ISS-MPLM-PLAN-017
Revision C
October 2003

PRESSURIZED CARRIERS
Group

EXPORT ADMINISTRATION
REGULATIONS (EAR) CONTROLLED DATA

Multi Purpose Logistics Module

Programmable Thermostat Development Plan

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

Signature Page

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Pressurized Carriers/MPLM Element Manager

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline	-		Baseline Document
Revision	A	2/13/03	ECR# : FD24-0015 Fill in TBD's in section 11.0 Implementation Approach
Revision	B	5/6/03	Deleted Schematics
Revision	C	10/03	Update Fig. 1 to note removal of thermal pad Update Section 7.0

MPLM Thermostat Development Table of Contents

Table of Figures

1. INTRODUCTION

This document describes the overall plan for accomplishing the design, development, test qualification, and flight hardware acceptance testing of the Multi-Purpose Logistics Module (MPLM) programmable thermostats. This hardware development activity is being performed in accordance with the management guidelines set forth in the ISS-MPLM-PLAN-015, "MPLM Sustaining Engineering Plan ". These programmable thermostats will replace the existing fixed temperature set point units in the Passive Thermal Control Sub-system (PTCS) 28Vdc shell heater circuits.

2. APPLICABLE DOCUMENTS

NPD 1280.1	Marshall Management Manual
NPD 7120.4B	Program/Project Management
NPG 7120.5A	Program & Project Management Process and Requirements
ISS-MPLM-PLAN-018	MPLM Programmable Thermostat Test Plan
FPD-FD24.001	Pressurized Carriers Group Risk Management Plan
ISS-MPLM-PLAN-008	Safety and Mission Assurance Plan
ISS-MPLM-PLAN-019	Pressurized Carriers Group Quality Plan
FD24-CM01	Pressurized Carriers Group Configuration Management Plan
SSP 50021	Space Station Safety Requirements Document
MSFC-SPEC-3274	Thermostat Hardware End Item Specification
MSFC-SPEC-3322	Data Recorder Hardware End Item Specification
ISS-MPLM-MAN-020	GSE Users Manual
ISS-MPLM-PLAN-015	MPLM Sustaining Engineering Plan

3. OBJECTIVES

The primary goal of the thermostat development activity is to replace current PTCS thermostats with improved state of the art programmable devices. This upgrade will improve the operational efficiency of the MPLM on-orbit shell heaters by providing better shell temperature control through the use of thermostats with programmable set points and closed loop feedback control capability. This feature results in more efficient Space Transportation System (STS) heater power consumption, leading to increased cryogenic savings resulting from reduced fuel cell operations. The reduction in the cryogenic usage is needed to support future STS payload manifests, including the implementation of the MPLM active refrigeration cooling system. Shell Heaters are used to provide thermal conditioning in order to prevent condensation from forming inside the MPLM.

The primary design requirement of the Programmable Thermostats is to design and manufacture a new set of thermostats that will be operationally and functionally the

equivalent to the existing fixed point thermostats. Thermostats will be designed such that no single event can cause more than one thermostat to fail. This requirement is intended to be applied at the thermostat system level and not at the MPLM PTCS level. The thermostats will also be designed so that the failure of one or more thermostats to operate (turn on or off) will not cause damage to the MPLM system.

An additional design requirement of the Programmable Thermostat Development activity is that the new/replacement Thermostat will not effect the functionality of the MPLM PTCS, and that when installed will not introduce any uncontrolled hazards to the System and will provide the same function as the existing fixed point thermostats.

Additional benefits from the use of the programmable thermostats include more efficient pre and post launch operations. The need for internal MPLM warm air purges will no longer be necessary since the programmable thermostats when powered will allow the PTCS heaters to more accurately control the internal MPLM environment during pad and ferry flight operations. Other benefits include resource savings in future mission operations due to reduced engineering analytical services.

4. CUSTOMER DEFINITION AND ADVOCACY

The primary customer for this hardware development task is the JSC International Space Station (ISS) Program Vehicle Office. All technical, cost, schedule, issues, concerns and updates are relayed to the ISS Vehicle Office.

5. PROJECT AUTHORITY

This activity is being performed in accordance with and in compliance to the International Space Station Program Office directive CR #003578 (see Appendix A).

6. MANAGEMENT

6.1 MSFC ORGANIZATION

6.1.1. Flight Projects Directorate, Flight Systems Department, Pressurized Carriers Group (FD24) is solely responsible for the Design, Development, Testing, Qualification, and Delivery of the new Programmable Thermostat hardware and will provide management and engineering oversight for this in house design effort, including the development of the necessary resource information. ALTEC will provide the necessary installation assembly drawings.

