years		MLM-RP-MT-0008 RQ 920
ALFA M24DN20GT	Elect. pneum. valves seal		X			15 years		MLM-RP-MT-0008 RQ 920
	VCO face seal fittings		X			15 years		MLM-RP-MT-0008 RQ 920
ALFA M24DN15	Manual valves seal		X			15 years		MLM-RP-MT-0008 RQ 920
2A-V4AR-SS	Manual valves soft seal		X			15 years		MLM-RP-MT-0008 RQ 920
	Packing		X			15 years		MLM-RP-MT-0008 RQ 920
27/95+LP-200-95-60	Filter gasket		X			15 years		MLM-RP-MT-0008 RQ 920
2A-V4AR-55	Instrument valve soft seal		X			15 years		MLM-RP-MT-0008 RQ 920
	Packing		X			15 years		MLM-RP-MT-0008 RQ 920
ALFA M24DN25	Manual valve seal		X			15 years		MLM-RP-MT-0008 RQ 920
	(GSE for water loop servicing)							(*) From Manufacturing date

LIMITED LIFE ITEM LIST

C.I. Number: M3T020G
UNIT/EQUIPMENT: UNTS

SUBSYSTEM: FGSE

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE (*)		
ALFAM24DN20	Manual valve seal		X			15 years		MLM-RP-MT-0008 RQ 920
SS-CHVC016-1/3	Check valve o-ring body seal		X			15 years		MLM-RP-MT-0008 RQ 920
	Bonded poppet		X			15 years		MLM-RP-MT-0008 RQ 920
SS-18RS12	Needle valve upper packing		X			15 years		MLM-RP-MT-0008 RQ 920
	Lower packing		X			15 years		MLM-RP-MT-0008 RQ 920
	Stem Tip (soft seal)		X			15 years		MLM-RP-MT-0008 RQ 920
SS-CHV08-1/3	Check valve o-ring body seal		X			15 years		MLM-RP-MT-0008 RQ 920
	Bonded poppet		X			15 years		MLM-RP-MT-0008 RQ 920
27/95	Filter gasket		X			10 years		MLM-RP-MT-0008 RQ 920
	Filtering element		X			10 years		MLM-RP-MT-0008 RQ 920
241-2DN15-KVS25	Variable orifice packing		X			15 years		MLM-RP-MT-0008 RQ 920
732.51DN100FS6 (higher UNTS unit P/N C315988-1B)	Diff. Presure gauge sealing ring		X			15 years		MLM-RP-MT-0008 RQ 920 (*) From Manufacturing date

LIMITED LIFE ITEM LIST

SUBSYSTEM: FGSE

C.I. Number: M3T010G
UNIT/EQUIPMENT: WSK

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
A 12 A316202-1	Q.D. Symetric	X		250				ADP CLT-MT-ADP-0002
M 5 A316202-1	Q.D. Symetric	X		250				"
M 6 A316211-1	Q.D. Symetric	X		250				"
M 12 A316212-1	Q.D. Symetric	X		250				"
M 5 A316205-1	Q.D. Symetric	X		250				"
M 6 A316206-1	Q.D. Symetric	X		250				"
(higher WSK unit P/N C316119-1B)	(GSE for water loop servicing)							

LIMITED LIFE ITEM LIST

C.I. Number: M3T050G
UNIT/EQUIPMENT: GLTS

SUBSYSTEM: FGSE

PART No.	ITEM / NOMENCLATURE	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
PN 608010-T	Ball bearing	X				2 years		
PN 033759-T	Ball bearing	X				2 years		
(higher GLTS unit P/N 850.0135)	(GSE for water loop servicing)							

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MECHANICAL GROUND SUPPORT EQUIPMENT (MGSE).

LIMITED LIFE ITEM LIST

C.I. Number: M2T020G
UNIT/EQUIPMENT: H108/A

SUBSYSTEM: MGSE

PART No.	ITEM NOMENCLATURE / FUNCTION	MATERIALS		DECLARED LIFE PARAMETERS			CRITICAL ITEM LIST REFERENCE	REMARKS
		METALLIC	NON METALLIC	OPERATIVE CYCLES	OPERATIVE HOURS	AGE LIFE		
UNFEWB0420-4-6	Special screw 1/4"	X		15				
MBL22	Screw	X		15				
24UNF-0.562 (I.ss) (higher H108/A unit P/N 9601004)	Helicoil 3/8" (MPLM AAC lifting and storage)	X		15				

APPENDIX D – PICTORIAL OVERVIEW OF MPLM.

TABLE 15. PICTORIAL OVERVIEW OF MPLM.

PHOTOGRAPH	DESCRIPTION
Figure 28	Flight 6A manifest. ***JSC Magic Simulation.***
Figure 29	Forward ODS/PMA key dimensions. ***JSC Magic Simulation.***
Figure 30	Orbiter camera locations. ***JSC Magic Simulation.***
Figure 31	Attachment of MPLM to ISS. ***JSC Magic Simulation.***
Figure 32	MPLM grapple fixture mounting location. ***MPLM assembly.***
Figure 33	MPLM forward starboard trunnion. ***MPLM construction.***
Figure 34	Side view of the MPLM common berthing mechanism. ***MPLM construction.***
Figure 35	View looking outboard at ROEU installation orientation view (12/13/1995).
Figure 36	View looking down on sill at ROEU location view of potential interference (STS 72 ROEU)
Figure 37	ROEU mated on STS 72.
Figure 38	ROEU mated on STS 72
Figure 39	ROEU mated on STS 72
Figure 40	FRGF (Front View).
Figure 41	FRGF (Backside view).
Figure 42	FRGF (Side View).

Magic Animations

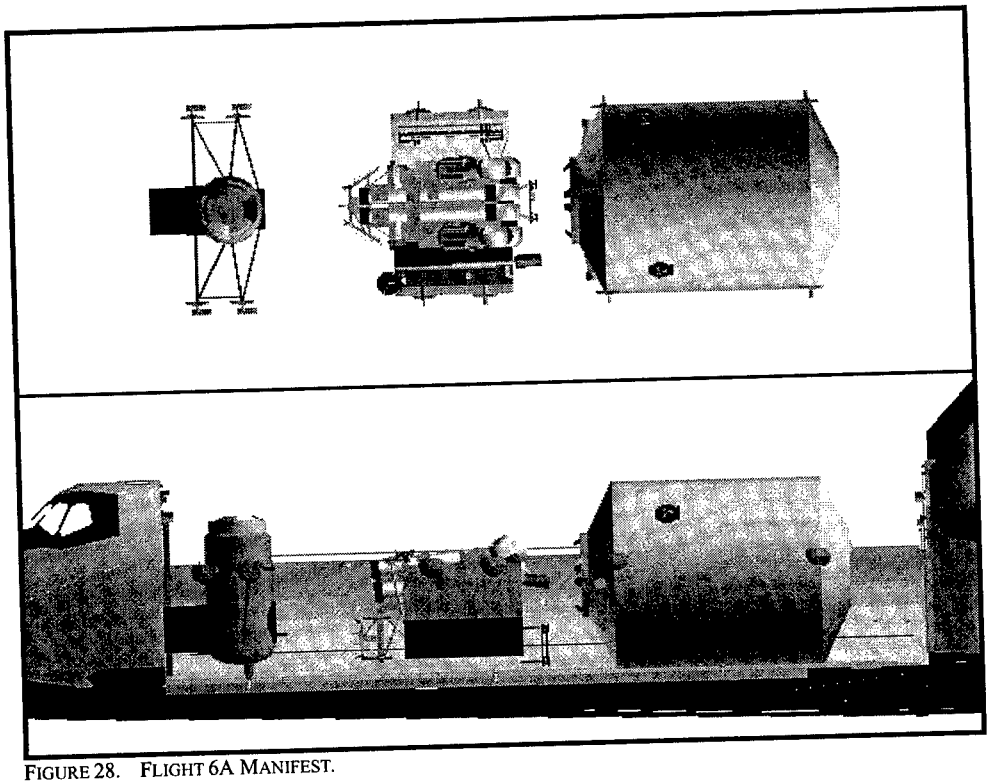

FIGURE 28. FLIGHT 6A MANIFEST.

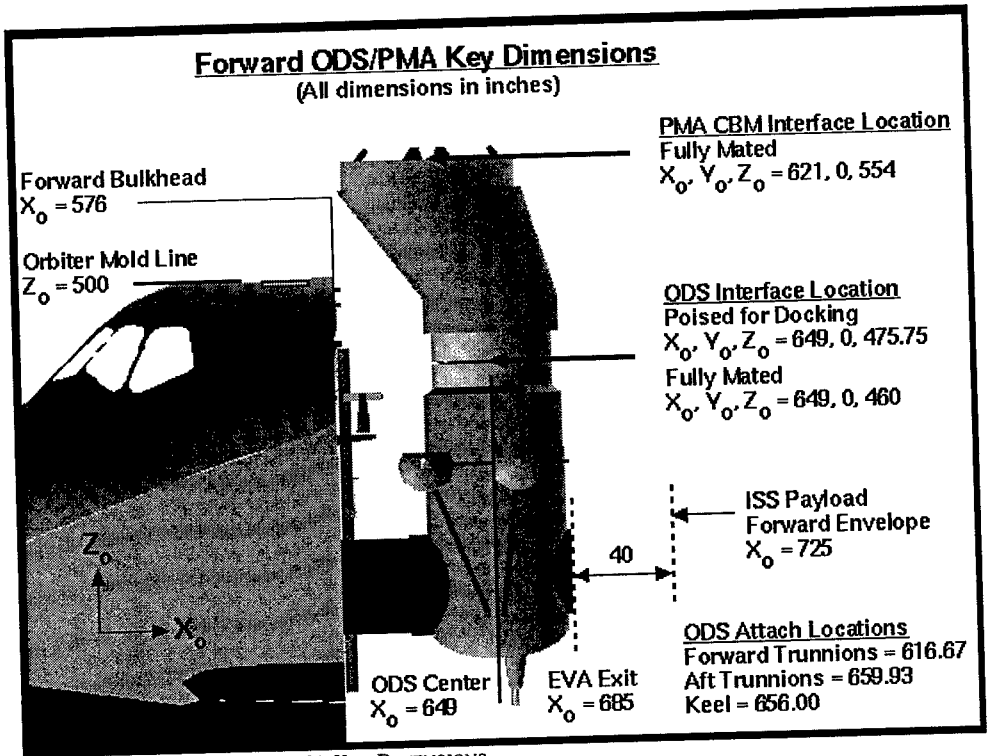

FIGURE 29. FORWARD ODS/PMA KEY DIMENSIONS.

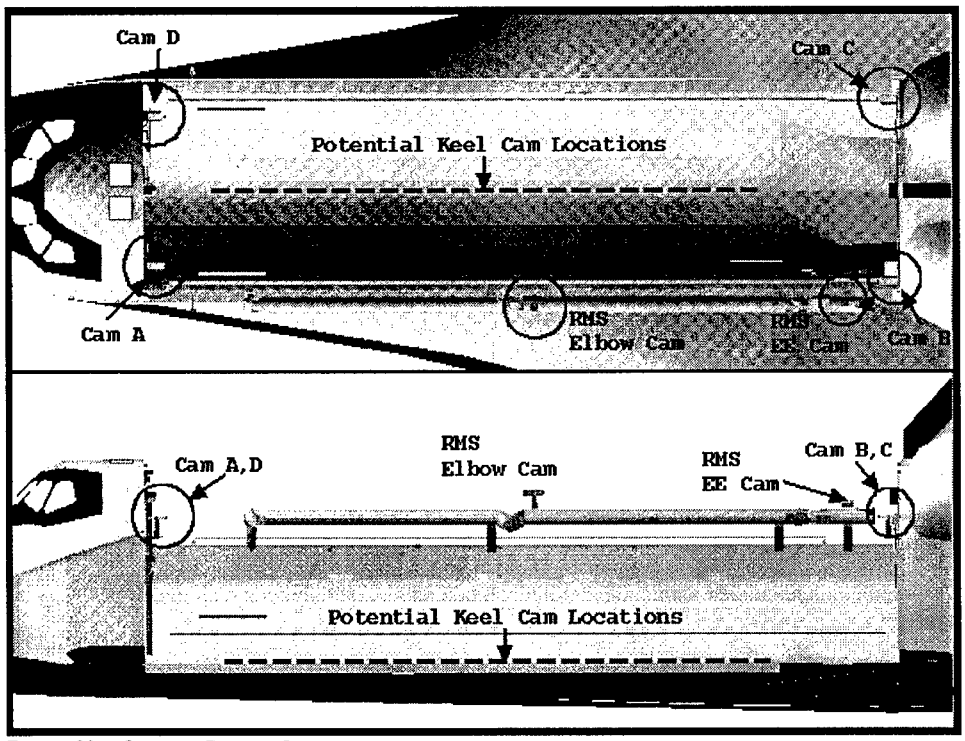

FIGURE 30. ORBITER CAMERA LOCATIONS.

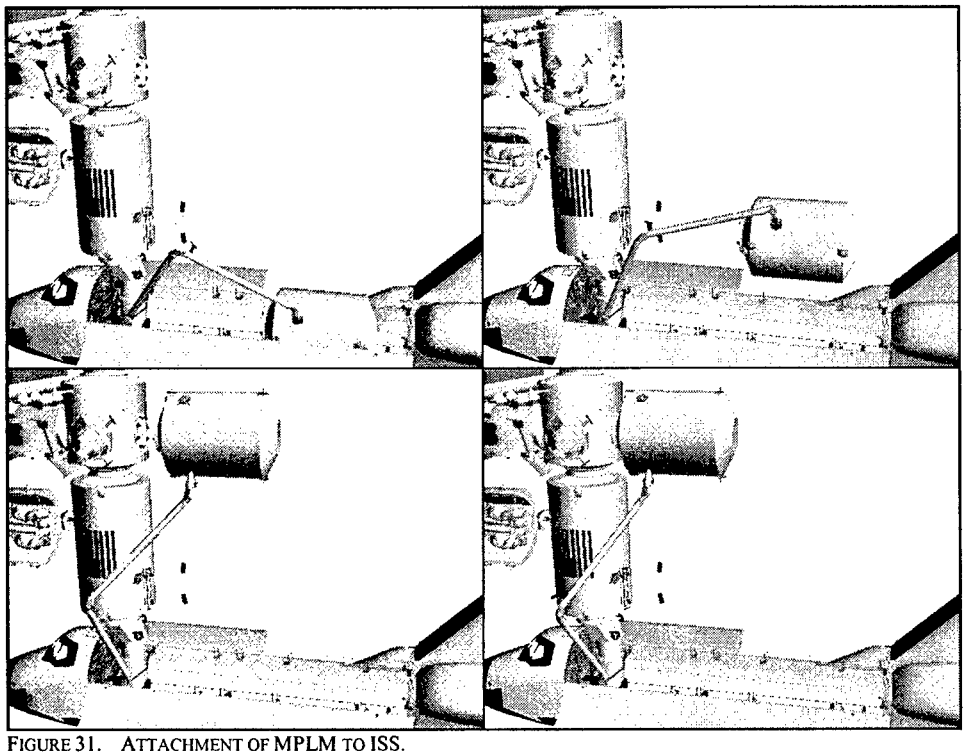

FIGURE 31. ATTACHMENT OF MPLM TO ISS.

MPLM Pictures

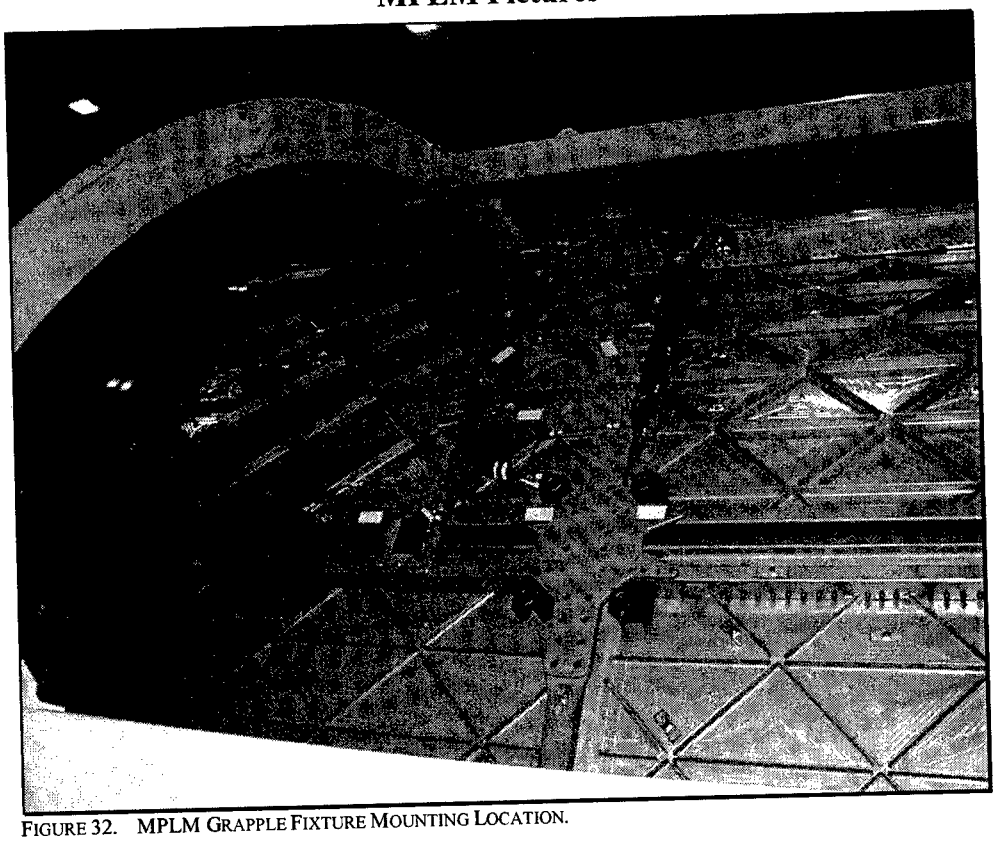

FIGURE 32. MPLM GRAPPLE FIXTURE MOUNTING LOCATION.

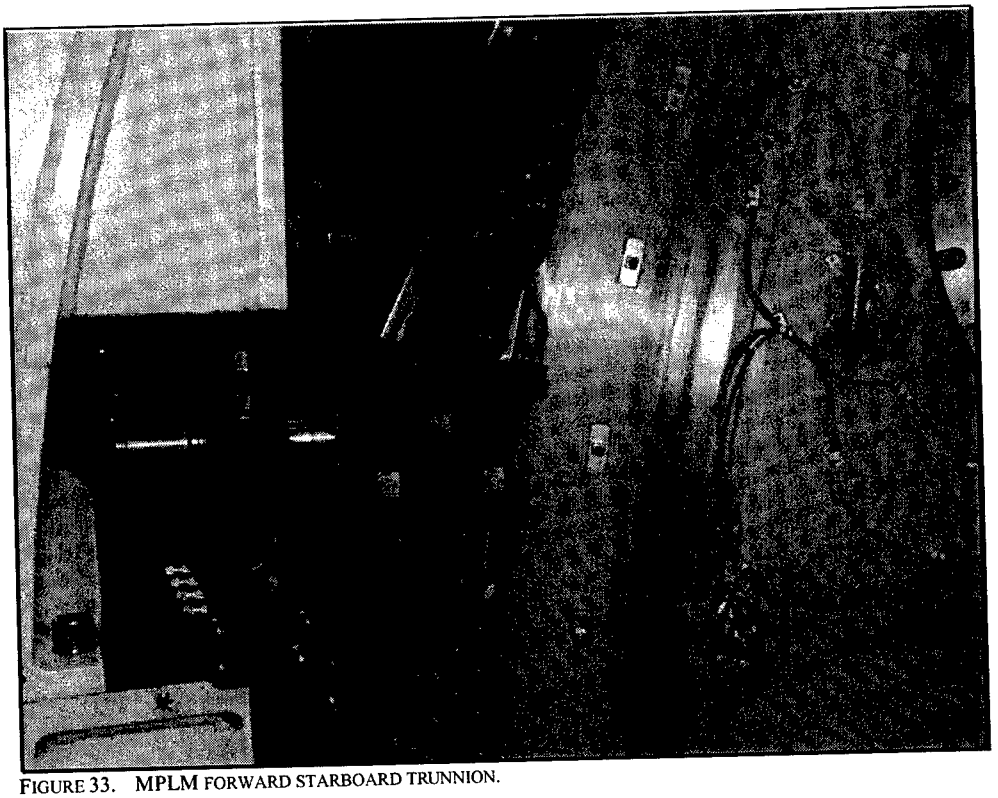

FIGURE 33. MPLM FORWARD STARBOARD TRUNNION.

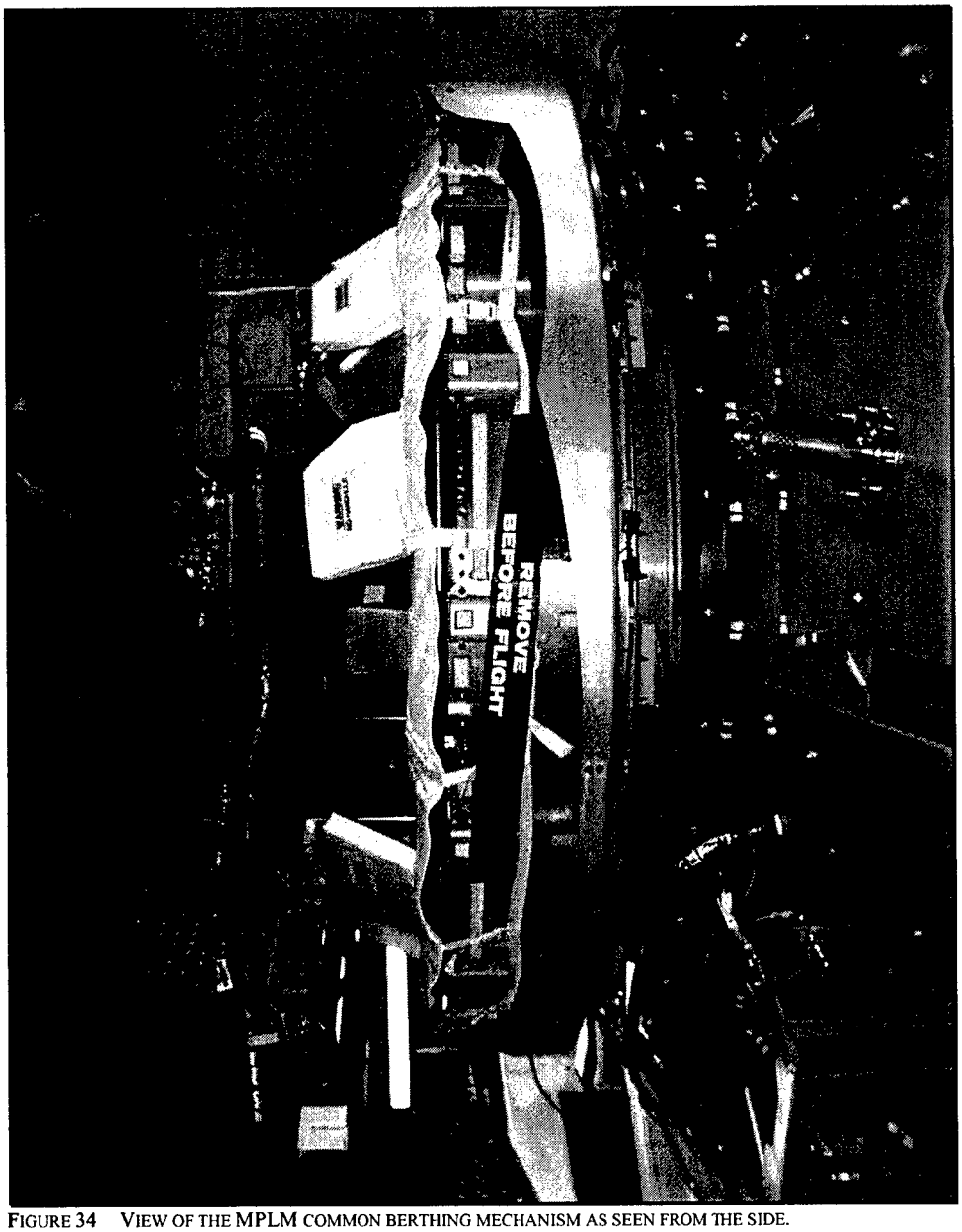

FIGURE 34 VIEW OF THE MPLM COMMON BERTHING MECHANISM AS SEEN FROM THE SIDE.

ROEU

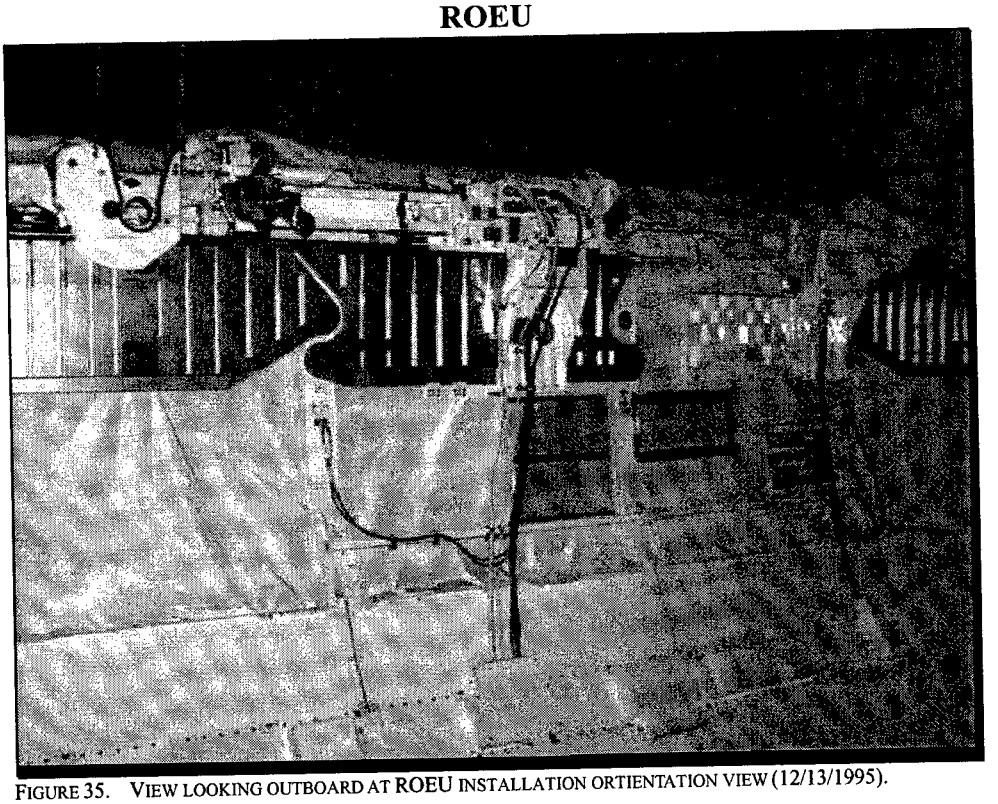

FIGURE 35. VIEW LOOKING OUTBOARD AT ROEU INSTALLATION ORTIENTATION VIEW (12/13/1995).

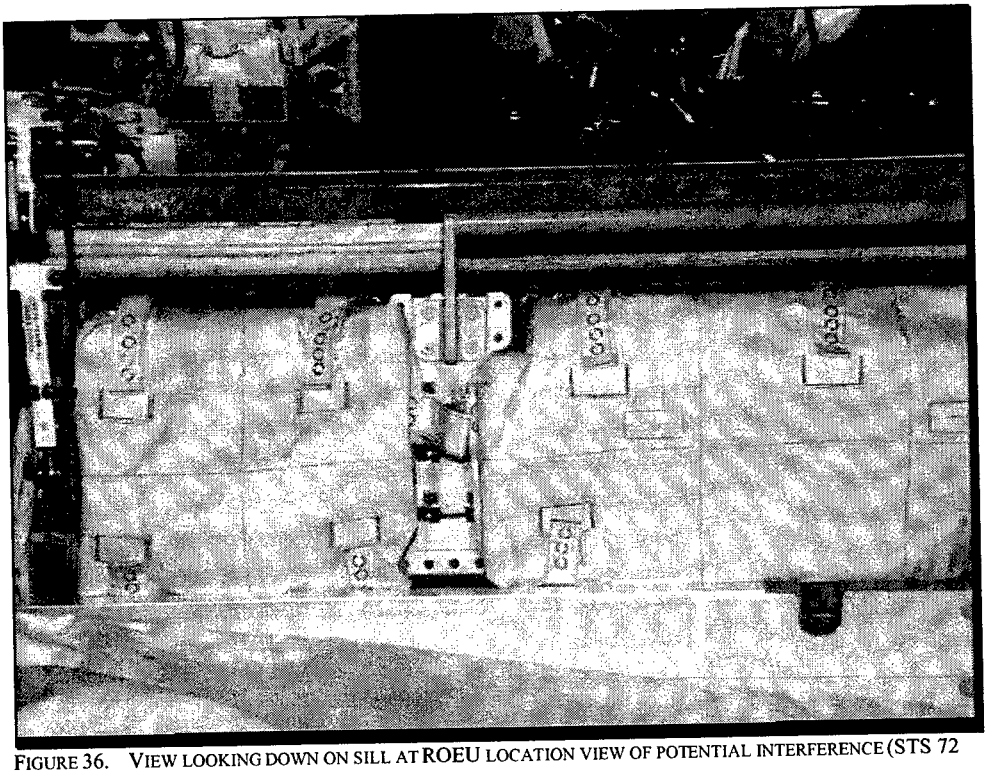

FIGURE 36. VIEW LOOKING DOWN ON SILL AT ROEU LOCATION VIEW OF POTENTIAL INTERFERENCE (STS 72 ROEU).

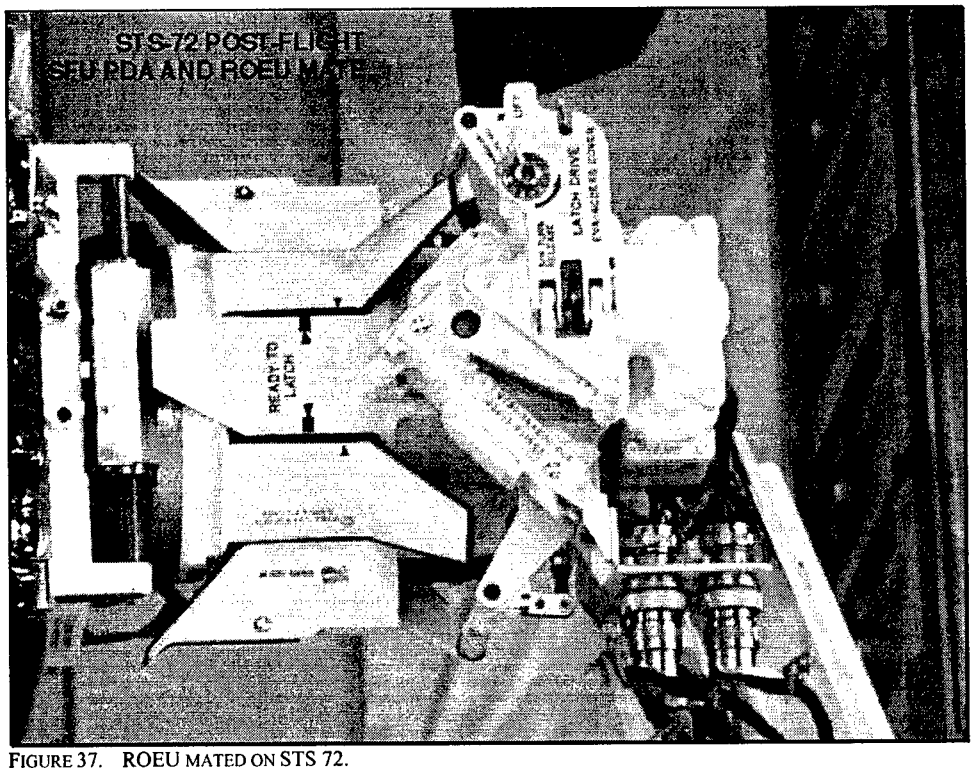

FIGURE 37. ROEU MATED ON STS 72.

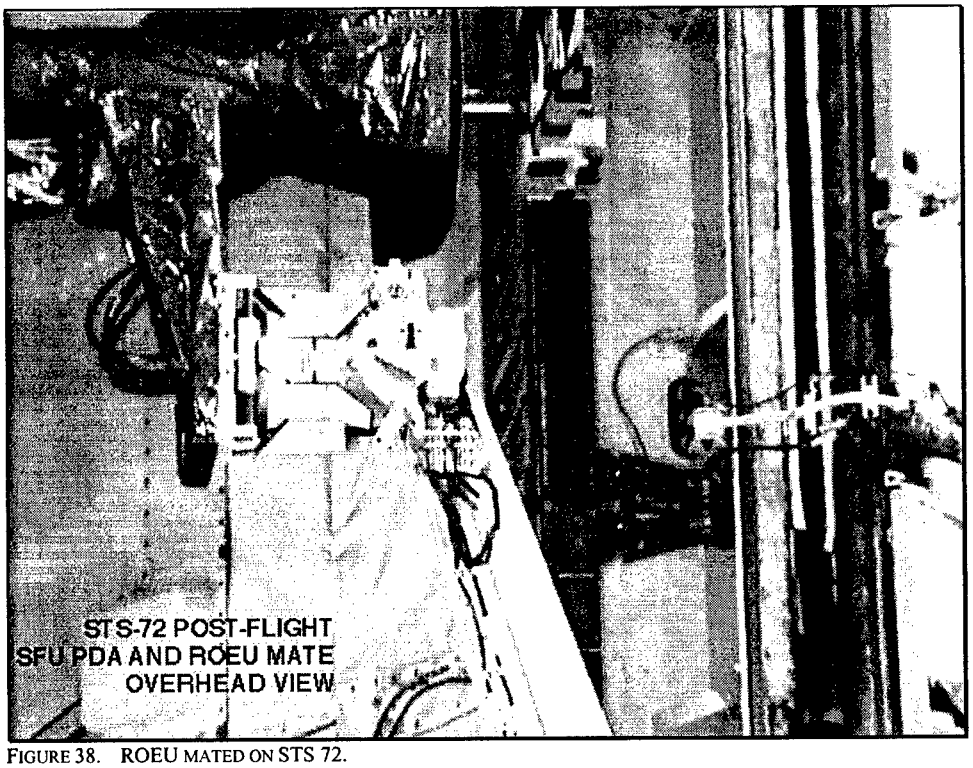

FIGURE 38. ROEU MATED ON STS 72.

FIGURE 39. ROEU MATED ON STS 72.

FRGF

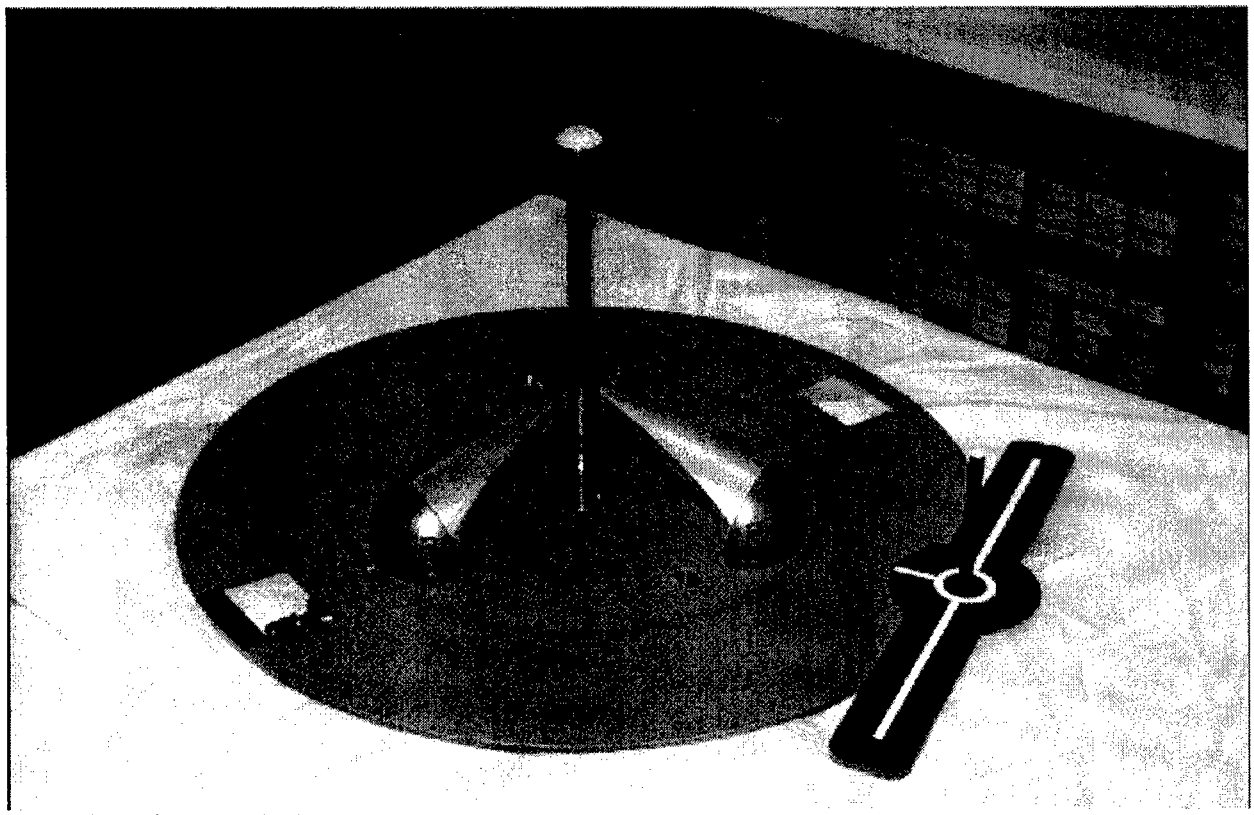

FIGURE 40. FRGF (FRONT VIEW).

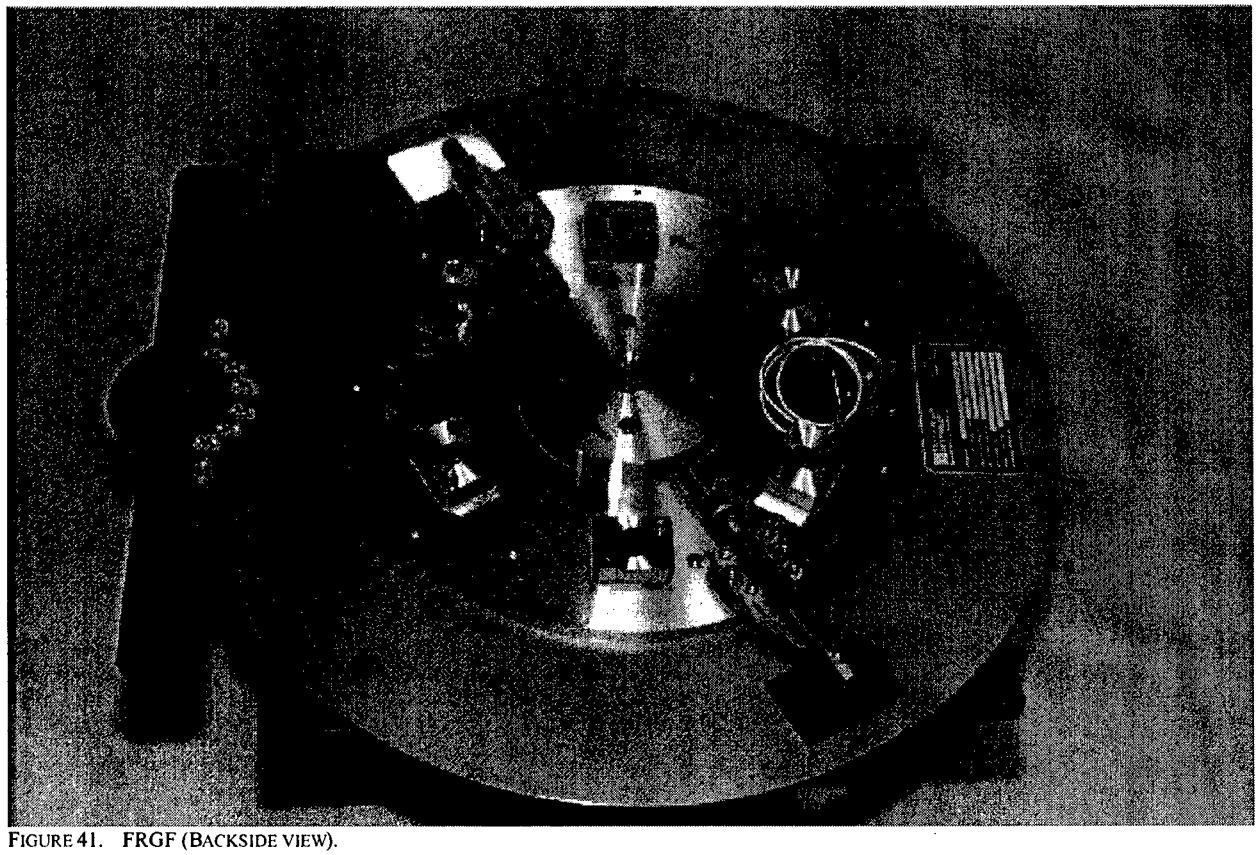

FIGURE 41. FRGF (BACKSIDE VIEW).

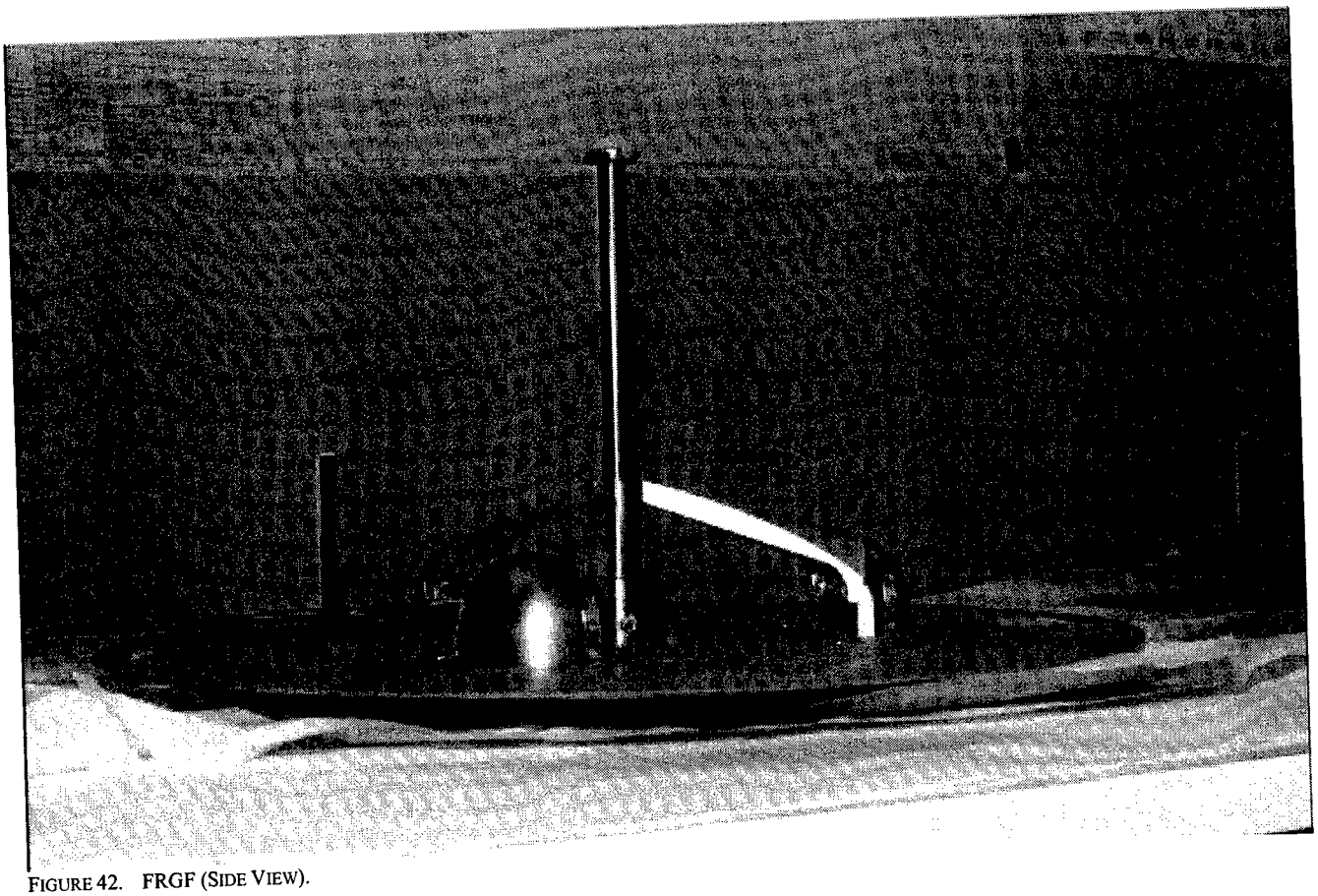

FIGURE 42. FRGF (SIDE VIEW).

APPENDIX E – FLIGHT SAFETY VERIFICATION TRACKING LOG (SVTL).