6.1.2 The MSFC Engineering Directorate (ED) is located at MSFC, and is tasked to support the Pressurized Carriers Group in the successful accomplishment of this activity.

6.1.2.1 ED 10, Avionics Department will be responsible for performing the Thermostat electronic components design, completing the software requirements/ design, and electronic parts and software procurements.

6.1.2.2 ED 20, Structures, Mechanical & Thermal Department will perform the necessary Vibration, Thermal Vacuum Qualification and Flight Acceptance testing.

6.1.2.3 ED 40, Systems Engineering Department will perform the necessary EMI/EMC Qualification, and Flight Hardware Acceptance testing.

6.1.3 QS30, Safety and Mission Assurance will perform the necessary safety and reliability assessments of the programmable thermostat design, provide inputs to ALTEC, and provide quality assurance coverage of the fabrication testing of the qualification and flight articles.

7. TECHNICAL SUMMARY

The current MPLM PTCS heater design consists of twenty-two individual thermostat circuits, connected to a common 28Vdc power supply. Temperature control is maintained using bimetalic type thermostats. The current setpoints are on at 84 and off at 95 degrees F. In the upgraded heater configuration twenty of the twenty-two bimetalic thermostats will be replaced by digitally programmable units. One Bimetallic thermostat will not be replaced because of the technical difficulties of routing the new communication cable through the module shell, and another, controling the keel fitting heater, will not be changed due to circuit difficulties

This new configuration will allow for closed loop control capability thru the use of remote temperature sensors connected to each thermostat.

A block diagram of the new MPLM PTCS heater system and a block diagram of the Programmable Thermostat are available in the thermostat End Item Specification, MSFC-SPEC-3274. Figure 1, shows a three dimensional representation of the thermostat hardware installation. Each heater circuit will contain a programmable thermostat connected to an external temperature sensor, a

Resistive Temperature Device (RTD), used to provide continuous temperature monitoring capability. The capability will exist such that all of the MPLM thermostats' set points and control spans can be programmed remotely on the ground thru the communication cable using a laptop computer or equivalent.

Each thermostat will have programmable temperature set points and control spans. The data acquisition system will use a standard 485 serial interface communications cable to provide digital control capability. The electronic thermostat will be capable of independently cycling +28Vdc power (maximum 5 amperes) to the heater element/elements based on the control temperature set point, the control span, and an external temperature sensor.

A Data recorder is being developed and incorporated into the new Thermostat system. A block diagram of the data recorder is available in the Data Recorder End Item Specification-MSFC-SPEC-3322. It will provide the capability of recording the temperature readings from all twenty temperature sensors (RTDs) at intervals during the period of the mission when the Thermostats are operating.

The recorder is being developed to the exact size and configuration of the new programmable thermostat in order to facilitate the development of the mounting method. The Data recorder will be mounted on the forward end cone of the module in a location that is accessible during ground servicing.

Data stored in the memory bank (a single 64 Megabit or 8 Megabytes flash memory chip) of the recorder can be downloaded to a ground system for analysis via the communication cable once the MPLM is back at the ground processing facility. Recorded data will include, but not limited to, thermostat (RTD), temperature, thermostat on/off cycles, etc.