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Mission ISS 7A.1 **Element** MPLM/Orbiter Integrated

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Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
1	MOI-1	1.1.1	Review of MPLM Structural design and tests (to demonstrate capability to withstand the foreseen loads during the different mission phases) MPLM-0001 Cause 1 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM TEST** MLM-SS-AI-0001 "MPLM Structural/Mechanical S/S Specification" MLM-RP-AI-0146 "MPLM Mechanical Design Report – Flight Hardware" MLM-TN-AI-0067 "MPLM Design Load Summary" MLM-PL-AI-0053 "MPLM Structure Subsystem Verification Plan"
2	MOI-1	1.1.2	Review of analysis results (to verify that positive margins of safety are provided for all mission phases with applied safety factors as defined in SSP 30559, Table 3.3.1-1) MPLM-0001 Cause 1 Verification A2 MPLM-0003 Cause 1 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM ANALYSIS** MLM-RP-AI-0060 "Mechanical S/S: Stress Report"
3	MOI-1	1.1.3	Review of negative differential pressure test results during the MPLM qualification. MPLM-0003 Cause 1 Verification B	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM TEST** MLM-SP-AI-0045 "MPLM Ultimate Negative Pressure test" 61/TP/T862/960082 "Test Procedure" MLML-MI-AI-0581 "Test Readiness Review" MLM-MI-AI-0582 "Post Test Review" MLM-RP-AI-0209 "MPLM-SM Qualification – Ultimate Negative Pressure Verification Test Report"
4	MOI-1	1.2.1	Review of Fracture Mechanics analysis results. MPLM-0001 Cause 1 Verification B (MPLM 5A.1 SVTL 1)	NONE	NO		FM1 6/16/1999 FM2 6/16/1999	**MPLM ANALYSIS** MLM-PL-AI-0014 MLM-LI-AI-0005 "System Fracture Sensitive Item List" MLM-LI-AI-0020 MLM-TN-AI-0136 "Fatigue Load Sectrum Evaluation" MLM-RP-AI-0062 "Fracture Control Report" MLM-RP-AI-0180 MLM-RP-AI-0062 "Mechanical S/S Fracture Control Report" MLM-LI-AI-0071 "MPLM System Limited Life Items List"
5	MOI-1	1.3.1	Review of the results of the EVA crew loads analysis. MPLM-0001 Cause 1 Verification E	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM ANALYSIS** MLM-DC-AI-0209 MLM-RP-AI-0060 "Mechanical S/S: Stress Report"
6	MOI-1	1.4.1	Quality control shall verify that the as built hardware matches the as built configuration list. MPLM-0001 Cause 2 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-SP-AI-0012 MIL-H-6088

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Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
7	MOI-1	1.5.1	Review of Inspection results. (This includes NDE inspection of welds after proof testing.) MPLM-0001 Cause 2 Verification B	NONE	NO		FM1 5/14/1998 FM2 5/27/1999	**MPLM INSPECTION** MLM-ED-AI-0016 "Manufacturing End Item Data Package for MPLM Flight Unit (FM 1)" Reverified for FM2 (27 May 99) Non-destructive inspection of the flight hardware weldings has been performed. Reference to doc. MLM-ED-AI-0034, Manufacturing End Item Data Package for MPLM Flight Unit (FM2).
8	MOI-1	1.6.1	Review of structural analysis and tests to verify that the MPLM can withstand expected vibration induced loading. MPLM-0001 Cause 3 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM ANALYSIS** MLM-SS-AI-0001 "MPLM Structural/Mechanical S/S Specification MLM-RP-AI-0185 "Vibro-Acoustic Test Report" MLM-TN-AI-0155 "MPLM Vibroaccustic Environment Test Analysis Correlation"
9	MOI-1	1.7.1	Review of fastener design and inspection results. MPLM-0001 Cause 3 Verification B	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-PR-AI-0030 "MPLM Vibro-Acoustic Test Procedure" MLM-LI-AI-0071 "MPLM System Limited Life Items List" MLM-MA-AI-0005 "MPLM PHS&T and Maintenacne Manual" MLM-RP-AI-0028 "Logistic Support Analysis Report" This is a post test inspection of fasteners following Vibro-Acoustic testing. (KSC Procedure)
10	MOI-1	1.8.1	Review of analysis results. MPLM-0001 Cause 4 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM ANALYSIS** MLM-TN-AI-0136 MLM-RP-AI-0062 "Mechanical S/S Fracture Control Report"
11	MOI-1	1.9.1	Review of creep analysis results to verify that the structure is designed to preclude cumulative strain as a function of time. MPLM-0001 Cause 5 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM ANALYSIS** MLM-RP-AI-0060 "Mechanical S/S: Stress Report – Vol.1, para 29.0"
12	MOI-1	1.10.1	Review of MPLM thermal stress/distortion analysis results. MPLM-0001 Cause 7 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM ANALYSIS** MLM-RP-AI-0060 "Mechanical S/S: Stress Report" MLM-TN-AI-0067 "Mechanical S/S: Design Load Summary" MLM-TN-AI-0114 "Mechanical S/S: Mathematical Model Description"
13	MOI-1	1.11.1	Review of design and material selection and treatment. MPLM-0001 Cause 12 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-LI-AI-0018 "MPLM System Materials and Mechanical Parts List" MLM-LI-AI-0017 "MPLM Process List"

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Note: Shaded Items are considered closed.

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Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
14	MOI-1	1.12.1	Review of MPLM MDPS layout. MPLM-0001 Cause 14 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** Alenia drawing 031P011 sheet 2, 3 "External Layout" Alenia drawing 1300P001 "MDPS Assembly", 1310P001 "MDPS Cylinder Assembly", 1320P001 "MDPS – FWD cone Assembly", 1330P001 "MDPS – Aft Cone Assembly"
15	MOI-1	1.12.2	Review of meteoroids and Debris Impact Analysis results. MPLM-0001 Cause 14 Verification A2	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-TN-AI-0143 "Meteoriods and Debris Impact Analysis"
16	MOI-1	1.13.1	Review of drawings, MULs, material specifications, and element design data to insure that materials used in the MPLM satisfy SCC requirements. MPLM-0006 Cause 1 Verification A (MPLM 5A.1 SVTL 218)	NONE	NO		FM1 5/14/1998 FM2 9/30/1999	**MPLM** **INSPECTION** MLM-LI-AI-0018 "Material Identification UsageList" MLM-LI-AI-0101 "MPLM MUA Summary List" Reverified for FM2 (30 Sep 99) All data relevant to MPLM materials properties (stress corrosion, corrosion, offgassing, outgassing, fungus, flammability) are contained in the MPLM MIUL (Material Identification Usage List), doc. MLM-LI-AI-0018. Review of MIUL content and applicable drawings information together with the NASA/MSFC material laboratory approved MUA's show that the MPLM materials meet the requirements. Summary of the MPLM submitted MUA's is contained in doc. MLM-LI-AI-0101 "MPLM MUA Summary List". Product Assurance (PA) certification ensures that the as-built configuration is in accordance with design drawings and materials list.

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Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
17	MOI-1	1.14.1	Review of data from drawings and MULs to verify that the materials used in the MPLM satisfy corrosion control requirements. MPLM-0006 Cause 2 Verification A	NONE	NO		FM1 5/14/1998 FM2 9/30/1999	**MPLM INSPECTION** MLM-LI-AI-0018 "Material Identification Usage List" MLM-LI-AI-0101 "MPLM MUA Summary List" Reverified for FM2 (30 Sep 99) All data relevant to MPLM materials properties (stress corrosion, corrosion, offgassing, outgassing, fungus, flammability) are contained in the MPLM MIUL (Material Identification Usage List), doc. MLM-LI-AI-0018. Review of MIUL content and applicable drawings information together with the NASA/MSFC material laboratory approved MUA's show that the MPLM materials meet the requirements. Summary of the MPLM submitted MUA's is contained in doc. MLM-LI-AI-0101 "MPLM MUA Summary List". Product Assurance (PA) certification ensures that the as-built configuration is in accordance with design drawings and materials list.
18	MOI-1	1.15.1	Review of the MPLM external treatment process. MPLM-0006 Cause 3 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-NL-AI-0003 "Anodic Chromic Oxydation Implementation Procedure"
19	MOI-1	1.15.2	Review of the test plan and test report. MPLM-0006 Cause 3 Verification A2	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM TEST** MPLM-PL-AI-0034 "MPLM-MDPS Thermal Control Coating Development and Qualification Plan" QMC Report 97/134
20	MOI-1	1.16.1	Review of the ground operation maintenance procedure. MPLM-0006 Cause 3 Verification B (MPLM 5A.1 SVTL 168) (KSC procedure)	NONE	NO		CLOSED	**MPLM INSPECTION** MLM-MA-AI-0005 "MPLM PHS&T and Maintenance Manual" MLM-RP-AI-0028 "Logistic Support Analysis Report" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. (KSC Procedure)

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Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
21	MOI-1	1.17.1	Load Data Book for STS-102 Verification Loads Analysis, TM-270-300-TBD. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 007010101 Boeing Safety and Reliability Engineering review of Load Data Book for STS-102 Verification Loads Analysis, SCB0.N210.2000.056, dated December 15, 2000 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
22	MOI-1	1.17.2	Boeing Safety and Reliability Engineering review of D/270-400/300 – Structural Dynamics and Loads Safety Statement. Boeing RSS/USA Verification	NONE	NO		2/14/2001	**ORBITER** RSS99D0518 CIRAHR No 007010102 Boeing Safety and Reliability Engineering review of D/N210 and D/N230 – Structure Dynamics and Loads Safety Statement. ECD February 15, 2001 Closed per email from Harry Maltby dated Feb 14, 2001. Remaining items are considered normal work under the shuttle process and is the responsibility of USA. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
23	MOI-1	1.17.3	Boeing Safety and Reliability Engineering review of Vehicle Summary Weight Statement. (D/335-130 – Mass Properties). Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 007010103 Boeing Safety and Reliability Engineering review of Vehicle Summary Weight Statement (Mass Properties) **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
24	MOI-1	1.17.4	Boeing Safety and Reliability Engineering review of ICD-A-21350 (Shuttle Orbiter/MPLM) Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 007010104 Boeing Safety and Reliability Engineering review of Interface Control Documents: ICD-A-21342 (ODS) ICD-A-21448 (Shuttle Orbiter/ICC) ICD-A-21350 (Shuttle Orbiter/MPLM) ICD-A-21353 (Shuttle Orbiter/OSVS) ICD-A-21403 (Shuttle Orbiter/SSV) **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
25	MOI-1	1.18.1	Stress Reports: STS85-0254/Vol 11 (books 3 & 4 – Section 11.6.5) Latch Part No's: V073-544530, V073-544300, V073-544430. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
26	MOI-1	1.18.2	Load Data Book for STS-102 Verification Loads Analysis, TM-270-300-TBD. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 007010202 Boeing Safety and Reliability Engineering review of Load Data Book for STS-102 Verification Loads Analysis, SCB0.N210.2000.056, dated December 15, 2000 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
27	MOI-1	1.18.3	Active longeron latches: V073-544550 standard weight at Bay 8 is installed per Tech Order M072-TBD; V073-544530 Super Middle Weight at Bays 12 is installed per Tech Order M072-544201. Longeron bridges are installed per Tech Orders: Bay 8 – M072-002008 and Bay 12 – M072-002012. Fibriloid liner and vitrolube are inspected and serviced per T.O. M072-340500. See also TPS's: Bays 8 & 12 – TBD. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 007010204 Active longeron latches: V073-544550 standard weight at Bay 8 is installed per Tech Order M072-544101; V073-544530 Supper Middle Weight Bay 12 is installed per Tech Order M072-544201. The longeron bridges are installed per Tech Orders: Bay 8 M072-002008 May 12 M072-002012 Fibriloid liner and vitrolube are inspected and serviced per T.O. M072-340500. See also TPS's: Bay 8 CM-3-29-133 and CM-3-29-134 Bay 12 CM-3-29-125 and CM-3-29-126 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
28	MOI-1	1.18.4	OMRSD File II, Vol. IV, (Premate). OMI TBD Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 007010210 FMEA/CIL: Active Longeron Latch – Supper Middle Weight. (Bay 12, V073-544530) 02-5E-L01-01 (1/1) Latch Drive Mechanism (physical binding/jamming); 02-5E-L01-02 (1/1) Latch Drive Mechanism (fails free) 02-5E-L02-02 (1/R2) Motor/Brake Assy (loss of output) 02-5E-L02-03 (1/R2) Motor/Brake Assy (fails to engage) 02-5E-L04-01 (1/1) EVA Drive (fails to function) 02-5E-L05-01 (1/1) Latch/Trunnion & Bridge Interface (physical binding/jamming) 02-5E-L05-01 (1/1) Limit Switch (transfers prematurely/inadvertently – latch closed) **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
29	MOI-1	1.19.1	Load Data Book for STS-102 Verification Loads Analysis TBD Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 007010301 Boeing Safety and Reliability Engineering review of Load Data for STS-102 Verification Loads Analysis, SCB0.N210.2000.056, dated December 15, 2000. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
30	MOI-1	1.19.2	Boeing Safety and Reliability Engineering review of D/270-400/300 – Structural Dynamics and Loads Safety Statement. Boeing RSS/USA Verification	NONE	NO		2/14/2001	**ORBITER** RSS99D0518 CIRAHR No 007010302 Boeing Safety and Reliability Engineering Review of D/270-400/300 – Structure Dynamics and Loads Safety Statement. ECD: February 15, 2001 Closed per email from Harry Maltby dated Feb 14, 2001. Remaining items are considered normal work under the shuttle process and is the responsibility of USA. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
31	MOI-1	1.20.1	Review of Stress Analysis (STS87-0359) confirms positive safety margin, which was verified by limit load test. ROEU-1 Verification 1	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights.** **United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
32	MOI-1	1.20.2	Review of drawings (V751-544100, -110, -200) and Stress Analysis (STS87-0359). ROEU-1 Verification 2	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights.** **United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
33	MOI-1	1.20.3	Material and Processes (M&P) approval of engineering drawings verifies choice of materials precluding stress corrosion. ROEU-1 Verification 2	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights.** **United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**

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Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
34	MOI-1	1.21.1	Review of structural analysis confirms positive safety margin, which was verified by limit load test.	NONE	NO	Before FL UF3	NA	ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
35	MOI-1	1.21.2	Review of stress analysis No # TBD.	NONE	NO	Before FL UF3	NA	ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
36	MOI-1	1.21.3	Materials and Processes (M&P) approval of engineering drawings verifies choice of materials precluding stress corrosion.	NONE	NO	Before FL UF3	NA	ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
37	MOI-1	1.22.1	Kick load Analysis/Structure Analysis will be verified to see that the hardware meets worst case impact/kick load to a factor of safety	NONE	NO	Before FL UF3	NA	ORBITER/MPLM COOLING SYSTEM Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
38	MOI-1	1.23.1	Materials Memo MATL-XXX	NONE	NO	Before FL UF3	NA	ORBITER/MPLM COOLING SYSTEM Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.

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Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
39	MOI-1	1.24.1	Fracture control report XXX	NONE	NO	Before FL UF3	NA	**ORBITER/MPLM COOLING SYSTEM** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
40	MOI-1	1.25.1	QA/QC will be inspection of as built hardware to drawing # XXX. Installation procedure #XXX	NONE	NO	Before FL UF3	NA	**ORBITER/MPLM COOLING SYSTEM** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
41	MOI-1	1.26.1	QA/QC will be inspection of as built # XXX to verify proper fasteners are used. Strength and Fracture Assessment will be verified fasteners have positive margins of safety and are used within their capabilities	NONE	NO	Before FL UF3	NA	**ORBITER/MPLM COOLING SYSTEM** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
41a	MOI-1	1.27.1	Review of the MPLM flight fitting design/installation drawings to insure that the flight fittings meet the requirements of ICD-A-21350.	NONE	NO		2/26/99	**INTEGRATED** PIRN A03115 to ICD-A-21350 was updated to include MPLM trunnion length. PIRN review has been completed by BNA and DX21. This verification is closed for all future flights.
41b	MOI-1	1.27.2	Review of the MPLM flight fitting design by the Shuttle Program to insure that flight fittings are acceptable and will interface properly the the Orbiter Payload Retention System.	NONE	NO		2/26/99	**INTEGRATED** The Boeing Reusable Space Systems (RSS) group made a presentation on MPLM trunnion length selection to the JMICB on February 26, 1999. As a result of this meeting, IRN A03115 was added to ICD-A-21350 to clarify the requirements for MPLM trunnion length (specifically at X0 1202.73). In addition, the shuttle program looked at all the MPLM flight fittings and found that they were compliant with the requirements of the new ICD. This verification is closed for all future flights.

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41c	MOI-1	1.27.3	QA certification that the as built MPLM flight fittings match the approved design/installation drawings.	NONE	NO		MAY 1999	**INTEGRATED** The main trunnions were replaced in May of 1999. The kit was funished by Alenia and contained two trunnions that were 12.077 inches long. These replaced the two 13.327 inch trunnions. This can be referenced in TPS SS-MPLM-FM1-T109 (JFB05). This verification is closed for all future flights.
42	MOI-1	2.1.1	Review of analysis results (verification of safety factors for pressure). MPLM-0002 Cause 1 Verification A	NONE	NO		FM1 5/14/1998 FM2 9/30/1999	**MPLM** **ANALYSIS** MLM-RP-AI-0060 "Mechanical S/S: Stress Report" Reverified for FM2 (30 Sep 99) Proof Pressure test has been performed during the MPLM Flight Model (FM2) acceptance program to verify the capability of the MPLM primary structure to withstand the proof positive differential pressure of 22.8 psid. Test has been performed according to the specification doc. MLM-SP-AI-0080 "MPLM Proof Pressure Test Specification". Test results are contained in doc. MLM-RP-AI-0465 "MPLM FM2 Acceptance Proof Pressure Verification Report". Pressure Decay test has been performed during the MPLM Flight Model (FM2) acceptance program in accordance to the test specification doc. MLM-SP-AI-0081 "MPLM Pressure Decay Test Specification". Test results are contained in doc. MLMpRP-AI-0466 "MPLM FM2 Acceptance Pressure Decay Verification Report".

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43	MOI-1	2.2.1	Review of MPLM structure Qualification test results. . MPLM-0002 Cause 1 Verification B1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **TEST** MLM-SP-AI-0024 "MPLM Proof Pressure test specification" MLM-PR-AI-0016 "MPLM Proof Test Procedure" MLM-MI-AI-0579 "Test Readiness Review" MLM-MI-AI-0580 "Post Test Review" MLM-PR-AI-0016 "MPLM Proof Pressure test procedure" MLM-MI-AI-0585 "Test Readiness Review" MLM-MI-AI-0586 "Post Test Review" MLM-MI-AI-0605 "Test Readiness Review" MLM-MI-AI-0606 "Post Test Review" MLM-RP-AI-0200 "MPLM SM Qualification – Proof Pressure Verification Test Report (Hatch closed)" MLM-RP-AI-0201 "MPLM SM Qualification – Proof Pressure Verificatio Test Report (Hatch Open)" MLM-SP-AI-0045 "MPLM Ultimate Negative Pressure Test" 61/TP/T862/960093 "Test Procedure" MLM-MI-AI-0581 "Test Readiness Review" MLM-MI-AI-0582 "Post Test Review" MLM-RP-AI-0210 "MPLM SM Qualification – Ultimate Pressure Verification Test Report"
44	MOI-1	2.2.2	Review of MPLM structure Acceptance results. MPLM-0002 Cause 1 Verification B2 (MPLM 5A.1 SVTL 9)	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-SP-AI-0073 "MPLM FM1 – Proof Pressure Test Specification MPL-05-A" MLM-RP-AI-0387 "MPLM FM1 – Proof Pressure Verification Test Report (Hatch Closed)" MLM-RP-AI-0388 "MPLM FM1 – Proof Pressure Verification Test Report (Hatch Open)"
45	MOI-1	2.3.1	Review of fracture mechanics analysis results. MPLM-0002 Cause 1 Verification C	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-RP-AI-0179 "MPLM Fracture Control Report" MLM-RP-AI-0180 "Fracture Control Summary Report"
46	MOI-1	2.4.1	Review of the MPLM PPR function configuration and characteristics. MPLM-0002 Cause 2 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-DOR-RP-0002 "ECLS Design Definition Report" MLM-CTI-RP-0002 "Design Definition Reprot for MPLM Components" MLM-CTI-RP-0004 "Life cycle analysis report" Carleton Drawing B40484 "Positive Pressure Relief Assembly", B41103 "Positive Pressure Relief Valve", B41102 "Non-Thrust Vent Assembly (PPRA)"

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47	MOI-1	2.4.2	Review of the PPRA functional test results during FM 1 acceptance. MPLM-0002 Cause 2 Verification A2 (MPLM 5A.1 SVTL 10)	NONE	NO		FM1 5/14/1998 FM2 5/27/1999	**MPLM** **TEST** MLM-CTI-DP-0021 (PPRA S/N 003) MLM-CTI-DP-0022 (PPRA S/N 004) MLM-CTI-DP-0024 (PPRA S/N 006) Reverified for FM 2 (27 May 99) PPRA Flight Units Acceptance Tests have been performed as described in doc. MLM-CTI-TP-0008 "Acceptance Test Procedure for PPRA" PPRA Flight Units (FM 2) Acceptance tests results are contained in doc. MLM-CTI-DP-0022 (PPRA S/N 004), MLM-CTI-DP-0024 (PPRA S/N 006) and MLM-CTI-DP-0027 (PPRA S/N 009).
48	MOI-1	2.5.1	Review of MPLM Software design (SCP implementation). MPLM-0002 Cause 2 Verification B1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-SS-AI-0011 "S/W Requirements document for MPLM MDM CSCI" MLM-DD-AI-0001 "S/W Design document for MDM CSCI"
49	MOI-1	2.5.2	Review of the Software Verification Test results. MPLM-0002 Cause 2 Verification B2 (MPLM 5A.1 SVTL 11)	NONE	NO		FM1 5/14/1998 FM2 5/27/1999	**MPLM** **TEST** MLM-PL-AI-0005 "MPLM Software Test Plan" MLM-PR-AI-0006 "S/W Test Description for the MPLM MDM CSCI" MLM-RP-AI-0252 "Software Test Reports for the MPLM MDM CSCI" Reverified for FM2 (27 May 99) PDB Flight Unit (FM 2) Acceptance test results are contained in doc. MLM-ED-FI-0066 "PDB FM2 S/N 102 ADP"
50	MOI-1	2.5.3	Review of integrated system test results. MPLM-0002 Cause 2 Verification B3	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **TEST** MLM-PR-AI-0050 "ECLSS Integration & Test" MLM-RP-AI-0283 "MPLM EQM – ECLSS Integration Test Report" MLM-RP-AI-0421 "MPLM-FM1 – ECLSS Integration Test Report"
51	MOI-1	2.6.1	deleted (srp phase iii)					
52	MOI-1	2.6.2	deleted (srp phase iii)					
53	MOI-1	2.7.1	Review of PPRA Structural analysis. MPLM-0002 Cause 2 Verification E1 (MPLM 5A.1 SVTL 13)	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-CTI-RP-0035 "Structural Analysis Report for Positive Pressure Relief Assembly"

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54	MOI-1	2.7.2	Review of PPRA Structural Qualification test results. MPLM-0002 Cause 2 Verification E2 (MPLM 5A.1 SVTL 14)	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **TEST** MLM-CTI-TP-0007 "Qualification Test Procedure for PPRA" MLM-CTI-TR-0003 "PPRA Qualification Test results"
55	MOI-1	2.7.3	Review of Structural Acceptance test results. MPLM-0002 Cause 2 Verification E3 (MPLM 5A.1 SVTL 15)	NONE	NO		FM1 5/14/1998 FM2 5/27/1999	**MPLM** **TEST** MLM-CTI-TP-0008 "Acceptance Test Procedure for PPRA" MLM-CTI-DP-0021 (PPRA S/N 003) MLM-CTI-DP-0022 (PPRA S/N 004) MLM-CTI-DP-0024 (PPRA S/N 006) Reverified for FM 2 (27 May 99) PPRA Flight Units Acceptance Tests have been performed as described in doc. MLM-CTI-TP-0008 "Acceptance Test Procedure for PPRA" PPRA Flight Units (FM 2) Acceptance tests results are contained in doc. MLM-CTI-DP-0022 (PPRA S/N 004), MLM-CTI-DP-0024 (PPRA S/N 006) and MLM-CTI-DP-0027 (PPRA S/N 009).
56	MOI-1	2.8.1	Review of Ground Operation procedures (PPRA Mechanical Relief Valve and PPRA Motor Driven Valve functional test). MPLM-0002 Cause 2 Verification F1 (MPLM 5A.1 SVTL 158) (11/2/1999) MPLM-0002 Cause 2 Verification F2 (MPLM 5A.1 SVTL 159) (KSC Procedure)	NONE	NO		CLOSED	**MPLM** **INSPECTION** MLM-MA-AI-0005 "MPLM PHS&T and Maintenance Manual" MLM-RP-AI-0028 "Logistic Support Analysis Report" MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to Launch/Landing Sites Procedures" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. Documented in NASA document MU04819C "MPLM Generic O&M Requirement", item number U024LT.020 for PPRA mechanical releif valve functional test and U024LT.030 for PPRA Motor Driven Valve functional test.