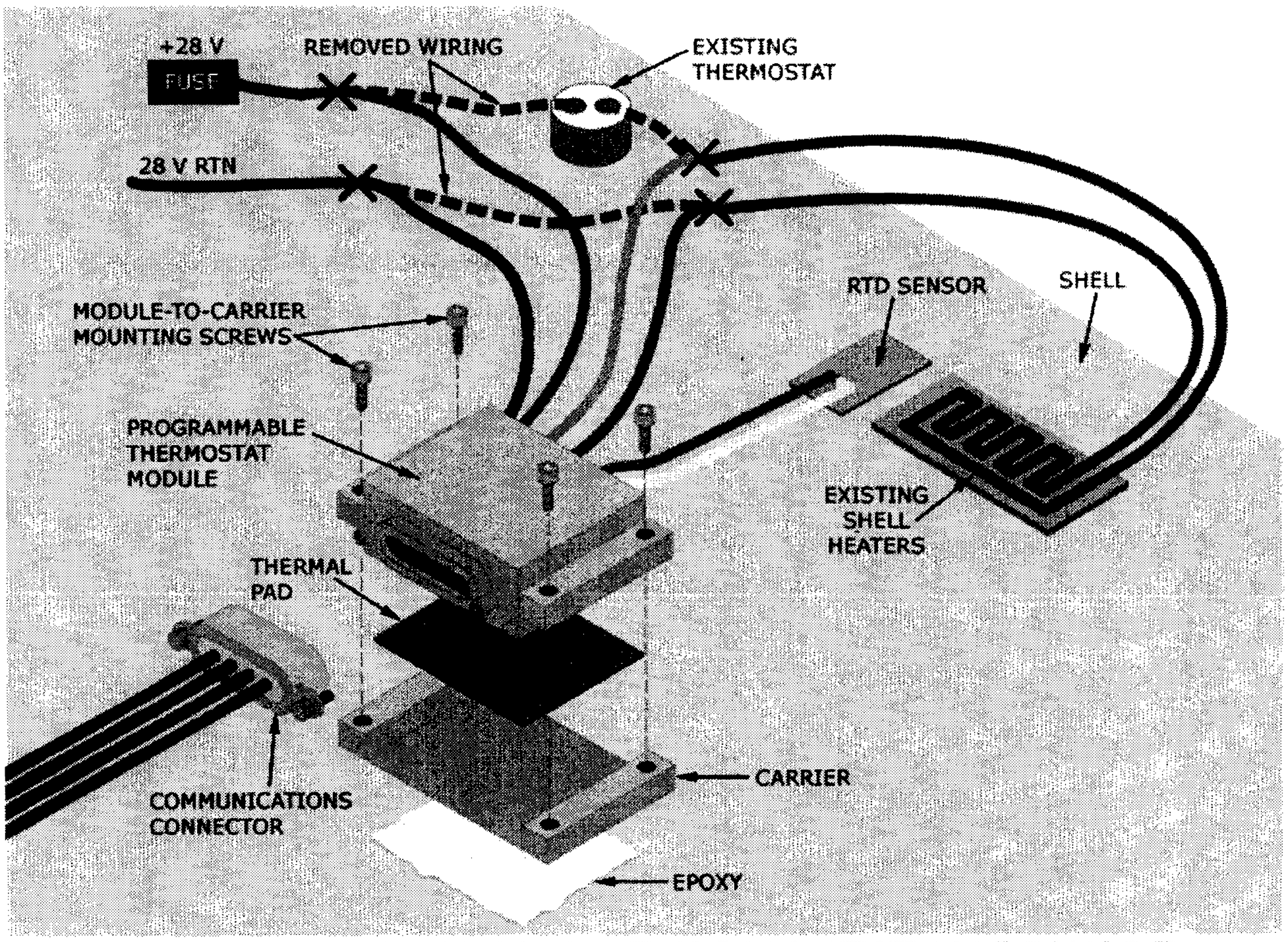

Figure 1: MPLM Programmable Thermostat Hardware

NOTE:
The Data Recorder is not shown in the above figure. A single data recorder, mounted in the same type carrier, will be attached to each flight module.

The thermal pad has been replaced with a thermally conductive silicon compound.

The installed programmable thermostat and RTD sensor is also illustrated in Figure 1. The mounting assembly consists of an aluminum bracket bonded to the MPLM external pressure shell. The thermostat and data recorder will be electrically bonded to the MPLM shell through a "green wire." This approach provides the highest level of confidence and reliability. The programmable thermostat will be secured to the mounting bracket via mounting screws (bolts, etc). This installation design allows for easy replacement of failed units.

MSFC will rely upon ALTEC to provide the location of the RTDs. They will be located per ALTEC's detailed installation drawing and mounted to the module shell per the venders mounting recommendations.

The Programmable Thermostats are powered by the Orbiter 28Vdc system while the MPLM is in the Payload bay, and at no time interfaces with the ISS 120Vdc power system.

8. SCHEDULES

The Qualified Flight Hardware will be delivered to KSC in time to be integrated onto the MPLM prior to the first active MPLM flight.

The Pressurized Carriers Group/FD24 will maintain detailed schedules for the thermostat development effort. FD24 will track the schedule and ensure major milestones are being met. The schedule status will be presented to the Flight Project Directorate management team at their monthly status meetings and to the ISS Program at their regularly scheduled quarterly reviews.

9. RESOURCES

ISS Directive # SSCN: 003578 (Appendix A) provided the Resources necessary for the performance of this activity. However, It should be noted that the Total NASA Funding shown on the SSCN is shared between MSFC, KSC and ASI.