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57	MOI-1	2.8.2	Review of Ground Operation procedures (PPRA final check-out, final inspection, cleaning, and installation verification). MPLM-0002 Cause 2 Verification F3 (MPLM 5A.1 SVTL 160) (KSC Procedure) MPLM-0002 Cause 2 Verification F4 (MPLM 5A.1 SVTL 161) (KSC Procedure)	NONE	NO		CLOSED	**MPLM** **INSPECTION** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to Launch/Landing Sites Procedures" MLM-MA-AI-0005 "MPLM PHS&T and Maintenance Manual" MLM-RP-AI-0028 "Logistic Support Analysis Report" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. Documented in NASA document MU04819C "MPLM Generic O&M Requirement", item number U024EA.430-C for PPRA final check-out, final inspection, cleaning, and installation.
58	MOI-1	2.9.1	Review of connector verification analysis (functional test to verify that no bent pins are present in the connector which feeds the PPRA motor driven valves) MPLM-0002 Cause 2 Verification H	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** Connector Verification Analysis
59	MOI-1	2.10.1	Review of analysis results (maximum positive pressure reached inside the MPLM due to the internal temperature transient inside the MPLM during the ascent phase). MPLM-0002 Cause 6 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-DOR-TN-0016 "ACS Postive Pressure Relief Analysis" MLM-TN-AI-0196 "MPLM ACS System Anslysis for Safety Review – Phase II"
60	MOI-1	2.10.2	Review of ground procedures (DA opening before launch to equalize pressure). MPLM-0002 Cause 6 Verification A2 (MPLM 5A.1 SVTL 162) (KSC Procedure)	NONE	NO		CLOSED	**MPLM** **INSPECTION** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to Launch/Landing Sites Procedures" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. **(not a requirement as of today???)**
61	MOI-1	2.11.1	Review of analysis results (maximum positive pressure reached inside the MPLM due to temperature transients for the listed scenarios). MPLM-0002 Cause 6 Verification B	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-TN-AI-0130 "MPLM ECS Analysis" MLM-TN-AI-0196 "MPLM ACS System Analysis for Safety Review – Phase II"

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62	MOI-1	3.1.1	Review of the MPLM NPR function configuration and characteristics. MPLM-0003 Cause 2 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-DOR-RP-0002 "ECLSS Design Definition Report" MLM-CTI-RP-0002 "Design Definition Report for MPLM Components" MLM-CTI-RP-0004 "Life cycle analysis report, paragraph 9.0" Carleton Drawing B40483 "Negative pressure Relief Assembly"
63	MOI-1	3.1.2	Review of the NPRA functional test results during flight unit acceptance. MPLM-0003 Cause 2 Verification A2 (MPLM 5A.1 SVTL 16)	NONE	NO		FM1 5/14/1998 FM2 5/27/1999	**MPLM** **TEST** MLM-CTI-DP-0028 Reverified for FM 2 (27 May 99) NPRA Flight Unit Acceptance Tests have been performed as described in doc. MLM-CTI-TP-0010, "Acceptance Test Procedure for NPRA". NPRA Flight Units (FM 2) Acceptance test results are contained in doc. MLM-CTI-DP-0039 (NPRA S/N 010), MLM-CTI-DP-0040 (NPRA S/N 011), MLM-CTI-DP-0041 (NPRA S/N 012), MLM-CTI-DP-0043 (NPRA S/N 014), MLM-CTI-DP-0044 (NPRA S/N 015).
64	MOI-1	3.1.3	Review of analysis results (maximum negative pressure reached during the reentry of a depressurized MPLM after a failure and with only four NPRVs operating). MPLM-0003 Cause 2 Verification B	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALSYSIS** MLM-DOR-TN-0015 "ACS Negative pressure Relief Analysis"
65	MOI-1	3.2.1	Review of NPRA structural analysis results. MPLM-0003 Cause 2 Verification C1 (MPLM 5A.1 SVTL 17)	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-CTI-RP-0033 "Structural Analysis Report for Negative Pressure Relief Assembly"

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66	MOI-1	3.2.2	Review of NPRA structural qualification and acceptance test results. MPLM-0003 Cause 2 Verification C2 (MPLM 5A.1 SVTL 18) (5/14 1998) MPLM-0003 Cause 2 Verification C3 (MPLM 5A.1 SVTL 19) (7/9/1998)	NONE	NO		FM1 7/9/1998 FM2 5/27/1999	**MPLM** **TEST** MLM-CTI-TR-0004 "Qualification Test Procedure for NPRA" MLM-CTI-TP-0010 "Acceptance Test Procedure for NPRA" MLM-CTI-TP-0010 "Acceptance Test Procedure for NPRA" MLM-CTI-DP-0028 Reverified for FM 2 (27 May 99) NPRA Flight Unit Acceptance Tests have been performed as described in doc. MLM-CTI-TP-0010, "Acceptance Test Procedure for NPRA". NPRA Flight Units (FM 2) Acceptance test results are contained in doc. MLM-CTI-DP-0039 (NPRA S/N 010), MLM-CTI-DP-0040 (NPRA S/N 011), MLM-CTI-DP-0041 (NPRA S/N 012), MLM-CTI-DP-0043 (NPRA S/N 014), MLM-CTI-DP-0044 (NPRA S/N 015).
67	MOI-1	3.3.1	Review of analysis results (design verification for NPRA MLI blanket cap). MPLM-0003 Cause 2 Verification D (MPLM 5A.1 SVTL 20)	NONE	NO		FM1 2/16/1999 FM2 2/16/1999	**MPLM** **ANALYSIS** In the present MPLM MLI configuration, no blanket caps are needed on the external side of the NPRA's. This is based on results of a dedicated System Assessment.
68	MOI-1	3.4.1	Review of analysis results (NPR window area evaluation). MPLM-0003 Cause 2 Verification E1 (MPLM 5A.1 SVTL 21)	NONE	NO		FM1 2/16/1999 FM2 2/16/1999	**MPLM** **ANALYSIS** MLM-DOR-TN-0015 "ACS Negative Pressure Relief Analysis" Alenia Drawing 031P0159 "Fire Suppression Containment Panel Layout sheets 1 and 2"
69	MOI-1	3.4.2	Review of Ground procedures (NPR window opening). MPLM-0003 Cause 2 Verification E2 (MPLM 5A.1 SVTL 163) (KSC Procedure)	NONE	NO		CLOSED	**MPLM** **ANALYSIS** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to Launch/Landing Sites Procedures" Ground Operations Procedures used to control flight hazards. Verification for these proposed controls is complete when formal acceptance is provided by KSC. (KSC Procedure)

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70	MOI-1	3.4.3	Review of flight operation procedures (NPR window opening). MPLM-0003 Cause 2 Verification E3 (MPLM 5A.1 SVTL 116) (OCAD)	NONE	NO		CLOSED	**MPLM** **PROCEDURAL** MLM-RP-AI-0177 "MPLM Orbital Operations procedures and Data Inputs"" Flight Operations Procedures used to control a hazard: Verification for these proposed controls is complete when formal acceptance is provided by MOD through an operation hazard control summary or Detailed Evaluation Report. OCAD ID 2268 Implementation "MPLM egress procedure", MPLM Book"
71	MOI-1	3.5.1	Review of ground procedures (NPRV functional test and NPRA inspection, cleaning and installation verification). MPLM-0003 Cause 2 Verification F1 (MPLM 5A.1 SVTL 164) (11/2/1999) MPLM-0003 Cause 2 Verification F2 (MPLM 5A.1 SVTL 165) (KSC Procedure)	NONE	NO		CLOSED	**MPLM** **TEST** MLM-RP-AI-0174 "MPLM PHS&T and Maintenance Manual" MLM-RP-AI-0028 "Logistics Support Analysis Report" MLM-MA-AI-0005 "MPLM PHS&T and Maintenance Manual" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. Documented in NASA document MU04819C "MPLM Generic O&M Requirements", item number U024LT.050, relevant to NPRV functional test and NPRA inspection, cleaning and installation verification.
72	MOI-1	4.1.1	Review of MPLM Depressurization function (configuration and characteristics) MPLM-0014 Cause 1 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-DOR-RP-0002 "ECLS Design Definition Report" MLM-CTI-RP-002 "Design Definition Report for MPLM Components" MLM-CTI-RP-0004 "Life Cycle analsysis report" Carleton Drawing B40481 "Cabin Depressurization Assembly" B41100 "Cabin Depressurization Valve" B41099 "Non-Thrust Vent Assembly – Heated – CDA"

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73	MOI-1	4.1.2	Review of the DA functional test results during Flight Unit Acceptance. MPLM-0014 Cause 1 Verification A2 (MPLM 5A.1 SVTL 60)	NONE	NO		FM1 7/9/1998 FM2 5/27/1999	**MPLM** **TEST** MLM-CTI-DP-0018 (DA S/N 003) and MLM-CTI-DP-0019 (DA S/N 004) **Reverified for FM 2 (27 May 99)** DA Flight Unit Acceptance tests have been performed as described in doc. MLM-CTI-TP-0006 "Acceptance Test Procedure for CDA". DA Flight Units (FM 2) Acceptance test results are contained in doc. MLM-CTI-DP-0045 (DA S/N 008) and MLM-CTI-DP-0046 (DA S/N 009).
74	MOI-1	4.2.1	Review of DA, PPRA, NPRA, ARS, and IMV component structural analysis results. MPLM-0014 Cause 1 Verification B1 (MPLM 5A.1 SVTL 61) (5/14/1998) MPLM-0014 Cause 2 Verification B1 (MPLM 5A.1 SVTL 66) (5/14/1998) MPLM-0014 Cause 3 Verification B1 (MPLM 5A.1 SVTL 71) (5/14/1998) MPLM-0014 Cause 4 Verification B1 (MPLM 5A.1 SVTL 74) (5/14/1998) MPLM-0014 Cause 5 Verification B1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-CTI-RP-0034 "Structural Analysis Report for Cabin Depressurization Assembly" MLM-CTI-RP-0035 "Structurral Analysis Report for Positive Pressure Releif Assembly" MLM-CTI-RP-0033 "Structural Analysis Report for Negative Pressure Releif Assembly" MR E-8481 "Structural Analysis Report (SSOV)" MLM-RIBRE-TN-0002 "Sampling Line Analysis" MLM-CTI-RP-0036 "Structural Analysis Report and Analytical Models for Inter-Module Ventilation Shut-Off Valve" MLM-DOR-RP-9008 "MPLM-ECLSS Structural Analysis Report" MLM-DOR-TN-0031 "Stress analysis for the ISOV V-Clamp" MLM-RP-AI-0062 "Structural analysis for the IMV safety cap"
75	MOI-1	4.2.2	Review of DA, PPRA, NPRA, ARS, and IMV component structural qualification and acceptance test results. MPLM-0014 Cause 1 Verification B2 (MPLM 5A.1 SVTL 62) (7/9/1998) MPLM-0014 Cause 2 Verification B2 (MPLM 5A.1 SVTL 67) (7/9/1998) MPLM-0014 Cause 3 Verification B2 (MPLM 5A.1 SVTL 72) (7/9/1998) MPLM-0014 Cause 4 Verification B2 (MPLM 5A.1 SVTL 75) (10/15/1998) MPLM-0014 Cause 5 Verification B2 (MPLM 5A.1 SVTL 79) (6/16/1999)	NONE	NO		FM1 6/16/1999 FM2 5/27/1999	**MPLM** **TEST** MLM-CTI-TP-0005 "Qualification Test Procedure for CDA" MLM-CTI-TR-0002 MLM-CTI-TP-0006 "Acceptance Test Procedure for CDA" MLM-CTI-DP-0018 (DA S/N 003) MLM-CTI-DP-0019 (DA S/N 004) MLM-CTI-TP-0007 "Qualification Test Procedure for PPRA" MLM-CTI-TR-0003 MLM-CTI-TP-0008 "Acceptance Tst Procedure for PPRA" MLM-CTI-DP-0021 (PPRA S/N 003) MLM-CTI-DP-0022 (PPRA S/N 004) MLM-CTI-DP-0024 (PPRA S/N 006) MLM-CTI-TP-0009 "NPRA Qualification Test Procedure for NPRA" MLM-CTI-TR-0004 "NPRA Qualification test results" MLM-CTI-TP-0010 "Acceptance Test Procedure for NPRA" MR T-8755 "SSOV Qualification Tests" MR T-8756 "SSOV Qualification Test Results" MR T-8753 "Acceptance Test

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								Procedure for SSOV" MR M-9198 "SSOV Flight Unit (FM 1) Acceptance Test Results" MLM-CTI-TP-0003 "Qualification Test Procedure for IMV Valve" MLM-CTI-TR-0001 "ISOV Qualification Test Procedure for IMV Valve" MLM-CTI-TP-0004 "Acceptance Test Procedure for IMV Valve" MLM-CTI-DP-0015 (ISOV S/N 004) MLM-CTI-DP-0016 (ISOV S/N 005) **Reverified for FM 2 (27 May 99)** PPRA Flight Units Acceptance Tests have been performed as described in doc. MLM-CTI-TP-0008 "Acceptance Test Procedure for PPRA" PPRA Flight Units (FM 2) Acceptance tests results are contained in doc. MLM-CTI-DP-0022 (PPRA S/N 004), MLM-CTI-DP-0024 (PPRA S/N 006) and MLM-CTI-DP-0027 (PPRA S/N 009). **Reverified for FM 2 (27 May 99)** NPRA Flight Unit Acceptance Tests have been performed as described in doc. MLM-CTI-TP-0010, "Acceptance Test Procedure for NPRA". NPRA Flight Units (FM 2) Acceptance test results are contained in doc. MLM-CTI-DP-0039 (NPRA S/N 010), MLM-CTI-DP-0040 (NPRA S/N 011), MLM-CTI-DP-0041 (NPRA S/N 012), MLM-CTI-DP-0043 (NPRA S/N 014), MLM-CTI-DP-0044 (NPRA S/N 015). **Reverified for FM 2 (27 May 99)** DA Flight Unit Acceptance tests have been performed as described in doc. MLM-CTI-TP-0006 "Acceptance Test Procedure for CDA". DA Flight Units (FM 2) Acceptance test results are contained in doc. MLM-CTI-DP-0045 (DA S/N 008) and MLM-CTI-DP-0046 (DA S/N 009). Reverifed for FM2 (27 May 99) SSOV Flight Unit Acceptance Tests have been performed as described in doc. MR T-8753, "Acceptance Test Procedure for SSOV". SSOV Flight Unit (FM 2) Acceptance test results are contained in doc. MR-M-9198 (SSOV S/N 005). Acceptance test results for the ARS piping are contained in doc. MLM-RIBRE-ADP-TGSL-FM2-001. ISOV Flight Unit Acceptance Tests have been performed as

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								described in doc. MLM-CTI-TP-0004 "Acceptance Test Procedure for IMV Valve". ISOV Flight Units (FM 2) Acceptance Test results are contained in doc. MLM-CTI-DP-0053 (ISOV S/N 009) and MLM-CTI-DP-0054 (ISOV S/N 010).
76	MOI-1	4.3.1	Review of Avionic System design (inhibits implementation on the power line to DA, PPRA, ARS, and IMV Motor driven valves and SSOV and ISOV motor, to avoid unwanted activation). MPLM-0014 Cause 1 Verification C1 MPLM-0014 Cause 2 Verification C1 MPLM-0014 Cause 4 Verification C1 MPLM-0014 Cause 5 Verification C1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-SS-AI-0013 "Avionic Subsystem Specification" MLM-EQ-AI-0047 "MPLM Power Distribution Box (PDB) Specification" MLM-RP-FI-004 "PDB Design Definition" MLM-RP-AI-0006 "Avionics Design Report"
77	MOI-1	4.3.2	Review of Qualification and Acceptance Test results to verify that the inhibits are implanted in the flight hardware and operate as requested. MPLM-0014 Cause 1 Verification C2 (MPLM 5A.1 SVTL 63) (7/9/1998) MPLM-0014 Cause 2 Verification C2 (MPLM 5A.1 SVTL 68) (7/9/1998) MPLM-0014 Cause 4 Verification C2 (MPLM 5A.1 SVTL 76) (7/9/1998) MPLM-0014 Cause 5 Verification C2 (MPLM 5A.1 SVTL 80) (7/9/1998)	NONE	NO		FM1 7/9/1998 FM2 5/27/1999	**MPLM TEST** MLM-EQ-AI-0047 "Verification Matrix" MLM-RP-FI-0053 "PDB QM Electrical Test Report" MLM-ED-FI-0062 "PDB FM1 S/N 101 ADP" **Reverified for FM2 (27 May 99)** PDB Flight Unit (FM 2) Acceptance test results are contained in doc. MLM-ED-FI-0066 "PDB FM2 S/N 102 ADP"

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78	MOI-1	4.4.1	Review if Ground Operation Processing Procedures (DA, PPRA, NPRA Motor Driven Valve and ARS SSOV and IMV ISOV functional test, including hardware Interlock verification and DA final check-out) MPLM-0014 Cause 1 Verification F1 (MPLM 5A.1 SVTL 191) (11/2/1999) MPLM-0014 Cause 1 Verification F4 (MPLM 5A.1 SVTL 194) (KSC Procedure) MPLM-0014 Cause 2 Verification F1 (MPLM 5A.1 SVTL 181) (11/2/1999) MPLM-0014 Cause 2 Verification F4 (MPLM 5A.1 SVTL 184) (11/2/1999) MPLM-0014 Cause 5 Verification F1 (MPLM 5A.1 SVTL 177) (KSC Procedure) MPLM-0014 Cause 5 Verification F4 (MPLM 5A.1 SVTL 180) (KSC Procedure) MPLM-0014 Cause 3 Verification C1 (MPLM 5A.1 SVTL 185) (11/2/1999) MPLM-0014 Cause 4 Verification E1 (MPLM 5A.1 SVTL 188) (11/2/1999) MPLM-0014 Cause 4 Verification E2 (MPLM 5A.1 SVTL 189) (KSC Procedure)	NONE	NO		CLOSED	**MPLM INSPECTION** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to Launch/Landing Sites Procedures" MLM-MA-AI-0005 "MPLM PHS&T and Maintenance Manual" MLM-RP-AI-0028 "logistic Support Analysis Report" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. Documented in NASA document MU04819C "MPLM Generic O&M Requirements" U024EA.120 DA Motor Driven Valve functional test and Hardware Interlock verification U024EA.310 SSOV functional test U024EA.430 DA final check-out PPRA final inspection, cleaning, and installation verification Final check-out to verify closed position of ISOV's U024LT.030 PPRA Mechanical Relief Valve functional test U024LT.050 NPR Valves functional pressure test U024LT.060 SSOV leak test U024LT.080 IMV leak check

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79	MOI-1	4.4.2	Review of Ground Operation Maintenance procedures (DA, PPRA, NPRA leakage test and DA, ARS SSOV, and IMV ISOV final inspection, cleaning, and installation verification) MPLM-0014 Cause 1 Verification F2 (MPLM 5A.1 SVTL 192) (KSC Procedure) MPLM-0014 Cause 1 Verification F3 (MPLM 5A.1 SVTL 193) (KSC Procedure) MPLM-0014 Cause 2 Verification F2 (MPLM 5A.1 SVTL 182) (KSC Procedure) MPLM-0014 Cause 2 Verification F3 (MPLM 5A.1 SVTL 183) (11/2/1999) MPLM-0014 Cause 5 Verification F2 (MPLM 5A.1 SVTL 178) (11/2/1999) MPLM-0014 Cause 5 Verification F3 (MPLM 5A.1 SVTL 179) (11/2/1999) MPLM-0014 Cause 3 Verification C2 (MPLM 5A.1 SVTL 186) (11/2/1999) MPLM-0014 Cause 3 Verification C3 (MPLM 5A.1 SVTL 187) (11/2/1999) MPLM-0014 Cause 4 Verification E3 (MPLM 5A.1 SVTL 190) (KSC Procedure)	NONE	NO		CLOSED	**MPLM INSPECTION** MLM-MA-AI-0005 "MPLM PHS&T and Maintenacne Manual" MLM-RP-AI-0028 "Logistic Support Analysis Report" MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to Launch/Landing Sites Procedures" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. Documented in NASA document MU04819C "MPLM Generic O&M Requirements" U024EA.120 DA final inspection, cleaning, and installation verification U024LT.010 DA leakage test U024LT.020 PPRA leakage test U024LT.030 PPRA Motor Driven Valve functional test U024LT.040 NPR Valves leak test U024EA.290 IMV motor driven valves functional test U024EA.430 NPRAs inspection, cleaning, and installation verification SSOV final inspection and check-out IMV I/F final inspection
80	MOI-1	4.5.1	Review of Flight Operations procedures (final check-out to verify that DA valves and ARS SSOV and IMV ISOVs are closed and inhibits are in place) MPLM-0014 Cause 1 Verification G (MPLM 5A.1 SVTL 131) (OCAD) MPLM-0014 Cause 5 Verification G (MPLM 5A.1 SVTL 139) (10/15/1998) MPLM-0014 Cause 4 Verification F1 (MPLM 5A.1 SVTL 136) (10/15/1998) MPLM-0014 Cause 4 Verification F2 (MPLM 5A.1 SVTL 137) (10/15/1998)	NONE	NO		CLOSED	**MPLM PROCEDURAL** MLM-RP-AI-0177 "MPLM Orbital Operations procedures and Data Inputs" Flight Operations Procedures used to control a hazard: Verification for these proposed controls is complete when formal acceptance is provided by MOD through an operation hazard control summary or Detailed Evaluation Report. OCAD ID 2269 Implementation "MPLM deactivation procedure", "MPLM vestibule deoutfitting procedure", MPLM Book"

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81	MOI-1	4.6.1	Review of Connector Verification Analysis (functional test to ensure that no bent pins are present in the connector) MPLM-0014 Cause 1 Verification H MPLM-0014 Cause 2 Verification G	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** (KSC Procedure)
82	MOI-1	4.7.1	Review of the MPLM PPR function (configuration and characteristics) MPLM-0014 Cause 2 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-DOR-RP-0002 "ECLS Design Definition Report" MLM-CTI-RP-002 "Design Defintion report for MPLM components" MLM-CTI-RP-0004 "Life cycle analysis report" Carleton Drawings B40484 "Positive Pressure Releif Assembly" B41103 "Positive Pressure Relief Valve" B41102 "Non-Thrust Vent Assembly (PPRA)"
83	MOI-1	4.7.2	Review of the PPRA functional tests results during Flight Unit Acceptance MPLM-0014 Cause 2 Verification A2 (MPLM 5A.1 SVTL 65)	NONE	NO		FM1 7/9/1998 FM2 5/27/1999	**MPLM** **TEST** MLM-CTI-DP-0021 (PPRA S/N 003) MLM-CTI-DP-0022 (PPRA S/N 004) and MLM-CTI-DP-0024 (PPRA S/N 006) Reverified for FM 2 (27 May 99) PPRA Flight Units Acceptance Tests have been performed as described in doc. MLM-CTI-TP-0008 "Acceptance Test Procedure for PPRA" PPRA Flight Units (FM 2) Acceptance tests results are contained in doc. MLM-CTI-DP-0022 (PPRA S/N 004), MLM-CTI-DP-0024 (PPRA S/N 006) and MLM-CTI-DP-0027 (PPRA S/N 009).
84	MOI-1	4.7.3	Review of the assessment for PPRA opening during ascent (compliance with SP 30559 para 3.1.9.3.e) MPLM-0014 Cause 2 Verification A3 (MPLM 5A.1 SVTL 103)	NONE	NO		FM1 7/9/1998 FM2 7/9/1998	**MPLM** **ANALYSIS** Opening of one PPRA during ascent and failure in stacked open position does not constitute a hazard to the Orbiter. See Attachment 20.
85	MOI-1	4.8.1	Review of the MPLM NPR function (configuration and characteristics) MPLM-0014 Cause 3 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-DOR-RP-0002 "ECLS Design Definition Report" MLM-CTI-RP-002 "Design Defintion report for MPLM components" MLM-CTI-RP-0004 "Life cycle analysis report" Carleton Drawings B40483 "Negative Pressure Assembly"

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86	MOI-1	4.8.2	Review of the NPRA functional tests results during Flight Unit Acceptance MPLM-0014 Cause 3 Verification A2	NONE	NO		FM1 5/14/1998 FM2 5/27/1999	**MPLM** **TEST** Reverified for FM 2 (27 May 99) NPRA Flight Unit Acceptance Tests have been performed as described in doc. MLM-CTI-TP-0010, "Acceptance Test Procedure for NPRA". NPRA Flight Units (FM 2) Acceptance test results are contained in doc. MLM-CTI-DP-0039 (NPRA S/N 010), MLM-CTI-DP-0040 (NPRA S/N 011), MLM-CTI-DP-0041 (NPRA S/N 012), MLM-CTI-DP-0043 (NPRA S/N 014), MLM-CTI-DP-0044 (NPRA S/N 015).
87	MOI-1	4.9.1	Review of the MPLM ARS function (configuration and characteristics) MPLM-0014 Cause 4 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-DOR-RP-0002 "ECLS Design Definition Report" MLM-MOG-RP-8396 "Design Definition Report (SSOV)" Drawing 683-19485 "Fluid Connector and Pressure Cap" DASA Drawing Z1260065 "Configuration of the ARS line" MOOG Drawing C11948 "Configuration of the SSOV line"
88	MOI-1	4.9.2	Review of the SSOV functional tests results during Flight Unit Acceptance MPLM-0014 Cause 4 Verification A2	NONE	NO		FM1 5/14/1998 FM2 5/27/1999	**MPLM** **TEST** MR M-9198 (SSOV S/N 003) **Reverifed for FM2 (27 May 99)** SSOV Flight Unit Acceptance Tests have been performed as described in doc. MR T-8753, "Acceptance Test Procedure for SSOV". SSOV Flight Unit (FM 2) Acceptance test results are contained in doc. MR-M-9198 (SSOV S/N 005). Acceptance test results for the ARS piping are contained in doc. MLM-RIBRE-ADP-TGSL-FM2-001.
89	MOI-1	4.10.1	Review of MPLM Inter-Module Ventilation function design (configuration and characteristics). MPLM-0014 Cause 5 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-DOR-RP-0002 "ECLS Design Definition Report" MLM-CTI-RP-002 "Design definition report for MPLM components" Carleton Drawing B40482 "ISOV" B41108 "ISOV" MLM-DOR-RP-0004 "ECLSS Drawing Report"

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90	MOI-1	4.10.2	Review of IMV Shut-Off Valves (ISOV's) functional test results during Flight Units Acceptance MPLM-0014 Cause 5 Verification A2	NONE	NO		FM1 5/14/1998 FM2 5/27/1999	**MPLM** **TEST** Functional Tests are perfomred during the ISOV Flight Units (FM 1) Acceptance to verify the assembly performance parameters. Results are contained in MLM-CTI-DP-0036 (ISOV S/N 007) and MLM-CTI-DP-0037 (ISOV S/N 008) **Reverified for FM 2 (27 May 99)** ISOV Flight Unit Acceptance Tests have been performed as described in doc. MLM-CTI-TP-0004 "Acceptance Test Procedure for IMV Valve". ISOV Flight Units (FM 2) Acceptance Test results are contained in doc. MLM-CTI-DP-0053 (ISOV S/N 009) and MLM-CTI-DP-0054 (ISOV S/N 010).
91	MOI-1	4.11.1	Review of Material Usage List MPLM-0014 Cause 6 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-LI-AI-0018 "Material Investigation Usage List"
92	MOI-1	4.12.1	Review of ground operation procedures (hatch viewport visual inspection) MPLM-0014 Cause 8 Verification A (MPLM 5A.1 SVTL 197)	NONE	NO		FM1 11/2/1999 FM2 11/2/1999	**MPLM** **INSPECTION** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to OMRS and Procedures" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. (part of normal KSC Procedure)
93	MOI-1	4.13.1	Review of flight operations procedure (hatch viewport visual inspection) MPLM-0014 Cause 8 Verification B (MPLM 5A.1 SVTL 141) (OCAD)	NONE	NO		CLOSED	**MPLM** **PROCEDURAL** MLM-RP-AI-0177 "MPLM Orbital Operations procedures and Data Inputs" Flight Operations Procedures used to control a hazard: Verification for these proposed controls is complete when formal acceptance is provided by MOD through an operation hazard control summary or Detailed Evaluation Report. OCAD ID 2270 was rejected "Proposed Ops control does not provide sufficient data on how to determine viewport structural integrity, nor how to respond if viewport problems are identified."

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94	MOI-1	4.14.1	Review of ground operations processing procedure (Hatch PEV and inspection and functional test) MPLM-0014 Cause 9 Verification A (MPLM 5A.1 SVTL 198) (KSC Procedure)	NONE	NO		CLOSED	**MPLM** **TEST** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to OMRS and Procedures" Ground Operations Procedures used to contro flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. Documented in NASA document MU04819C "MPLM Generic O&M Requirements" U024AM.040 Hatch PEV inspection and functional test U024EA.430 inspection to verify close position of PEV
95	MOI-1	4.15.1	Review of flight operations procedure (Hatch PEV closure verification) MPLM-0014 Cause 9 Verification B (MPLM 5A.1 SVTL 142) (OCAD)	NONE	NO		CLOSED	**MPLM** **PROCEDURAL** MLM-RP-AI-0177 "MPLM Orbital Operations procedures and Data Inputs" Flight Operations Procedures used to control a hazard: Verification for these proposed controls is complete when formal acceptance is provided by MOD through an operation hazard control summary or Detailed Evaluation Report. OCAD ID 2271 Implemented in "MPLM Egress Procedure"
96	MOI-1	4.16.1	Boeing Safety and Reliability Engineering review of D/290-400 – Aerodynamics Safety Statement. Boeing RSS/USA Verification	NONE	NO		2/14/2001	**ORBITER** RSS99D0518 CIRAHR No 007020101 Boeing Safety and Reliability Engineering Review of D/N430 – Aerodynamics Safety Statement. ECD: February 15, 2001 Closed per email from Harry Maltby dated Feb 14, 2001. Remaining items are considered normal work under the shuttle process and is the responsibility of USA. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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97	MOI-1	4.17.1	Boeing Safety and Reliability Engineering review of D/290-400 – Aerodynamics Safety Statement. Boeing RSS/USA Verification	NONE	NO		2/14/2001	**ORBITER** RSS99D0518 CIRAHR No 007030101 Boeing Safety and Reliability Engineering Review of D/N430 – Aerodynamics Safety Statement. ECD: February 15, 2001 Closed per email from Harry Maltby dated Feb 14, 2001. Remaining items are considered normal work under the shuttle process and is the responsibility of USA. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
98	MOI-1	4.17.2	Boeing Safety and Reliability Engineering review of ICD-A-21350 (Shuttle Orbiter/MPLM). Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** **INSPECTION** ICD-A-21350 "Shuttle Orbiter/MPLM Interface Control Document" RSS99D0518 CIRAHR No 007030102 Same closure as RSS99D0518 CIRAHR No 007010104 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
98a	MOI-1	4.17.3	MSFC analysis of vent location to verify that the MPLM does not block the Orbiter Payload Bay vents.	NONE	NO		1/4/2000	**INTEGRATED** **ANALYSIS** Boeing Reusable Space Systems analysis on technical memorandum No. SCBA.N200.2000.001 "Thermal Assessment of Failed-Open Vent Doors Impact on STS-102 (ISS-5A.1) Payload/Hardware" was conducted to determine the effect of a failed open payload bay vent door on the MPLM. The analysis shows that the MPLM does not block the vents. **This analysis is good for all MPLM flights.**

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98b	MOI-1	4.17.4	Review of the OMRSD to insure that ground procedures call for a gross leak check of the MPLM as a part of integration.	NONE	NO		2/9/2001	**INTEGRATED PROCEDURAL** U024LT-140 MPLM Gross Leak Test OMRSD was approved on Feb. 9, 2001
99	MOI-1	5.1.1	Review of FRGF layout and attachment design. MPLM-0001 Cause 10 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** Alenia Drawing 020P011 "Shell External Layout" 030P028 sheet 1 "Grapple Fixture Interfaces" 1160P011 "FRGF Adapter Assembly"
100	MOI-1	5.1.2	Structural analysis to verify that the MPLM FRGF structural interface is designed to accommodate the load cases during the RMS operation. MPLM-0001 Cause 10 Verification A2	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM ANALYSIS** MLM-SS-AI-0001 "MPLM Structural/Mechanical S/S Specification" MLM-RP-AI-0060 "Mechanical S/S Stress Report"
101	MOI-1	5.2.1	SPAR-RMS-ATP.699, Acceptance Test Procedure, SPAR-RMS-QTP.902, Qualification test procedure. JSC Engineering Directorate Verification	NONE	NO		JAN 1995	**FRGF Analysis was written generically by the Automation, Robotics, and Simulation Division of the JSC Engineering Directorate to cover all flights.**
102	MOI-1	5.2.2	Reference OMRSD/OMI section. JSC Engineering Directorate Verification	NONE	NO		JAN 1995	**FRGF INSPECTION** OMRSD File II, Vol. II – Payload I/F General Requirements. P01000.024 Grapple Fixture Inspection **Analysis was written generically by the Automation, Robotics, and Simulation Division of the JSC Engineering Directorate to cover all flights.**
103	MOI-1	5.2.3	deleted (srp phase iii)					
104	MOI-1	5.3.1	SPAR-RMS-ATP.699, "Flight Releasable Grapple Fixture – Acceptance Test Plan" JSC Engineering Directorate Verification	NONE	NO		JAN 1995	**FRGF Analysis was written generically by the Automation, Robotics, and Simulation Division of the JSC Engineering Directorate to cover all flights.**
105	MOI-1	5.3.2	JSC-25578, "Flight Releasable Grapple Fixture Qualification Vibration Test Report" JSC Engineering Directorate Verification	NONE	NO		JAN 1995	**FRGF Analysis was written generically by the Automation, Robotics, and Simulation Division of the JSC Engineering Directorate to cover all flights.**

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106	MOI-1	5.3.3	Acceptance Test Record results located in section 9 of the FRGF's respective End Item Data Package (EIDP) JSC Engineering Directorate Verification	NONE	NO		JAN 1995	**FRGF** **Analysis was written generically by the Automation, Robotics, and Simulation Division of the JSC Engineering Directorate to cover all flights.**
107	MOI-1	5.3.4	Reference OMRSD section JSC Engineering Directorate Verification	NONE	NO		JAN 1995	**FRGF** **INSPECTION** OMRSD File II, Vol. II – Payload I/F General Requirements. P01000.024 Grapple Fixture Inspection **Analysis was written generically by the Automation, Robotics, and Simulation Division of the JSC Engineering Directorate to cover all flights.**
108	MOI-1	5.3.5	deleted (SRP Phase III)					
109	MOI-2	1.1.1	Review of Material Identification Usage List (MIUL) MPLM-0008 Cause 1 Verification A (MPLM 5A.1 SVTL 33)	NONE	NO		FM1 5/28/1998 FM2 9/30/1999	**MPLM** **INSPECTION** MLM-LI-AI-0101 "MPLM MUA Summary List" Reverified for FM2 (30 Sep 99) All data relevant to MPLM materials properties (stress corrosion, corrosion, offgassing, outgassing, fungus, flammability) are contained in the MPLM MIUL (Material Identification Usage List), doc. MLM-LI-AI-0018. Review of MIUL content and applicable drawings information together with the NASA/MSFC material laboratory approved MUA's show that the MPLM materials meet the requirements. Summary of the MPLM submitted MUA's is contained in doc. MLM-LI-AI-0101 "MPLM MUA Summary List". Product Assurance (PA) certification ensures that the as-built configuration is in accordance with design drawings and materials list.
110	MOI-2	2.1.1	Review of MPLM HCU design. MPLM-0029 Cause 1 Verification B	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-RP-CGS-004 "HCU Design Definition Report" Alenia Drawing 051P044 "MPLM Heaters Supply and Control"

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111	MOI-2	2.2.1	Review of protection design MPLM-0029 Cause 2 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-SS-AI-0013 "Avionic Subsystem Specification" MLM-EQ-AI-0047 "MPLM Power Distribution Box (PDB) Specification" MLM-RP-FI-004 "PDB Deisgn Definition" MLM-RP-AI-0006 "Avionic Design Report" MLM-EQ-AI-0101 "Heaters Control Unit (HCU) Specification" MLM-RP-CGS-004 "HCU Design Definition Report"
112	MOI-2	2.2.2	Review of PDB and HCU equipment Qualification and Acceptance (to verify the correct implementation of the protection devices). MPLM-0029 Cause 2 Verification A2 (MPLM 5A.1 SVTL 95)	NONE	NO		FM1 7/9/1998 FM2 5/27/1999	**MPLM** **INSPECTION** MLM-EQ-AI-0047 "Verification Matrix" MLM-RP-FI-0053 "PDB QM Electrical Test Report" MLM-RP-CGS-013 "MPLM HCU Report for verification for HCU-QM" Reverified for FM2 (27 May 99) PDB Flight Unit (FM 2) Acceptance test results are contained in doc. MLM-ED-FI-0066 "PDB FM2 S/N 102 ADP" HCU Flight Unit (FM 2) Acceptance tests results are contained in doc. MLM-ED-CGS-M42070F-002 "HCU FM2 ADP".
113	MOI-2	2.3.1	Review of MPLM Battery design MPLM-0029 Cause 2 Verification B1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** Yardney Drawings 19802 "Battery Assembly 19xLR40DC-3" 19803 "Case Weldment 19xLR40DC-3" Yardney Document 3613-97 "Safety and Hazards Report for Alenia Battery 19xLR40DC-3"
114	MOI-2	2.3.2	Review of test results to verify that the MPLM battery case structural strength against MDP value MPLM-0029 Cause 2 Verification B2 (MPLM 5A.1 SVTL 96)	NONE	NO		FM1 11/2/1999 FM2 11/2/1999	**MPLM** **TEST** Yardney Document TP 6117
115	MOI-2	2.3.3	Review of analysis results (worst case failure scenario for MPLM Battery) MPLM-0029 Cause 2 Verification B3 (MPLM 5A.1 SVTL 97)	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** Yardney Document s613-97 "Safety and Hazards Report for Alenia Battery"

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116	MOI-2	2.3.4	Review of Ground Operation Processing procedures (MPLM Battery activation/check-out) MPLM-0029 Cause 2 Verification B4 (MPLM 5A.1 SVTL 207) (KSC Procedure)	NONE	NO		CLOSED	**MPLM** **INSPECTION** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to OMRS and Procedures" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. Documented in NASA document MU04819C "MPLM Generic O&M Requirements" U024EA.370 MPLM Battery Activation and check-out
117	MOI-2	2.4.1	Review of Ground Operation Maintenance procedure (visual inspection of battery connectors) MPLM-0029 Cause 2 Verification C1 (MPLM 5A.1 SVTL 208) (KSC Procedure)	NONE	NO		CLOSED	**MPLM** **INSPECTION** MLM-MA-AI-0005 "MPLM PHS&T and Maintenance Manual" MLM-RP-AI-0028 "Logistic Support Analysis Report" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. (KSC Procedure)
118	MOI-2	2.4.2	Review of connector verification analysis (functional test to ensure that no bent pins are present in the connector) MPLM-0029 Cause 2 Verification C2	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** Documented in NASA document MU04819C "MPLM Generic O&M Requirements" U024EA.370 Functional test to insure that no bend pins are present
119	MOI-2	2.5.1	Review of MPLM Battery structural analysis MPLM-0029 Cause 3 Verification A (MPLM 5A.1 SVTL 98)	NONE	NO		FM1 2/16/1999 FM2 2/16/1999	**MPLM** **ANALYSIS** MPLM Battery structural analysis, to verify capability to withstand the NSTS cargo bay depress/repress enviornment during ascent/descent, is contained in Yardney doc. 3617-98, Structural Report for Alenia MPLM Battery.
120	MOI-2	2.6.1	Review of thermal analysis results (to verify that the battery can withstand the foreseen thermal environment) MPLM-0029 Cause 4 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** Yardney Document 3612-97 "Thermal Analysis Report for Alenia Battery 19xLR40DC-3"
121	MOI-2	2.71	Review of MPLM Battery interface layout MPLM-0029 Cause 5 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** Alenia Drawing 1100P001 Sheets 16, 17, 18 "Shell Assembly" 1190P121 "Battery Support Assembly"

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122	MOI-2	2.7.2	Review of MPLM Battery structural analysis MPLM-0029 Cause 5 Verification A2 (MPLM 5A.1 SVTL 99)	NONE	NO		FM1 2/16/1999 FM2 2/16/1999	**MPLM ANALYSIS** Yardney Document 3617-98 "Structural Analysis for Alenia MPLM Battery"
123	MOI-2	2.7.3	Review of MPLM Battery attachment points structural analysis MPLM-0029 Cause 5 Verification A3 (MPLM 5A.1 SVTL 100)	NONE	NO		FM1 2/16/1999 FM2 2/16/1999	**MPLM ANALYSIS** Yardney Document 3617-98 "Structural Report for Alenia MPLM Battery"
124	MOI-2	2.8.1	Review of ground operation maintenance procedure (MPLM Battery installation) MPLM-0029 Cause 6 Verification A (MPLM 5A.1 SVTL 209) (KSC Procedure)	NONE	NO		CLOSED	**MPLM INSPECTION** MLM-MA-AI-0005 "MPLM PHS&T and Maintenance Manual" MLM-RP-AI-0028 "Logistic Support Analysis Report" Ground Operations Procedures used to control flight hazards: Verification for these proposed controls is complete when formal acceptance is provided by KSC. Documented in NASA document MU04819C "MPLM Generic O&M Requirements" U024EA.370 functional test of MPLM battery
125	MOI-2	2.9.1	Review of battery design and location MPLM-0029 Cause 7 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** Alenia Drawing 020P011 sheet 6 and 7 "Shell External layout with MDPS" Yardney Document 3613-97 "Safety and Hazards Report for Alenia Battery 19xLR40DC-3" 3619-98 "FMEA for MPLM Battery" OP502-44 "Operating Insturctions"
126	MOI-2	2.9.2	Review of battery declared material list MPLM-0029 Cause 7 Verification A2	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** Yardney Document DL-19798 "Data List for Alenia Battery 19xLR40DC-3" MLM-LI-AI-0018 "Material Identification Usage List"
127	MOI-2	3.1.1	Review of water-cooling loop design MPLM-0015 Cause 1 Verification 1A	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-RP-AI-102 "MPLM TCS S/S Design Report" 2000P001 "ATCS installation drawing" **Not applicable to any passive flight. First active flight is Flight UF3.**

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128	MOI-2	3.1.2	Review of water cooling loop structural analysis MPLM-0015 Cause 1 Verification 1B	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-RP-AI-0125 "ATCS Piping Structural Design Report" MLM-RP-MT-0016 "WPP Stress Analysis" MLM-RP-HS-0004 "WPP Pump/Motor Controller Stress Analysis" AC504174/2 "WPP Accumulator Design" MLM-RP-BE-0003 "Stress Analysis on WMV Assembly" MLM-RP-BE-0005 "DPT Structural Analysis" **Not applicable to any passive flight. First active flight is Flight UF3.**
129	MOI-2	3.1.3	Review of water-cooling loop components vibration test results MPLM-0015 Cause 1 Verification 1C (MPLM 5A.1 SVTL 86)	NONE	NO		NA FM1 4/14/2000 FM2 4/14/2000	**MPLM** **TEST** MLM-RP-MT-0032 "WPP Qualification Test Report" MLM-ED-BE-M51130Q96089 MLM-RP-BE-0051 MLM-SP-AI-0038 "Quick Disconnect Procurement Statement" **Not applicable to any passive flight. First active flight is Flight UF3.**
130	MOI-2	3.1.4	Review of proof and ultimate pressure test results during water-cooling loop components/equipment qualification MPLM-0015 Cause 1 Verification 1D (MPLM 5A.1 SVTL 87)	NONE	NO		NA FM1 11/2/1999 FM2 11/2/1999	**MPLM** **TEST** MLM-RP-MT-0032 MLM-RP-BE-0020 MLM-RP-BE-0049 TR 01-97 "1/2 Flexible Hoses Qualification Test Report" MLM-SP-AI-0038 "Quick Disconnect Procurement Specification" MLM-ED-BE-M51130Q97017 "DPT Qualification Data Package" MLM-PR-AI-0119 "MPLM-TCS Vibration Qualification Test Procedure for SSQD" **Not applicable to any passive flight. First active flight is Flight UF3.**
131	MOI-2	3.1.5	Review of proof at integrated system level during the water-cooling loop (EQM) qualification MPLM-0015 Cause 1 Verification 1E	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **TEST** MLM-RP-AI-0285 "MPLM ATCS EQM Proof/Leak Test Report" **Not applicable to any passive flight. First active flight is Flight UF3.**

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132	MOI-2	3.1.6	Review of proof pressure test results during water-cooling loop components/equipment flight unit (FM 1) acceptance MPLM-0015 Cause 1 Verification 1F (MPLM 5A.1 SVTL 88)	NONE	NO		FM1 10/15/1998 FM2 5/27/99	**MPLM** **TEST** MLM-MT-ADP-0010 "Water Pump Package data package" MLM-ED-BE-M51100F97-061 "Water Modulating Valve data package" MLM-ED-BE-M51100F97-062 "Water ON/OFF Valve data package" MLM-ED-BE-97050 "Delta Pressure Transducer data package" MBE P/N 460 526 B31051 A00-5A S/N 001 "Metal Bellow Expander data package" **Reverified for FM 2 (27 May 99)** Proof pressure test has been performed at Water Cooling Loop component level during Flight Units (FM 2) Acceptance phase. Test results are contained in the Acceptance data packages for the ATCS components (WPP, WMV, WOV, DPT, MBE).
133	MOI-2	3.1.7	Review of proof and leak tests at integrated system level during the Water Cooling Loop Flight Unit (FM 1) Acceptance MPLM-0015 Cause 1 Verification 1G (MPLM 5A.1 SVTL 89)	NONE	NO		FM1 10/15/1998 FM2 9/30/1999	**MPLM** **TEST** MLM-LB-AI-003 "System Log for MPLM FM 1" MLM-RP-AI-0428 "MPLM ATCS FM1 Proof/Leak Test Report" **Reverifed for FM 2 (30 Sep 99)** Proof pressure and leak test have been performed at Water cooling Loop integrated system level during the Flight Unit (FM2) Acceptance. The Proof pressure test is performed at a value of 1.5 x MDP = 315 psia. Test results are contained in doc. MLM-RP-AI-0503 "MPLM FM2 ATCS I&T Test Report".
134	MOI-2	3.2.1	Review of Water Cooling Loop Design/Analysis to account for water thermal expansion MPLM-0015 Cause 1 Verification B	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-TN-AI-0177 "ACTS Thermo-Hydraulic Analysis" **Not applicable to any passive flight. First active flight is Flight UF3.**
135	MOI-2	3.3.1	Review of Analysis results (assessment of flexible lines for flow induced vibrations) MPLM-0015 Cause 1 Verification C	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** NASA MSFC 20MO2540 "Assessment of Flexbile lines for Flow induced Vibrations" MLM-RP-AI-0218 "TCS Requirements Verification" **Not applicable to any passive flight. First active flight is Flight UF3.**

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136	MOI-2	3.4.1	Review of Analysis results (pressure transient due to unwanted WOV closure when the MPLM WPP is running) MPLM-0015 Cause 1 Verification D (MPLM 5A.1 SVTL 143)	NONE	NO		NA FM1 10/15/1998 FM2 10/15/1998	**MPLM** **ANALYSIS** MLM-RP-MT-0032 "Water Pump Package qualification data package" MLM-TN-AI-0177 "ATCS Analysis" MLM-ED-BE-M51100Q96089 "Qualification Data Package" MLM-ED-BE-M51130Q97017 "DPT Qualification Data Package" 460526B31051A00 "MBE Qualification Data Package" **Not applicable to any passive flight. First active flight is Flight UF3.**
137	MOI-2	3.5.1	Review of compatibility assessment of the MPLM water loop with Freon environment MPLM-0015 Cause 1 Verification F	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** **Not applicable to any passive flight. First active flight is Flight UF3.**
137a	MOI-2	3.5.2	Review of compatibility assessment of CR 1325.	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**INTEGRATED** **ANALYSIS** CR 1325 was cancelled **Not applicable to any passive flight. First active flight is Flight UF3.**
138	MOI-2	3.6.1	Review of Analysis results (NSTS Ascent/Descent Accelerations Forces Effect combined with a failure of the NSTS PHX). MPLM-0015 Cause 1 Verification G	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** Alenia Fax SIME/BS/96-0187 dated March 26, 1996 and Alenia Fax SIME/BS/96-0202 dated March 29, 1996
139	MOI-2	3.7.1	Quality control shall verify that the as built hardware is in accordance with the design requirements MPLM-0015 Cause 2 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **TEST** SG-SP-AI-0087 "Orbital Welding Specification" MLM-RP-AI-0151 The following qualification tests were performed for the orbital welding: corrosion test – susceptiblity to stress corrosion; mechanical properties – tensile test, micro/macro hardness, pressure test, leakage test.

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140	MOI-2	3.7.2	Weldments inspection (NDE inspection) MPLM-0015 Cause 2 Verification A2	NONE	NO		FM1 5/14/1998 FM2 5/27/1999	**MPLM INSPECTION** Non-destructive inspection of the flight hardware weldings has been performed. Results are reported in relevant steps of the certification worksheets, available in Alenia Laboratory datafile. **Reverified for FM 2 (27 May 99)** Non-destructive inspection of the ATCS flight hardware weldings is performed. Results are reported in relevant steps of the certification worksheets, available in Alenia Laboratory datafile.
141	MOI-2	3.8.1	Review of Water Cooling Loop design configuration (Q/D's provisions for maintenance/reconfiguration) MPLM-0015 Cause 2 Verification B	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-RP-AI-0102 "MPLM TCS S/S Design Report" Alenia dwg. 2000P001 "ATCS Installation". **Not applicable to any passive flight. First active flight is Flight UF3.**
142	MOI-2	3.9.1	Review of Ground Operations Processing procedures (Water Cooling Loop reconfiguration) MPLM-0015 Cause 2 Verification C (MPLM 5A.1 SVTL 200) (KSC Procedure)	NONE	NO	Before: FL 5A.1	NA	**MPLM PROCEDURAL** MLM-MA-AI-0005 "MPLM PHS&T and Maintenance Manual" MLM-RP-AI-0028 "Logistic Support Analysis Report" This documentation contains the steps which have to be implemented to perform the ATCS reconfiguration during the Ground Operation Processing. This is reflected in the NASA document MU04819C "MPLM Generic O&M Requirements", item number U024LI.070, relevant to the ATCS loop servicing. Up to now, no KSC procedure has been prepared to cover the MPLM active mission configuration. Verification is considered complete when formal acceptance is provided by KSC through emission and approval of KSC operating procedures (as per closure rationale of Action Item SRP98-068) **Not applicable to any passive flight. First active flight is Flight UF3.**

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143	MOI-2	3.10.1	Review of WPP deisgn (implementation of the Accumulator Quantity Sensor) MPLM-0015 Cause 3 Verification D1	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-RP-AI-0102 "MPLM TCS S/S Design Report" MLM-RP-MT-0020 "MPLM WPP Design Definition Report" **Not applicable to any passive flight. First active flight is Flight UF3.**
144	MOI-2	3.10.2	Review of the C&W parameters identification and implementation (water leakage detection) MPLM-0015 Cause 3 Verification D2	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-RQ-AI-0003 "MPLM Command & Control and FDI Requirements" MLM-SS-AI-0011 "S/W Requirements document for MPLM MDM CSCI" MLM-DD-AI-0001 "S/W Document for MDM CSCI" MPLM-PL-AI-0005 "MPLM Software Test Plan" MLM-PR-AI-0006 "S/W Test Description for the MPLM MDM CSCI" MLM-RP-AI-0252 "Software Test Reports for the MPLM MDM CSCI" MLM-RP-AI-0467 "Software Test Reports for the MPLM MDM CSCI" **Not applicable to any passive flight. First active flight is Flight UF3.**
145	MOI-2	3.11.1	Review of Material Usage List MPLM-0015 Cause 3 Verification A	NONE	NO		FM1 5/14/1998 FM2 9/30/1999	**MPLM** **INSPECTION** MLM-LI-AI-0018 "Materials Indetification Usage List" Reverified for FM2 (30 Sep 99) All data relevant to MPLM materials properties (stress corrosion, corrosion, offgassing, outgassing, fungus, flammability) are contained in the MPLM MIUL (Material Identification Usage List), doc. MLM-LI-AI-0018. Review of MIUL content and applicable drawings information together with the NASA/MSFC material laboratory approved MUA's show that the MPLM materials meet the requirements. Summary of the MPLM submitted MUA's is contained in doc. MLM-LI-AI-0101 "MPLM MUA Summary List". Product Assurance (PA) certification ensures that the as-built configuration is in accordance with design drawings and materials list.

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146	MOI-2	3.12.1	Review of ROFU PDA Q/D design and configuration MPLM-0015 Cause 4 Verification A	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** ROFU PDA Fault Tolerance and Performance characteristis contained in NASA Letter MS3-98-020, dated June 11, 1998. **Not applicable to any passive flight. First active flight is Flight UF3.**
147	MOI-2	3.13.1	Review of Bulkhead Q/D configuration MPLM-0015 Cause 4 Verification B	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-RP-AI-102 "MPLM TCS S/S Design Report" Alenia Drawing 2000P001 MLM-SP-AI-0038 "Quick Disconnect Procurement Specification" DWG 683-16348 Rev. D "Coupling, quick disconnect, fluid, self-sealing, internal" **Not applicable to any passive flight. First active flight is Flight UF3.**
148	MOI-2	3.14.1	Review of ground operation processing procedures (Q/D's caps installed during MPLM integration) MPLM-0015 Cause 4 Verification C (MPLM 5A.1 SVTL 201) (KSC Procedure)	NONE	NO	Before: FL 5A.1	NA	**MPLM** **INSPECTION** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to OMRS and Procedures" MLM-MA-AI-0005 "MPLM PHS&T and Maintenance Manual" MLM-RP-AI-0028 "Logistic Support Analysis Report" This is reflected in the NASA document MU04819C MPLM Generic O&M Requirements, item number U024EA.430-P/Q, relevant to the visual inspection to verify that the caps on the fluid interfaces are installed. Up to now, no KSC procedure has been prepared to cover the MPLM active mission configuration. Verifcation is complete when formal acceptance is provided by KSC through emission and approval of KSC operating procedures (as per closure rationale of Action Item SRP98-068). **Not applicable to any passive flight. First active flight is Flight UF3.**

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149	MOI-2	3.15.1	Review of Flight Operation procedures (Bulkhead Q/D's caps installation during MPLM deactivation) MPLM-0015 Cause 4 Verification D (OCAD)	NONE	NO		NA	**MPLM** **PROCEDURAL** MLM-RP-AI-0177 "MPLM Orbital Operations procedures and Data Inputs" MOD formal acceptance is contained in NASA/JSC Letter DO14-98-010, "Operational Controls Agreement Document (OCAD) for MPLM", dated July 30, 1998, MOD Operational Control # MPLM-OSO-01 The following additional information has been provided in the above documentation: *MPLM vestibule prep for departure is a planned procedure for all MPLM flight. Vestibule prep for departure procedure is consistent with information provided in OP-01 documentation and will include steps to install bulkhead Q/D caps prior to final MPLM close-out for applicable flights.* OCAD ID 2272 Rejected "Not applicable for STS-102 (5A.1) Orbiter cooling kit and MPLM ROFU not flown until flight Active MPLM flight (UF-3)." **Not applicable to any passive flight. First active flight is Flight UF3.**
150	MOI-2	3.16.1	Review of ROFU PDA Heaters configuration MPLM-0015 Cause 9 Verification A1	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-TN-AI-0174 "heters/Thermostats Definition and Installation" MLM-RP-AI-0006 "Avionic Design Report" **Not applicable to any passive flight. First active flight is Flight UF3.**
151	MOI-2	3.16.2	Review of thermal analysis results MPLM-0015 Cause 9 Verification A2	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-TN-AI-0207 "Payload Disconnect Assembly (PDA) Thermal Analysis" **Not applicable to any passive flight. First active flight is Flight UF3.**
152	MOI-2	3.17.1	Review of Shell Heaters configuration MPLM-0015 Cause 9 Verification B1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-TN-AI-0174 "Heaters/Thermostats Defintion and Installation" MLM-RP-AI-0006 "Avionic Design Report" MLM-RP-AI-102 "MPLM TCS S/S Design Report"

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153	MOI-2	3.17.2	Review of thermal analysis results MPLM-0015 Cause 9 Verification B2	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM ANALYSIS** MLM-TN-AI-0130 "ECS Analysis" Alenia internal letter SITE/S-0373
154	MOI-2	3.18.1	Review of QD freezing test results MPLM-0015 Cause 9 Verification C	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM TEST** MLM-SP-AI-0052 "MPLM Self Sealing Quick Disconnect Freezing Test Specification" MLM-RP-AI-0185 "MPLM Self Sealing Quick Disconnect Freezing Test Report" MLM-RP-AI-0183 "MPLM Self Sealing Quick Disconnect Freezing Test Description"
155	MOI-2	3.19.1	Review of Ground Operation Processing procedures (heaters/thermostats functional test) MPLM-0015 Cause 9 Verification D (MPLM 5A.1 SVTL 203) (KSC Procedure)	NONE	NO	Before: FL 5A.1	CLOSED	**MPLM INSPECTION** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to OMRS and Procedures" This documentation contains the steps which have to be implemented to perform the functional test of heaters and thermostats. This is reflected in the NASA document MU04819C "MPLM Generic O&M Requirements", item number U024EA.380, relevant to the Shell Heaters and Thermostats functional check-out; and item number U034EA.370, relevant to the PDA Heater copper path check-out. The item relevant to the PDA Heaters and Thermostats functional check-out has yet to be inserted in the OMRS. The Relevant procedure for activity at KSC is contained in KSC document OMI R17100V2 "6A MPLM PICO Test (currently under review – not yet released)". Verification is considered complete when formal acceptance is provided by KSC through emission and approval of KSC operating procedures (as per closure rationale of Action Item SRP98-068) **MPLM Alenia VTL No. 203 has been closed for passive flights.(**
156	MOI-2	3.20.1	Review of the ROFU PDA heaters function design MPLM-0015 Cause 11 Verification A1	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-TN-AI-0174 "Heaters/Thermostats Definition and Installation" MLM-RP-AI-0006 "Avionic Design Report" **Not applicable to any passive flight. First active flight is Flight UF3.**

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157	MOI-2	3.20.2	Review of the thermal analysis results (maximum temperature and pressure values which are reached in case a single heater remains on continuously). MPLM-0015 Cause 11 Verification A2	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-TN-AI-0207 "Payload Disconnect Assembly)PDA) Thermal Analysis" **Not applicable to any passive flight. First active flight is Flight UF3.**
158	MOI-2	3.20.3	Review of C&W implementation (ROFU PDA heaters overtemperature control). MPLM-0015 Cause 11 Verification A3	NONE	NO		NA FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-RQ-AI-0003 "MPLM Command & Control and FDI Requirements" MLM-SS-AI-0011 "S/W Requirements document for MPLM MDM CSCI" MLM-DD-AI-0001 "MPLM Software Test Plan" MLM-PR-AI-0006 "S/W Test Description for the MPLM MDM CSCI" MLM-RP-AI-0252 "Software Test Reports for MPLM MDM CSCI" MLM-RP-AI-0047 "MPLM Orbital Operations Analysis and Requirements" **Not applicable to any passive flight. First active flight is Flight UF3.**
159	MOI-2	3.21.1	Review of quick disconnect engineering drawings number TBD and specifications	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
160	MOI-2	3.21.2	Material and Processes (M&P) approval of quick disconnect seal material compatible with: pure water, water contaminated with ammonia, and water contaminated with Freon-124.	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**

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161	MOI-2	3.21.3	Review of engineering drawings number TBD.	NONE	NO	Before: FL UF3	NA	ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
162	MOI-2	3.21.4	Review of Load/Stress report number TBD.	NONE	NO	Before: FL UF3	NA	ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
163	MOI-2	3.22.1	Review of Orbiter hardware installation specification for the Orbiter MPLM cooling system	NONE	NO	Before FL UF3	NA	ORBITER/MPLM COOLING SYSTEM Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
164	MOI-2	3.23.1	Review of ATP and Qualification test report of Orbiter MPLM cooling system.	NONE	NO	Before FL UF3	NA	ORBITER/MPLM COOLING SYSTEM Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
165	MOI-2	3.24.1	During ground turnaround, functional tests will be performed for Orbiter MPLM cooling system.	NONE	NO	Before FL UF3	NA	ORBITER/MPLM COOLING SYSTEM Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.

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165a	MOI-2	3.25.1	This verification will address fault tolerance for the MPLM Heat Exchanger when information becomes available.	NONE	NO	Before: FL UF3	NA	**INTEGRATED** **Not applicable to any passive flight. First active flight is Flight UF3.**
166	MOI-2	4.1.1	Review of Orbiter hardware installation specification for the Orbiter MPLM cooling system	NONE	NO	Before FL UF3	NA	**ORBITER/MPLM COOLING SYSTEM** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration..**
167	MOI-2	4.2.1	Review of ATP and Qualification test report of Orbiter MPLM cooling system	NONE	NO	Before FL UF3	NA	**ORBITER/MPLM COOLING SYSTEM** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
168	MOI-2	4.3.1	During ground turnaround, functional tests will be performed for Orbiter MPLM cooling system	NONE	NO	Before FL UF3	NA	**ORBITER/MPLM COOLING SYSTEM** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
169	MOI-2	5.1.1	Review of MDPS panels and MLI Blankets venting design MPLM-0001 Cause 1 Verification C1 (MPLM 5A.1 SVTL 2) (5/14/1998) MPLM-0001 Cause 1 Verification D1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-RP-AI-0060 "Mechanical S/S: Stress Report"

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170	MOI-2	5.1.2	Review of MDPS panels and MLI Blankets installation procedure during module integration MPLM-0001 Cause 1 Verification C2 (MPLM 5A.1 SVTL 3) (6/16/1999) MPLM-0001 Cause 1 Verification D2 (MPLM 5A.1 SVTL 4) (6/16/1999)	NONE	NO		FM1 6/16/1999 FM2 6/16/1999	**MPLM** **INSPECTION** MDPS panels installation has been performed during MPLM FM 1 activity at KSC, according to procedure contained in doc. MLM-PR-AI-0140
171	MOI-2	5.1.3	Review of MDPS panels and MLI Blankets attachment points design (fail safe criteria). MPLM-0001 Cause 1 Verification C3 MPLM-0001 Cause 1 Verification D3	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-RP-AI-0145 "TCS EMC Plan, Assessment and Design Report" MLM-RP-AI-0102 "MPLM TCS S/S Design Report"
172	Deleted							
173	MOI-3	1.1.1	Review of the Materials Usage List for the MPLM MPLM-0009 Cause 1 Verification A (MPLM 5A.1 SVTL 34)	NONE	NO	Before: FL 5A.1	FM1 CLOSED FM2 9/30/99	**MPLM** **INSPECTION** MLM-LI-AI-0018 "MPLM Material Identification Usage List" MLM-LI-AI-0101 "MPLM MUA Summary List" Missing the approval by NASA of the MUA MLM-MU-AI-1018-038, relevant to the use of Pyrell and MUA relevant to the use of Al-Alloy 7050T3651. MPLM Alenia SVTL No. 34 has been closed. Reverified for FM2 (30 Sep 99) All data relevant to MPLM materials properties (stress corrosion, corrosion, offgassing, outgassing, fungus, flammability) are contained in the MPLM MIUL (Material Identification Usage List), doc. MLM-LI-AI-0018. Review of MIUL content and applicable drawings information together with the NASA/MSFC material laboratory approved MUA's show that the MPLM materials meet the requirements. Summary of the MPLM submitted MUA's is contained in doc. MLM-LI-AI-0101 "MPLM MUA Summary List". Product Assurance (PA) certification ensures that the as-built configuration is in accordance with design drawings and materials list.

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174	MOI-3	1.2.1	Review of Wire Insulation Flammability test results MPLM-0009 Cause 1 Verification B1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **TEST** The Wire insulation flamability testing has been performed by the NASA MSFC MP&M department using an AWG 20 size sample (worst case configuration). The wire has been tested for insulation flammability by the procedures outlined in NHB 8060.1C, Test 4A. The test has been performed at a current of 19.8 Amps for a time of 10 minutes. Based on the test results, the subject material has been declared to meet the acceptance criteria of NHB 8060.1C.
175	MOI-3	1.2.2	Review of Wire Arc Tracking test results MPLM-0009 Cause 1 Verification B2	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **TEST** Wire Arc Tracking testing has been performed by the NASA MSFC MP&M department using a AWG 12 size sample (worst case configuration). The subject wire has been tested for arc tracking by the procedures outlined in NHB 8060.1C, Test 18. Based on the test results, the subject material has been declared to meet the acceptance criteria of NHB 8060.1C.
176	MOI-3	1.3.1	Engineering drawings (V751-544100, -110, -200) inspected and approved by M&P. Electrical assembly drawing V751-741901) also signed off. ROEU-6 Verification 1	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
177	MOI-3	1.3.2	Installation drawings are inspected and approved by M&P ROEU-6 Verification 2&3	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**

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178	MOI-3	1.4.1	Engineering drawings number TBD approved by M&P	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
179	MOI-3	1.5.1	Boeing Safety and Reliability Engineering review of D/284-200 – L& T Materials and Process Engineering Safety Statement. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 002010101 Boeing Safety and Reliability Engineering review of D/284-200 – L& T Materials and Process Engineering Safety Statement. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
180	MOI-3	1.6.1	Boeing Safety and Reliability Engineering review of D/290-400 – Aerodynamics Safety Statement Boeing RSS/USA Verification	NONE	NO		2/14/2001	**ORBITER** RSS99D0518 CIRAHR No 002020101 Boeing Safety and Reliability Engineering Review of D/N430 – Aerodynamics Safety Statement. ECD: February 15, 2001 Closed per email from Harry Maltby dated Feb 14, 2001. Remaining items are considered normal work under the shuttle process and is the responsibility of USA. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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181	MOI-3	1.6.2	Boeing Safety and Reliability Engineering review of ICD-A-21350 (Shuttle Orbiter/MPLM) Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 002020102 Boeing Safety and Reliability Engineering Review of NCR-PFCS-01, "Ammonia Flammability for the PFCS when Launched as a Spare," dated February 2000. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
182	MOI-3	2.1.1	Quality control shall verify that the as built hardware matches the approved design requirements MPLM-0009 Cause 2 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** SG-MA-AI-005 "New method for design and manufacturing of standard MLI" MLM-TN-AI-0182 "MPLM new electrical bonding method" MLM-LI-AI-0065 "MPLM PTCS Drawings Family Tree"
183	MOI-3	2.2.1	Review of MLI bonding provisions MPLM-0009 Cause 2 Verification B1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-RP-AI-102 "MPLM TCS S/S Design Report" MLM-RP-AI-0145 "TCS EMC Plan, Assessment and Design Report"
184	MOI-3	2.2.2	Review of test results from the electrical bonding tests during MLI manufacturing MPLM-0009 Cause 2 Verification B2 (MPLM 5A.1 SVTL 35)	NONE	NO		FM1 6/16/1999 FM2 6/16/1999	**MPLM** **TEST** S20-100-G01 "Alenia Aerospazio Standard" MLM-LI-AI-0078 "MPLM PTCS S/S Configuration Item Data List (FM)" During MLI manufacturing, testing is performed via the appropriate test procedure document. Testing includes verification for each MLI blanket of the values for the internal layer to layer bonding, before the sewing of the edges for manufacturing completion.
185	MOI-3	2.2.3	Review of test results from the electrical bonding test after MLI installation during MPLM integration in Alenia MPLM-0009 Cause 2 Verification B3 (MPLM 5A.1 SVTL 36)	NONE	NO		FM1 6/16/1999 FM2 9/30/1999	**MPLM** **TEST** MLM-PR-AI-0140 "Test Working Procedure (TWP)" Reverified for FM 2 (30 Sep 99) Results of the bonding tests after MLI blankets installation are contained in the relevant procedure, doc. MLM-PR-AI-0138, "MPLM Mod. FMs – MLI Installation Procedure".

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186	MOI-3	2.3.1	Review of Flight Operations Procedures (On-Station reinstallation of MLI Blankets on the MPLM Hatch before re-entry to ground). MPLM-0009 Cause 2 Verification C (MPLM 5A.1 SVTL 118) (OCAD)	NONE	NO		FM1 10/15/1998 FM2 10/15/1998	**MPLM PROCEDURAL** MLM-RP-AI-0177 "Orbital Opeations Procedures and Data Inputs" MOD formal acceptance is contained in NASA/JSC Letter DO14-98-010, "Operational Controls Agreement Document (OCAD) for MPLM", dated July 30, 1998, MOD Operational Control #MPLM-OSO-02. Following additional information has been provided in the above documentation: *MPLM Vestibule prep for departure will include steps to re-install Hatch MLI ground straps consistent with OP-01 documentation*
187	MOI-3	2.4.1	Review of ground operation processing procedures for MLI bonding verification MPLM-0009 Cause 2 Verification D (MPLM 5A.1 SVTL 170)	NONE	NO		FM1 11/2/1999 FM2 11/2/1999	**MPLM PROCEDURAL** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to Launch/Landing Sites Procedures" The above document contains the steps needed to perform the MLI blankets bonding verification for all the blankets which are removed and re-installed during the Ground Operation Processing. This is reflected in the NASA document MU04819C MPLM Generic O&M Requirements, item number U024AM.050, relevant to the MLI bonding verification. Releveant procedure for activity at KSC is contained in KSC document OMI R5501.
188	MOI-3	2.5.1	Continuity testing of MLI called out on top-level assembly drawings V842-544100 (ODA) & V848-544001 (PDA).	NONE	NO	Before: FL UF3	NA	**ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
189	MOI-3	2.6.1	Bonding test will be required in the OMRS (KSC Procedure)	NONE	NO		FM1 JAN 2001 FM2 JAN 2001	**INTEGRATED TEST** Bonding test is called for in OMRS Volume III File Number VIII U024 "MPLM Generic O&M Requirements". Actual bonding check is listed under line U024EA.030 for bonding to the Orbiter and U024EA.060-B for bonding through the ROEU PDA. **This verification is considered closed for all subsequent flights.**

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190	MOI-3	3.1.1	Review of the Thermal Analysis to verify that the MDPS temperature never exceeds the maximum allowed temperature of 352 degrees F during the re-entry phase. MPLM-0009 Cause 14 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-TN-AI-0130 "ECS Analysis"
191	MOI-3	3.2.1	Boeing Safety and Reliability Engineering review of D/270-200 – P/L Thermal Integration Safety Statement Boeing RSS/USA Verification	NONE	NO		2/14/2001	**ORBITER** RSS99D0518 CIRAHR No 010010101 Boeing Safety and Reliability Engineering Review of D/N440 – P/L Thermal Integration Safety Statement. ECD: February 5, 2001 Closed per email from Harry Maltby dated Feb 14, 2001. Remaining items are considered normal work under the shuttle process and is the responsibility of USA. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
192	MOI-3	3.2.2	STS-102 Flight Verification Thermal Assessment, RSS99D0TBD. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 010010102 STS-102 Flight Verification Thermal Assessment, Launch – Five Months Analysis, TM-TS-00-301, dated September 12, 2000. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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193	MOI-3	3.2.3	STS-102 Flight Verification Thermal Assessment , L-1 month Report, RSS99D0TBD-1 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 010010103 STS-102 Flight Verification Thermal Assessment. Launch – 1 month Report, TBD. ECD: February 5, 2001. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
194	MOI-3	3.3.1	Review of heater thermal analysis number TBD. Review of MLI certification number TBD	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
195	Deleted by SRP							
196	Deleted by SRP							
197	Deleted by SRP							
198	Deleted by SRP							
199	Deleted by SRP							
200	Deleted by SRP							
201	MOI-3	5.1.1	Review of the MPLM wire harness insulation design MPLM-0009 Cause 3 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-RO-AI-0093 "Electrical Harness Design Report"
202	MOI-3	5.2.1	Review of the MPLM wire harness installation and routing design MPLM-0009 Cause 3 Verification B	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-RO-AI-0093 "Electrical Harness Design Report"
203	MOI-3	5.3.1	Review of the MPLM wire harness installation procedure MPLM-0009 Cause 3 Verification C1 (MPLM 5A.1 SVTL 37)	NONE	NO		FM1 7/9/1998 FM2 7/9/1998	**MPLM** **INSPECTION** MLM-PR-AI-0094 "MPLM +Z Stand Off Harness Installation" MLM-PR-AI-0091 "MPLM –Z Panel Harness Installation" MLM-PR-AI-0093 "MPLM +Y Panel Harness Installation" MLM-PR-AI-0104 "Heaters and Thermostats Installation Step by Step Procedure"

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204	MOI-3	5.3.2	Review of test results MPLM-0009 Cause 3 Verification C2 (MPLM 5A.1 SVTL 38))	NONE	NO		FM1 7/9/1998 FM2 9/30/1999	**MPLM** **TEST** Tests performed according to NHB 5300.4(3G) MLM-ED-AI-0026 "Test Results for MPLM FM 1" Tests performed as a part of MPLM system functional tests. Reverified for FM 2 (30 Sep 99) Harness functional check-out after installation has been performed as part of the MPLM system functional tests. To verify harness insulation integrity, as part of the harness acceptance after its integration in MPLM, the harness is tested for the dielectric withstanding voltage in accordance with NHB 5300.4(3G). Test results are contained in the Harness ADP for MPLM FM2, doc. MLM-ED-AI-0035.
205	MOI-3	5.4.1	Review of ground operation processing procedures (harness functional verification and inspection) MPLM-0009 Cause 3 Verification D (MPLM 5A.1 SVTL 171) (KSC Procedure)	NONE	NO	Before: FL 5A.1	CLOSED	**MPLM** **INSPECTION** MLM-RP-AI-0174 "MPLM Ground Processing Requirements: Inputs to Launch/Landing Sites Procedures" MLM-MA-AI-0005 "MPLM PHS&T, and Maintenance Manual" MLM-RP-AI-0028 "Logistics Support Analysis Report" The document "MPLM Ground Processing Requirments: Inputs to Launch/Landing Sites Procedures" contains the description of steps needed to perform the harness verification during the Ground Operation processing. This is reflected in NASA document MU04819C "MPLM Generic O&M Requirements" in the following line numbers: U024LI.020 "MPLM internal inspection" U024EA.070 "MDM Functional Verification" U024EA.110 "DA RPC Verification" U024EA.120 "DA #1 and #2 Verification" U024EA.130 "DA HW Interlock Verification" U024EA.140 "DA Heaters Check-Out" U024EA.145 "DA Heaters RPC Verification" U024EA.150 "WPP Accumulator Quantity Check" U024EA.160 "WPP RPC Verification" U024EA.170 "WPP Verification" U024EA.180 "PPRA RPC Verification" U024EA.190 "PPRA #1, #2, #3 Verification"

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								U024EA.200 "PPRA HW Interlock Verification" U024EA.210 "DSD RPC Verification" U024EA.220 "FDS Functional Verification" U024EA.230 "CFA RPC Verification" U024EA.234 "Cabin Fan Checkout" U024EA.240 "Air Temperature Sensor Check" U024EA.245 "Pressure Sensor Checks" U024EA.250 "WPP Interface Test" U024EA.255 "WOV Interface Test" U024EA.260 "R/Fs Power I/F Copper Path test" U024EA.270 "R/Fs Data I/F Copper Path Test" U024EA.280 "ISOV RPC Verification" U024EA.290 "ISOV Control Function" U024EA.300 "SSOV RPC Verification" U024EA.310 "SSOV Control Function" U024EA.320 "GLA's (#1 to #8) RPC's Verification" U024EA.330 "GLA's (#1 to #8) Verification" U024EA.340 "EEL Check-Out" U024EA.350 "HCU RPC Verification" U024EA.360 "HCU Check-Out" U024EA.370 "PDA Heater Copper Path Check-Out" U024EA.380 "Shell Heaters Check-Out" U024EA.390 "WOV RPC Verification" U024EA.400 "WOV Check-Out" U024EA.410 "WMV RPC Verification" U024EA.420 "WMV Check-Out" The relevant procedures for the functional checks at KSC are contained in the KSC document OMI R17100V2 "6A MPLM PICO Test" (currently under review). This document does not include functional verification for the WPP and WOV. Verification is complete when formal acceptance is provided by KSC through emission and approval of KSC operating procedures (as per closure rationale of Action Item SRP98-068).

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206	MOI-3	5.5.1	Review of power distribution protection design MPLM-0009 Cause 4 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-SS-AI-0013 "Avionic Subsystem Specification" MLM-EQ-AI-0047 "MPLM Power Distribution Box (PDB) Specification" MLM-RP-FI-004 "PDB Design Definition Report" MLM-RP-AI-0006 "Avionic Design Report" MLM-EQ-AI-0101 "Heaters Control Unit (HCU) Specification" MLM-TN-CGS-004 "MPLM-HCU-Fusing and Protection Analysis"
207	MOI-3	5.5.2	Review of PDB and HCU equipment Qualification and Acceptance (to verify correct implementation of the protection devices) MPLM-0009 Cause 4 Verification A2 (MPLM 5A.1 SVTL 39)	NONE	NO		FM1 7/9/1998 FM2 5/27/1999	**MPLM** **INSPECTION** MLM-EQ-AI-0047 "Verification Matrix" MLM-RP-FI-0053 "PDB QM Electrical Test Report" MLM-ED-FI-0062 "PDB FM1 S/N 101 ADP" MLM-RP-CGS-013 "MPLM-HCU Report for Verification for HCU-QM" MLM-ED-CGS-M42070F/01-01 "HCU FM1 ADP" Reverified for FM2 (27 May 99) PDB Flight Unit (FM 2) Acceptance test results are contained in doc. MLM-ED-FI-0066 "PDB FM2 S/N 102 ADP". HCU Flight Unit (FM 2) Acceptance tests results are contained in doc. MLM-ED-CGS-M42070F-002 "HCU FM2 ADP".
208	MOI-3	5.6.1	Review of MPLM power distribution wire/cable bundles sizing analysis MPLM-0009 Cause 4 Verification B	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM**

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209	MOI-3	5.7.1	Review of test results (bonding verification at MPLM flight unit (FM 1) integrated level) MPLM-0009 Cause 5 Verification A (MPLM 5A.1 SVTL 40)	NONE	NO		FM1 10/15/1998 FM2 9/30/1999	**MPLM TEST** MLM-RP-AI-0418 "MPLM FM1 System Bonding Measurement – Test Repport" MLM-RP-AI-0427 "MPLM FM1 Units Bonding Test Report" **Reverified for FM 2 (30 Sep 99)** Bonding measurements at integrated system level have been performed during MPLM FM2 integration, to ensure that the bonding requirements are satisfied. Bonding measurements are performed for structural parts and mechanisms, equipment, and harness. In particular, for each unit verified, after installation, that the resistance of the conductive path between the unit and the bonding point is under the limit value. Shield continuity test is performed as part of the system harness bonding verification. Results of the bonding verification for MPLM Flight Unit (FM2) are contained in doc. MLM-RP-AI-0495 "MPLM FM2 System Bonding Measurement Test Report" and MLM-RP-AI-0499 "MPLM FM2 Units Bonding Test Report".
210	MOI-3	5.8.1	Review of MPLM wire harness installation and routing MPLM-0009 Cause 5 Verification B1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-RP-AI-0093 "Electrical Harness Design Report"
211	MOI-3	5.8.2	Review of MPLM power line protection implementation MPLM-0009 Cause 5 Verification B2	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-RP-AI-0006 "Avionic Design Report" MLM-RP-FI-004 "PDB Design Definition" MLM-RP-CGS-004 "HCU Design Definition Report"
212	MOI-3	5.9.1	Review of heater design and installation MPLM-0009 Cause 5 Verification C	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-TN-AI-0174 "Heaters/thermostats Definition and Installation" MLM-RP-AI-0042 "Electrical Diagrams, Schematics and List Report" SG-SP-AI-0121 "Heater Installation Procedure"
213	MOI-3	5.10.1	Review of wire harness insulation design MPLM-0009 Cause 5 Verification D (MPLM 5A.1 SVTL 34)	NONE	NO		FM1 CLOSED FM2 5/14/1998	**MPLM INSPECTION** MLM-RP-AI-0093 "Electrical Harness Design Report"

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214	MOI-3	5.11.1	Approved electrical engineering drawing V751-741901 depicts circuit design and insulation. M & P sign-off insures materials compatibility. ROEU-3 Verification 1	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
215	MOI-3	5.11.2	OMRSD – File II – Vol IV, S07-ROEU Checkout. S0751A.XX7: ROEU ODA/PDA continuity premate verification. ROEU-3 Verification 2	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
216	MOI-3	5.11.3	Payload Operations Checklist and EVA Checklist (Developed by Payload Organization and Mission Operations Directorate) ROEU-3 Verification 3 ocad	NONE	NO		AUG 1991	**ROEU** **PROCEDURAL** Verification will be considered complete once formal acceptance is provided by MOD through an Operational Hazard Control Verification or Detailed Evaluation Report. Operational control will be documented in document **TBD** under OCAD reference number **TBD.** OCAD ID 2273 Rejected "Duplicate to OCAD 2274" **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
217	MOI-3	5.11.4	Continuity and high potential testing is called out on electrical engineering drawing V751-741901. Successfully completed testing is confirmed by Quality Engineering sign-off and recorded in the MOR book for each part number. ROEU-3 Verification 4	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**

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218	MOI-3	5.12.1	Review of electrical engineering drawing V847-544100 and V848-544001 depicts circuit design and insulation.	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
219	MOI-3	5.12.1	OMRSD – File II – Vol IV, S07-ROFU Checkout. S0751A.XX7: ROFU ODA/PDA continuity premate verification. Continuity and high potential testing is called out on electrical engineering drawing V847-544001 and V848-544001. Successfully completed testing is confirmed by Quality Engineering sign-off and recorded in the MOR book for each part number.	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
220	MOI-3	5.13.1	Verification for this proposed operational control is complete when formal acceptance is provided by MOD through an Operational Hazard Control Summary or Detailed Evaluation Report ocad	NONE	NO	Before: FL 5A.1	2/20/2001	**INTEGRATED** PROCEDURAL Verification will be considered complete once formal acceptance is provided by MOD through an Operational Hazard Control Summary or Detailed Evaluation Report. Operational control will be documented in document TBD under OCAD reference number TBD. OCAD ID 2274 Implementation "Generic – PDRS OPS Checklist STS-102 Flight Supplement, ROEU Demate" **This verification is considered closed for all MPLM flights.**
221	MOI-3	5.14.1	Bonding test will be required in the OMRS	NONE	NO		FM1 JAN 2001 FM2 JAN 2001	**INTEGRATED** **TEST** Bonding test is called for in OMRS Volume III File Number VIII U024 "MPLM Generic O&M Requirements". Actual bonding check is listed under line U024EA.030 for bonding to the Orbiter and U024EA.060-B for bonding through the ROEU PDA.
222	MOI-4	1.1.1	Deleted at SRP Phase III					
223	MOI-4	1.1.2	Deleted at SRP Phase III					
224	MOI-4	1.1.3	Deleted at SRP Phase III					

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225	MOI-4	1.2.1	Analysis of the MPLM dynamic envelope to verify clearances.	NONE	NO	Before FL 5A.1	6/2/2000	**INTEGRATED** **ANALYSIS** An analysis was presented to the JMICB on June 2, 2000 by Boeing Reusable Space Systems on "Orbiter cowcatcher/MPLM clearances". The report states that positive clearances between Orbiter and MPLM have shown that contact will not occur between any combination Orbiter vehicle and MPLM FM1 and FM2 utilizing STS-102 Verification Loads Analysis Cycle Results. **This verification is considered closed for all MPLM flights.**
226	MOI-4	1.2.2	Deleted at SRP Phase III					
227	MOI-4	2.1.1	Review of Depressurization Assembly (DA) and PPRA design MPLM-0016 Cause 1 Verification A1 MPLM-0016 Cause 2 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **INSPECTION** MLM-DOR-RP-0002 "ECLS Design Definition Report" MLM-CTI-RP-002 "Design definition Report for MPLM Components" Carleton Drawings B40481 "Cabin Depressurization Assembly" B41100 "Cabin Depressurization Valve" B41099 "Non-Thrust Vent Assembly – Heated – CDA" B40484 "Positive Pressure Relief Assembly" B41103 "Positive Pressure Relief Valve" B41102 "Non-Thrust Vent Assembly (PPRA)"
228	MOI-4	2.1.2	Review of analysis results for DA and PPRA (residual thrust form the NPV device and capability of the heating element to avoid ice formation in the NPV device). MPLM-0016 Cause 1 Verification A2 MPLM-0016 Cause 1 Verification A3 MPLM-0016 Cause 2 Verification A2 MPLM-0016 Cause 2 Verification A3	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **ANALYSIS** MLM-DOR-TN-0023 "Thrust Analysis Report of CDA and PPRA" MLM-DOR-RP-0015 "Thermal Analysis Report" MLM-TN-AI-0196 "MPLM ACS System Analysis for Safety Review – Phase II"

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229	MOI-4	2.2.1	Review of ground operations maintenance procedures (NPV device inspection). MPLM-0016 Cause 1 Verification B (MPLM 5A.1 SVTL 205) (11/2/1999) MPLM-0016 Cause 2 Verification B (MPLM 5A.1 SVTL 206) (11/2/1999)	NONE	NO		FM1 11/2/1999 FM2 11/2/1999	**MPLM INSPECTION** MM-MA-AI-0005 "MPLM PHS&T and Maintenance Manual" MLM-RP-AI-0028 "Logistic Support Analysis Report" Ground Operations Procedures used to control flight hazards. Verification for these proposed controls is complete when formal acceptance is provided by KSC. Documented in NASA document MU04819C "MPLM Generic O&M Requirements" U024EA.120, U024EA.140, U024LT.010 NPV device inspection U024LT.020, U024LT.030 part of PPRA performance and leak tests
230	MOI-5	1.1.1	Review of the MPLM grounding/bonding/shielding design MPLM-0010 Cause 1 Verification A1	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM INSPECTION** MLM-SR-AI-0001 "MPLM EMC Specification"
231	MOI-5	1.1.2	Review of EMC Requirements verification MPLM-0010 Cause 1 Verification A2 (MPLM 5A.1 SVTL 51)	NONE	NO		FM1 10/15/1998 FM2 10/15/1998	**MPLM INSPECTION** MLM-RP-AI-0279 "MPLM Segment Sepecification EMC Requirement Analysis Report" MLM-RP-AI-0280 "MPLM End Item Specification EMC Requirement Inspection Report" MLM-RP-AI-0281 "MPLM End Item Specification EMC Requirement Analysis Report"

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232	MOI-5	1.1.3	Review of Bonding test results MPLM-0010 Cause 1 Verification A3 (MPLM 5A.1 SVTL 52)	NONE	NO		FM1 10/15/1998 FM2 9/30/1999	**MPLM** **TEST** MLM-RP-AI-0418 "MPLM FM 1 System Bonding Measurement – Test Report" MLM-RP-AI-0427 "MPLM FM 1 Units Bonding Test Report" Bonding measurements at the integrated system level are performed during MPLM FM1 integration, to ensure that the bonding requirements are satisfied. Bonding measurements are performed for structural parts and mechanisms, equipment, and harness. The resistance of the conductive path between the unit and its bonding point is verified to be under the limit value for each unit after installation. Shield continuity test is also performed as a part of the system harness bonding verification. **Reverified for FM 2 (30 Sep 99)** Bonding measurements at integrated system level have been performed during MPLM FM2 integration, to ensure that the bonding requirements are satisfied. Bonding measurements are performed for structural parts and mechanisms, equipment, and harness. In particular, for each unit verified, after installation, that the resistance of the conductive path between the unit and the bonding point is under the limit value. Shield continuity test is performed as part of the system harness bonding verification. Results of the bonding verification for MPLM Flight Unit (FM2) are contained in doc. MLM-RP-AI-0495 "MPLM FM2 System Bonding Measurement Test Report" and MLM-RP-AI-0499 "MPLM FM2 Units Bonding Test Report".
232a	MOI-5	1.1.4	Review and approval of MPLM-RP-AI-0279 "MPLM Segment Specification EMC Requirement Analysis Report" by the JSC MS2 office.	NONE	NO	Before FL 5A.1	FEB 2001	**INTEGRATED INSPECTION (awaiting response from JSC MS2 office) (Dr. Li Lo) Document was submitted to JSC MS2 office. MS2 office saw no problems with the document. This verification is considered closed for all MPLM flights.**
233	MOI-5	1.2.1	Review of safety margin verification MPLM-0010 Cause 1 Verification B (MPLM 5A.1 SVTL 53)	NONE	NO		FM1 7/9/1998 FM2 7/9/1998	**MPLM** **INSPECTION** MLM-RP-AI-0279 "MPLM Segment Spec (SSP 41164) EMC Requirement Analysis Report"

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234	MOI-5	1.3.1	Review of Electrical/Electronic equipment thermal vacuum test or corona protection analysis results MPLM-0010 Cause 3 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** **TEST** MD 049-202 "SSMDM Verification Analsysis Report – MDM-10 Qualification by Simialrity Analysis, aRN-602" MLM-RP-FI-0053 "PDB QM Electrical Test Report" MLM-RP-CGS-013 "MPLM-HCU Report for Verification for HCU-QM"
235	MOI-5	1.4.1	Drawing VS72-270027 (Control Schematic EURECA) is used for the EMI/EMC analysis. Also used are VS72-270017 (IBSS) and VS72-270025 (UARS). ROEU-4 Verification 1	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
236	MOI-5	1.5.1	EMI/EMC analysis	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
237	MOI-5	1.5.2	Review of drawings to verify electromechanical components are the same as used by the ROEU that were previously approved.	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**

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Flight Safety Verification Tracking Log

Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
238	MOI-5	1.6.1	Boeing Safety and Reliability Engineering review of D/292-400 EMC Safety Statement Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 005 010101 Boeing Safety and Reliability Engineering Review of D/N520 – EMC Safety Statement. RSS99D0518 CIRAHR No 005 020101 Boeing Safety and Reliability Engineering Review of D/N520 – EMC Safety Statement. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
239	MOI-5	1.6.2	Boeing Safety and Reliability Engineering review of ICD-A-21350 MPLM. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 005 010102 Boeing Safety and Reliability Engineering review of ICD-A-21455-OOR RSS99D0518 CIRAHR No 005 020102 Boeing Safety and Reliability Engineering review of ICD-A-21455-OOR **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
240	MOI-5	1.7.1	Boeing Safety and Reliability Engineering review of D/292-400 EMC Safety Statement. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 006 010102 Boeing Safety and Reliability Engineering review of ICD-A-21455-OOR. RSS99D0518 CIRAHR No 006 020104 Boeing Safety and Reliability Engineering review of ICD-A-21455-ICC. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
241	MOI-5	1.7.2	Boeing Safety and Reliability Engineering review of ICD-A-21350 MPLM. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 006 010101 Boeing Safety and Reliability Engineering review of D/N520 – EMC Safety Statement. RSS99D0518 CIRAHR No 006 020101 Boeing Safety and Reliability Engineering review of D/N520 – EMC Safety Statement. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
242	MOI-5	1.8.1	EMI will be verified during Qualification Testing	NONE	NO	Before: FL UF3	NA	**ORBITER/MPLM COOLING SYSTEM** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**

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Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
243	MOI-5	2.1.1	Drawing VS72-270027 (Control Schematic EURECA) is used for the EMI/EMC analysis. Also used are VS72-270017 (IBSS) and VS72-270025 (UARS). ROEU-4 Verification 1	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
244	MOI-5	2.2.1	EMI/EMC analysis	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
245	MOI-5	2.2.2	Review of drawings to verify electromechanical components are the same as used by the ROEU that were previously approved.	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
246	MOI-6	1.1.1	Per drawing VS70-540124: The EURECA ROEU/Retention System Interface. ROEU-7 Verification 1	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**

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Note: Shaded Items are considered closed.

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Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
247	MOI-6	1.1.2	OMRSD- File II – Vol. IV: ROEU Checkout S0751A.XX2: Verify ROEU rotates to deploy position. S0751A.XX3: Verify ROEU hooks latch and continuity. S0751A.XX4: Verify ROEU rotates to relax position. S0751A.XX5: Verify ROEU hooks unlatch and continuity loss. S0751A.XX6: Verify ROEU rotates to stow position. S0751A.XX7: ROEU ODA/PDA continuity premate verify. ROEU-7 Verification 2	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights.** **United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
248	MOI-6	1.2.1	Review and approval of electrical installation drawings ROEU-9 Verification 1	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights.** **United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
249	MOI-6	1.3.1	Inspection of engineering drawings confirms fault tolerance criteria is met ROEU-11 Verification 1	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights.** **United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
250	MOI-6	1.3.2	Test reports. Assembly and checkout of the mechanical and electrical functions of the ROEU are specified for the Orbiter Disconnect Mechanism (ML0308-0185), the Arm Drive Mechanism (ML0308-0186), and the Orbiter Disconnect Assembly (ML0308-0187). ROEU-11 Verification 2	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights.** **United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**

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Note: Shaded Items are considered closed.

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Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
251	MOI-6	1.3.3	Inspection of engineering drawings V751-544200 and V751-544110 shows design for EVA operations. The EVA mechanism is checked in the procedures identified above. ROEU-11 Verification 1	NONE	NO		AUG 1991	**ROEU** **Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
252	MOI-6	1.4.1	Per drawing VS70-XXXXXXX: The MPLM ROFU/Retention System Interface	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
253	MOI-6	1.4.2	Review EVA contingency operations procedure ocad	NONE	NO	Before: FL UF3	NA	**ROFU** **PROCEDURAL** Verification will be considered complete once formal acceptance is provided by MOD through an Operational Hazard Control Verification or Detailed Evaluation Report. Operational control will be documented in document **TBD** under OCAD reference number **TBD.** **OCAD ID 2275 Rejected "Not applicable, ROFU is not flying on STS-102."** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**

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Note: Shaded Items are considered closed.

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Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
254	MOI-6	1.4.3	OMRSD- File II – Vol. IV: ROFU Checkout S0847A.XX2: Verify ROFU rotates to deploy position. S0847A.XX3: Verify ROFU hooks latch and continuity. S0847A.XX4: Verify ROFU rotates to relax position. S0847A.XX5: Verify ROFU hooks unlatch and continuity loss. S0847A.XX6: Verify ROFU rotates to stow position. S0847A.XX7: ROFU ODA/PDA continuity premate verify.	NONE	NO	Before: FL UF3	NA	ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
255	MOI-6	1.5.1	Review and approval of electrical and fluid installation drawings	NONE	NO	Before: FL UF3	NA	ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
256	MOI-6	1.6.1	Review of engineering drawings to verify fault tolerance criteria are met. Perform Failure Modes and Effects Analysis	NONE	NO	Before: FL UF3	NA	ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.
257	MOI-6	1.6.2	Test Reports. Assembly and checkout of the mechanical and electrical functions of the ROFU are specified for the Orbiter Disconnect Assembly and the Arm Drive Mechanism.	NONE	NO	Before: FL UF3	NA	ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.

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Note: Shaded Items are considered closed.

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Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
258	MOI-6	1.6.3	Review of engineering drawings to verify design for EVA operations	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
259	MOI-6	1.7.1	Verification for this proposed operational control is complete when formal acceptance is provided by MOD through an Operational Hazard Control Summary or Detailed Evaluation Report. ocad	NONE	NO	Before: FL 5A.1	2/20/2001	**INTEGRATED PROCEDURAL** Verification will be considered complete once formal acceptance is provided by MOD through an Operational Hazard Control Verification or Detailed Evaluation Report. Operational control will be documented in document **TBD** under OCAD reference number **TBD.** OCAD ID 2276 Implementation F: 5A.1 10C-2 Paragraph C and D. **This verification is considered closed for all MPLM flights.**
260	MOI-6	2.1.1	Boeing Safety and Reliability Engineering review of Payload Retention System Schematic, VS70-540353, STS-102. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER INSPECTION** VS70-540353 "Payload Retention System Schematic" **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Note: Shaded items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
261	MOI-6	2.1.2	OMRSD File II, Vol. IV (premate) S0073A.041 A – H – SEL 1 LCH 1 S0073A.042 A – H – SEL 1 LCH 2 S0073A.043 A – H – SEL 1 LCH 3 S0073A.044 A – H – SEL 1 LCH 4 S0073A.045 A – H – SEL 1 LCH 5 OMI: PT-3-29-071 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 013 020104 OMRSD File II, Vol. IV (premate) S0073A.041 A – H – SEL 1 LCH 1 S0073A.042 A – H – SEL 1 LCH 2 S0073A.043 A – H – SEL 1 LCH 3 S0073A.044 A – H – SEL 1 LCH 4 S0073A.045 A – H – SEL 1 LCH 5 OMI: PT-3-29-071 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
262	MOI-6	2.1.3	FMEA/CIL No. 05-6IE-200-1 (1R2) Switch, Rotary, P/L Retention Mechanism Selection/Sequence Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 013 020103 FMEA/CIL No. 05-6IE-200-1 (1R2) Switch, Rotary, P/L Retention Mechanism Selection/Sequence. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
263	MOI-6	2.2.1	Boeing Safety and Reliability Engineering review of Payload Retention System Schematic, VS70-540353, STS-102 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** **INSPECTION** VS70-540353 "Payload Retention System Schematic" **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Note: Shaded Items are considered closed.

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Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
264	MOI-6	2.2.2	OMRSD File II, Vol. IV (premate) S0073A.041 A – H – SEL 1 LCH 1 S0073A.042 A – H – SEL 1 LCH 2 S0073A.043 A – H – SEL 1 LCH 3 S0073A.044 A – H – SEL 1 LCH 4 S0073A.045 A – H – SEL 1 LCH 5 OMI: PT-3-29-071 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 013 030102 OMRSD File II, Vol. IV (premate) S0073A.041 A – H – SEL 1 LCH 1 S0073A.042 A – H – SEL 1 LCH 2 S0073A.043 A – H – SEL 1 LCH 3 S0073A.044 A – H – SEL 1 LCH 4 S0073A.045 A – H – SEL 1 LCH 5 OMI: PT-3-29-071 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
265	MOI-6	2.2.3	deleted					
266	MOI-6	2.3.1	Approval of the PRLAs and AKA for use with the MPLM by the Shuttle Program. (note: since current PRLA and AKA hazard reports could not be located, closure of this verification will depend on a COFR from the shuttle program certifying this hardware).	NONE	NO	Before: FL 5A.1	2/15/2001	**INTEGRATED** The shuttle program has selected the PRLAs and AKA based on the designed loads expected during a mission. This hardware has undergone extensive design and testing. There have been no problems or anomalies reported on this hardware. The STS-102 COFR has been signed for the Orbiter hardware (including the PRLAs and AKA) and was presented at LSFR. This COFR will also be presented at the FRR. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Mission ISS 7A.1 **Element** MPLM/Orbiter Integrated

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Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
267	MOI-6	2.4.1	Verification for this proposed operational control is complete when formal acceptance is provided by MOD through an Operational Hazard Control Summary or Detailed Evaluation Report. ocad	NONE	NO	Before: FL 5A.1	2/20/2001	**INTEGRATED PROCEDURAL** Verification will be considered complete once formal acceptance is provided by MOD through an Operational Hazard Control Verification or Detailed Evaluation Report. Operational control will be documented in document **TBD** under OCAD reference number **TBD**. OCAD ID 2277 Implementation F: A10.1.15-1 paragraph A3. **This verification is considered closed for all MPLM flights.**
268	MOI-6	3.1.1	Verification for this proposed operational control is complete when formal acceptance is provided by MOD through an Operational Hazard Control Summary or Detailed Evaluation Report. ocad	NONE	NO	Before: FL 5A.1	2/20/2001	**INTEGRATED PROCEDURAL** Verification will be considered complete once formal acceptance is provided by MOD through an Operational Hazard Control Verification or Detailed Evaluation Report. Operational control will be documented in document **TBD** under OCAD reference number **TBD**. OCAD ID Implementation P: EVA Checklist procedures **This verification is considered closed for all MPLM flights.**
269	MOI-7	1.1.1	Review of the thermal analysis results MPLM-0018 Cause 1 Verification A	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** Thermal analysis has been performed and is referenced in the Alenia internal letter G831/S-0134, dated February 25, 1997.
270	MOI-7	1.1.2	(EVA stay out areas) Verification for this proposed operation control is complete when formal acceptance is provided by MOD through an Operation Hazard Control Summary or Detailed Evaluation Report. ocad	NONE	NO		FEB 2001	**MPLM PROCEDURAL** Verification will be considered complete once formal acceptance is provided by MOD through an Operational Hazard Control Verification or Detailed Evaluation Report. Operational control will be documented in document **TBD** under OCAD reference number **TBD**. OCAD ID 2278 Rejected "Hazard Cause is based on out-dated technical data. If a MPLM EVA is required, a NASA provided EVA thermal analysis will be requested." This was submitted to MOD under OCAD ID 2278. 2278 was subsequently rejected. MOD response indicates that this control is unnecessary since there are not planned EVAs on the MPLM. **This verification is considered closed for all MPLM flights.**

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Note: Shaded Items are considered closed.

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Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
270a	MOI-7	1.1.3	A real time analysis will be perfomed for this flight. The applicable results will be documented in the tracking log.	NONE	NO		CLOSED	**(awaiting thermal analysis from the JSC thermal group) (Jeff Arend/JSC OM) Thermal Analysis was received from Grant View. The only concern mentioned in the analysis related to the MPLM was on the FRGF on the Starboard side of the MPLM. Temperatures on this area can exceed the 245 degree F hot limit for extended EMU TMG contact. There are no tasks at this point that require non-incidental contact with the TMG. Glove palm contact on this area should be achievable for several minutes.**
271	MOI-7	1.2.1	Review of the MPLM external configuration MPLM-0018 Cause 1 Verification B	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	**MPLM** The MPLM configuration is provided in doc. MLM-RP-AI-0019 "MPLM Baseline Configuration Report". The MPLM external layout, showing the MDPS installation, is provided in Alenia drawing 020P011 Sheets 5, 6, 7, and 8 "Shell (External) Layout with MDPS". Detailed MLI blanket installation is provided in Alenia drawings 013P0185 "PTCS Cylinder Assembly MLI Installation", 013P0186 "PTCS Overlap Belts MLI", 013P0187 "PTCS Aft Cone MLI Installation", 013P0188 "PTCS Fwd Cone MLI Installation", 013P0189 "PTCS Fitting MLI Installation".
272	MOI-7	1.3.1	Review of design Drawing No. TBD	NONE	NO	Before: FL UF3	NA	**ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
273	MOI-7	2.1.1	Review of HFE assessment results MPLM-0018 Cause 2 Verification A (MPLM 5A.1 SVTL 34)	NONE	NO		FM1 5/14/1998 FM2 5/14/1998	MPLM Detailed assessment is contained in doc. MLM-TN-AI-0200 "MPLM Human Engineering Safety Requirements Assessment". External inspection review (crew walk around) results summary is contained in "Trip Report – STS 99/ISS 6A MPLM Crew Walk down".

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Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
274	MOI-7	2.2.1	Review of "Swatch Test" results. MPLM-0018 Cause 2 Verification B (MPLM 5A.1 SVTL 90)	NONE	NO		FM1 6/16/1999 FM2 9/30/1999	MPLM Swatch test was performed during MPLM Flight Unit (FM 1) integration in Alenia. Final verification was performed during MPLM FM 1 activities at KSC after MDPS panels installation. Results are documented in doc. MLM-TN-AI-0200 "MPLM Human Engineering Safety Requirements Assessment". **Reverified for FM 2 (30 Sep 99)** Swatch test has been performed during MPLM Flight Unit (FM 2) integration in Alenia. Results are documented in a DCN (Document Change Notice MLM-DC-AI-0361, dated June 15th, 1999) to doc. MLM-TN-AI-0200 "MPLM Human Engineering Safety Requirements Assessment".
275	MOI-7	2.3.1	Review and approval of design drawings at CDR. ROEU-9 Verification 1	NONE	NO		AUG 1991	**ROEU Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
276	MOI-7	2.3.2	EVA analysis of Cargo element installation will be mapped for EVA hazards as part of payload bay closeout. ROEU-9 Verification 2	NONE	NO		AUG 1991	**ROEU Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
277	MOI-7	2.4.1	Review and approval of design drawings at CDR	NONE	NO	Before: FL UF3	NA	**ROFU Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**

Mission ISS 7A.1

International Space Station

Element MPLM/Orbiter Integrated

Flight Safety Verification Tracking Log

Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
278	MOI-7	2.4.2	EVA analysis Cargo element installation will be mapped for EVA hazards as part of payload bay closeout	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
279	MOI-7	2.4.3	Complete KSC walk down after ROFU installation	NONE	NO	Before: FL UF3	NA	**ROFU** **Not applicable to any passive flight. First active flight is Flight UF3. Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration.**
280	MOI-7	2.5.1	Review of KSC notification that the sharp edge inspection was completed such that no sharp edges, protrusions, or entrapment areas exist on accessible MPLM or shuttle interfacing hardware.	NONE	NO	Before: FL 5A.1	CLOSED	**INTEGRATED** (done as part of CEIT) Crew Walkdown was performed as part of CEIT at KSC on Jan. 6, 2001. No anomalies reported.
281	MOI-7	3.1.1	Verification for this proposed operational control is complete when formal acceptance is provided by MOD through an Operational Hazard Control Summary or Detailed Evaluation Report. ocad	NONE	NO	Before: FL 5A.1	FEB 2001	**INTEGRATED** **PROCEDURAL** Verification will be considered complete once formal acceptance is provided by MOD through an Operational Hazard Control Verification or Detailed Evaluation Report. Operational control will be documented in document **TBD** under OCAD reference number **TBD**. OCAD ID 2267. Flight rule is in place but paper work is still in process. **This verification is considered closed for all MPLM flights.**

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International Space Station

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Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
281a	MOI-7	3.1.2	The ODA/PDA connector between the MPLM and the ROEU meets the requirements set forth in MA2-97-093 (Crew Mating/Demating of Powered Connectors policy letter).	NONE	NO		FEB 2001	**INTEGRATED** Power going to and from the MPLM through the ROEU ODA/PDA connector has been evaluated. Upstream side of the connector does terminate in sockets as required. Before mating and demating, the MPLY systems are powered off which removes the load from the system. The 120 V portion of the system is powered off at the APCU. The 28 V portion of the system is powered off at the Primary P/L bus which also supplies power to the APCU. **This verification is considered closed for all MPLM flights.**
282	MOI-7	3.2.1	The electrical engineering drawing (V751-741901) verifies that the potting and sealing design standards are met ROEU-2 Verification 1	NONE	NO		AUG 1991	**ROEU Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
283	MOI-7	3.2.2	The engineering drawings which control the relative location of the cables are VS72-270027 (EURECA), VS72-270017 (IBSS), and the VS72-270025 (UARS) Control Schematics. ROEU-2 Verification 2	NONE	NO		AUG 1991	**ROEU Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
284	MOI-7	3.2.3	The control schematics VS72-720027 (EURECA), VS72-270017 (IBIS), and the VS72-270025 (UARS) establish the grounding scenario. ROEU-2 Verification 3	NONE	NO		AUG 1991	**ROEU Analysis was written generically by Boeing Reuseable Space Systems (RSS) to cover all flights. United Space Alliance (USA) is under contract to certify this hardware before each use as part of Orbiter Integration. This verification is considered closed for all future flights.**
285	MOI-7	3.3.1	Deleted by SRP					
286	MOI-7	3.3.2	Deleted by SRP					
287	MOI-7	3.3.3	Deleted by SRP					

Mission ISS 7A.1

International Space Station

Element MPLM/Orbiter Integrated

Flight Safety Verification Tracking Log

Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
288	MOI-8	1.1.1	Boeing Safety and Reliability Engineering review of Integrated Schematic (STS-102) VS72-200179. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No. 001 010101 Boeing Safety and Reliability Engineering review of Integrated Schematic (STS-102) VS72-200179. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
289	MOI-8	1.1.2	Boeing Safety and Reliability Engineering review of MPLM ICD-A-21350. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 010105 Boeing Safety and Reliability Engineering review of ICD-A-21350. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
289a	MOI-8	1.1.3	Boeing Safety and Reliability Engineering review of STS-102 Payload Retention System Schematic, VS70-540353 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 010103 Boeing Safety and Reliability Engineering review of STS-102 Payload Retention System Schematic, VS70-540353 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Flight Safety Verification Tracking Log

Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
290	MOI-8	1.2.1	Boeing Safety and Reliability Engineering review of Payload Retention Schematic, VS70-540353. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020101 Boeing Safety and Reliability Engineering review of Payload Retention Schematic, VS70-540353. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
291	MOI-8	1.2.2	Fault Tree Analysis "Inadvertent Operation of PRLA Motor A Opens Latch Mechanism during Orbiter Ascent" 10/07/88. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020102 Fault Tree Analysis "Inadvertent Operation of PRLA Motor A Opens Latch Mechanism during Orbiter Ascent" 10/07/88. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
292	MOI-8	1.2.3	Shuttle Orbiter failure modes and fault tolerance for interface services, NSTS 16979, Part 1, Rev. C, July 1991, including changes 1-3. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020103 Shuttle Orbiter failure modes and fault tolerance for interface services, NSTS 16979, Part 1, Rev. C, July 1991, including changes 1-3. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Flight Safety Verification Tracking Log

Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
292a	MOI-8	1.2.4	Failure Modes and Effects Analysis (FMEA) & Critical Item List (CIL) reports for the Remotely Operated Electrical Umbilical (ROEU), STS86-0149B & SSD90D0174A (2/91). Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020105 Failure Modes and Effects Analysis (FMEA) & Critical Item List (CIL) reports for the Remotely Operated Electrical Umbilical (ROEU), STS86-0149B & SSD90D0174A (2/91). **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
293	MOI-8	1.3.1	OMRSD File II, Vol. IV (premate) S0073A.041 A – H – SEL 1 LCH 1 S0073A.042 A – H – SEL 1 LCH 3 S0073A.043 A – H – SEL 1 LCH 3 S0073A.044 A – H – SEL 1 LCH 4 S0073A.045 A – H – SEL 1 LCH 5 OMI: PT-3-29-071 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020201 OMRSD File II, Vol. IV (premate) S0073A.041 A – H – SEL 1 LCH 1 S0073A.042 A – H – SEL 1 LCH 3 S0073A.043 A – H – SEL 1 LCH 3 S0073A.044 A – H – SEL 1 LCH 4 S0073A.045 A – H – SEL 1 LCH 5 OMI: PT-3-29-071 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
294	MOI-8	1.3.2	OMRSD File II, Vol. IV (Premate): ROEU S0751A.110-A-C ROEU Stow to Deploy Oper Verif (Sys 1&2) S0751A.120-A-C ROEU ODA/PDA Mate/Cont Op. Verif (Sys 1&2) S0751A.130-A-C ROEU ODA/PDA Demt/Dscnt Op. Verif (Sys 1&2) S0751A.140-A-C ROEU Deploy to Relax Op. Verif (Sys 1&2) S0751A.150-A-C ROEU Relax to Stow Op. Verif (Sys 1&2) OMI: PT-3-29-073 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020202 OMRSD File II, Vol. IV (Premate): ROEU S0751A.110-A-C ROEU Stow to Deploy Oper Verif (Sys 1&2) S0751A.120-A-C ROEU ODA/PDA Mate/Cont Op. Verif (Sys 1&2) S0751A.130-A-C ROEU ODA/PDA Demt/Dscnt Op. Verif (Sys 1&2) S0751A.140-A-C ROEU Deploy to Relax Op. Verif (Sys 1&2) S0751A.150-A-C ROEU Relax to Stow Op. Verif (Sys 1&2) OMI: PT-3-29-073 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
294a	MOI-8	1.3.3	OMRSD File II, Vol. II (Postmate): ROEU P350ED.015 ROEU Engage (A6U) P350ED.020 ROEU Disengage (A6U) OMI: PT-3-29-073 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020203 OMRSD File II, Vol. II (Postmate): ROEU P350ED.015 ROEU Engage (A6U) P350ED.020 ROEU Disengage (A6U) OMI: PT-3-29-073 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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International Space Station

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Flight Safety Verification Tracking Log

Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
294b	MOI-8	1.3.4	FMEA/CIL: 05-5-B03-7A-1&2 (1R2) MDM OA3; 05-5-B03-6-1&2 (1R2) MDM (Operation) OF1, OF2, OF4. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020204 FMEA/CIL: 05-5-B03-7A-1&2 (1R2) MDM OA3; 05-5-B03-6-1&2 (1R2) MDM (Operation) OF1, OF2, OF4. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
295	MOI-8	1.4.1	FMEA/CIL: 05-6-2658-2 (1R2) swtich, toggle, 4P2P, hermetically sealed payload bay mechanical power ON/OFF control Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020301 FMEA/CIL: 05-6-2658-2 (1R2) swtich, toggle, 4P2P, hermetically sealed payload bay mechanical power ON/OFF control **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
296	MOI-8	1.4.2	FMEA/CIL: 05-6IE-2003-2 (1R2), hybrid relay, payload retention latch.release control; 05-6IE-2013-1 (1R2) logic power. Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020302 FMEA/CIL: 05-6IE-2003-2 (1R2), hybrid relay, payload retention latch.release control; 05-6IE-2013-1 (1R2) logic power. **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Flight Safety Verification Tracking Log

Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
296a	MOI-8	1.4.3	OMRSD File II, Vol. IV (premate) S0073A.041 A – H – SEL 1 LCH 1 S0073A.042 A – H – SEL 1 LCH 2 S0073A.043 A – H – SEL 1 LCH 3 S0073A.044 A – H – SEL 1 LCH 4 S0073A.045 A – H – SEL 1 LCH 5 OMI: PT-3-29-071 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020303 OMRSD File II, Vol. IV (premate) S0073A.041 A – H – SEL 1 LCH 1 S0073A.042 A – H – SEL 1 LCH 2 S0073A.043 A – H – SEL 1 LCH 3 S0073A.044 A – H – SEL 1 LCH 4 S0073A.045 A – H – SEL 1 LCH 5 OMI: PT-3-29-071 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
296b	MOI-8	1.4.4	OMRSD File II, Vol. IV (Premate): ROEU S0751A.110-A-C ROEU Stow to Deploy Oper Verif (Sys 1&2) S0751A.120-A-C ROEU ODA/PDA Mate/Cont Op. Verif (Sys 1&2) S0751A.130-A-C ROEU ODA/PDA Demt/Dscnt Op. Verif (Sys 1&2) S0751A.140-A-C ROEU Deploy to Relax Op. Verif (Sys 1&2) S0751A.150-A-C ROEU Relax to Stow Op. Verif (Sys 1&2) OMI: PT-3-29-073 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020304 OMRSD File II, Vol. IV (Premate): ROEU S0751A.110-A-C ROEU Stow to Deploy Oper Verif (Sys 1&2) S0751A.120-A-C ROEU ODA/PDA Mate/Cont Op. Verif (Sys 1&2) S0751A.130-A-C ROEU ODA/PDA Demt/Dscnt Op. Verif (Sys 1&2) S0751A.140-A-C ROEU Deploy to Relax Op. Verif (Sys 1&2) S0751A.150-A-C ROEU Relax to Stow Op. Verif (Sys 1&2) OMI: PT-3-29-073 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

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Element MPLM/Orbiter Integrated

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Note: Shaded Items are considered closed.

Mission/Element: Flight 7A.1 MPLM/Orbiter Integrated **Date:** July 2001

Log No.	Hazard Report No.	Safety Ver. No.	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)
296c	MOI-8	1.4.5	OMRSD File II, Vol. II (Postmate): ROEU P350ED.015 ROEU Engage (A6U) P350ED.020 ROEU Disengage (A6U) OMI: PT-3-29-073 Boeing RSS/USA Verification	NONE	NO		JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020305 OMRSD File II, Vol. II (Postmate): ROEU P350ED.015 ROEU Engage (A6U) P350ED.020 ROEU Disengage (A6U) OMI: PT-3-29-073 **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**
297	MOI-8	1.5.1	Boeing Safety and Reliability Engineering Assessment, "Adjacent Pin-to-Pin Analysis on PRLA Connector". Boeing RSS/USA Verification	NONE	NO	ECD: June 2000	JAN 2001	**ORBITER** RSS99D0518 CIRAHR No 001 020401 Boeing Safety And Reliability Engineering Assessment, "Adjacent Pin-to-Pin Analysis on PRLA Connector" **Boeing Reuseable Space Systems (RSS) is under contract to United Space Alliance (USA) to certify this verification every flight in a Cargo Integration Risk Assessment Report (CIRAR). The next report will be issued for STS-105. This verification is considered closed for all future flights.**

MSFC DOCUMENTATION REPOSITORY - DOCUMENT INPUT RECORD

I. GENERAL INFORMATION

1. APPROVED PROJECT:	2. DOCUMENT/ DRAWING NUMBER:	3. CONTROL NUMBER:	4. RELEASE DATE:	5. SUBMITTAL DATE:
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6. DOCUMENT/DRAWING TITLE:
Multi Purpose Logistics Module (MPLM)/Orbiter Integrated Reflight Assessment

7. REPORT TYPE:
Reflight Assessment

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

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

14. SPECIAL INSTRUCTIONS:
Index,file and distribution per list attached for Baseline Multi Purpose Logistics Module (MPLM)/Orbiter Integrated Reflight Assessment

15. CONTRACTOR/SUBMITTING ORGANIZATION, ADDRESS AND PHONE NUMBER:
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16. ORIGINATING NASA CENTER:
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17. OFFICE OF PRIMARY RESPONSIBILITY:
Allen Shariett/FD23

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II. ENGINEERING DRAWINGS

20. REVISION:	21. ENGINEERING ORDER:	22. PARTS LIST:	23. CCBD:
			MP3-OO-0023

III. REPORTS, SPECIFICATIONS, ETC.

24. REVISION:	25. CHANGE:	26. VOLUME:	27. BOOK:	28. PART:	29. SECTION:
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- ☐ Proprietary (see MPD 2210.1)
- ☐ Patent (see MPG 2220.1)
- ☐ ITAR (see MPG 2220.1)
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V. ORIGINATING ORGANIZATION APPROVAL

40. NAME:	41. SIGNATURE:	42. ORG. CODE:	43. PHONE NUMBER:	44. DATE:
Randy K. McClendon	Randy K McClendon	FD23	(256) 544-3559	7 Sept 01

VI. TO BE COMPLETED BY MSFC DOCUMENTATION REPOSITORY

45. RECEIVED BY:	46. DATE RECEIVED:	47. WORK ORDER:
Carolyn Brazelton	9-14-2001	02-00921