MSFC funding is allocated to the MSFC FD 11 Business Management Office from the JSC Program Office via the JSC Business Management Office through the issuance of a Budget Change Document (BCD)

Weekly Team meetings will be held to evaluate the technical performance vs. the cost expenditures. In the event of 'variances' a review of the plan will be performed and action taken in order to mitigate potential impacts to cost and schedule.
Funding will be expended consistent to the FY 03 Cost and Obligation Phasing Plans that are consistent with the FY 03 Internal Task Agreement between JSC and MSFC.

Cost Plan vs. Actuals for the development activity will be documented by the MSFC FD 11 Business Management Office and reported to the ISS Program Business Management Office on a monthly basis by FD24. Variances to the Plan will be explained accordingly at this time. Similar presentations will be conducted on a regular basis at the FD monthly management reviews.

10. CONTROLS

The MPLM Programmable Thermostat Development Activity is subject to the controls as contained in NASA Procedures and Guidelines, NPG 7120.5A. Responsibilities are as follows:

Center Responsibilities – Johnson Space Center (JSC)

The JSC Vehicle Office Manager is responsible for providing overall direction, and funding of the Development activity.

Center Responsibilities – Marshall Space Flight Center (MSFC)

As a performing Center, the MSFC Manager of the Pressurized Carriers Group is responsible for:

a. Management of the MPLM Programmable Thermostat design, development, testing and delivery of the modification kit.
b. Development of an MPLM Programmable Thermostat Development Plan.
c. Developing and maintaining implementation of policies and procedures compliant with NPD 7120.4B, NPG 7120.5A.
d. Conducting the required design reviews, progress reviews, and pre-delivery acceptance review.
e. Chairing the MPLM Configuration Control Board.
f. Development of an Internal Task Agreement (ITA) w/ISSPO to support this task.
g. Development of the Collaborative Work Commitments (CWCs) with other MSFC organizations.
h. Approving the Test program
i. Approving final inspection and acceptance
j. Post delivery sustaining engineering oversight

The System Engineers of the Pressurized Carriers Group are responsible for:

a. Development of the End Item Specification and all other supporting engineering documentation.

b. Maintenance of the End Item Specification and all other supporting Engineering documentation.
c. The technical aspects of the Programmable Thermostat Development Activity.
d. Development of the Test and Operational scenarios.
k. Approving and concurring in design changes.
e. Leading design reviews and Team meetings as required.
f. Consulting and advising the Group Lead.
g. Leading integration and flight preparation
h. Reviewing analysis and interpretation of data
i. Post delivery sustaining engineering oversight

11. IMPLEMENTATION APPROACH

MSFC is responsible for accomplishing the overall Management of the Thermostat Development Activity. The personnel from FD 24/Pressurized Carriers Group will provide the system engineering and integration effort with support from the various MSFC organizations in the satisfactory accomplishment of this activity. The following programmatic assumptions apply:

MSFC will utilize its infrastructure to accomplish the design, development, qualification, testing and delivery of the replacement Programmable Thermostat. A documentation tree (shown in figure 2) shows the key documents that will be produced in support of this activity.

The MPLM programmable thermostat design will use industrial grade EEE parts. A waiver will be obtained to use industrial grade parts in lieu of radiation hardened EEE parts. The thermal environment that these parts will be subjected to is consistent with industrial grade parts qualifications. Furthermore, the thermostats will be mounted on the MPLM under the MLI and debris panels, providing a benign radiation environment. The use of the industrial grade parts will reduce hardware development costs, and the new thermostats are of a similar size and weight as the existing thermostat design.

The MSFC Engineering Directorate will provide the engineering expertise necessary to satisfactorily accomplish this activity.

Qualification and flight acceptance testing of MSFC developed hardware/software will be performed at MSFC. Qualification testing will be performed on a random sampling basis to provide confidence in the vendor's manufacturing process.

MSFC will rely upon ALTEC to provide detailed Thermostat Installation drawings to KSC. ALTEC will also provide routing and layout drawings for the new communication harness, including a detailed Installation drawing.

KSC/Boeing Huntsville will provide the manufacturing drawing of the Thermostat Communication cable.

KSC will manufacture test and deliver the Communication cable per the above drawing.

MSFC will rely upon Kennedy Space Center to perform installation of the thermostats and communication cable on the MPLM Flight Modules per KSC established procedures.

A Hardware/Software ownership matrix has been developed and is shown as Figure 3. The diagram has been developed in an effort to identify the organization responsible for the development and delivery of that particular hardware or software item.

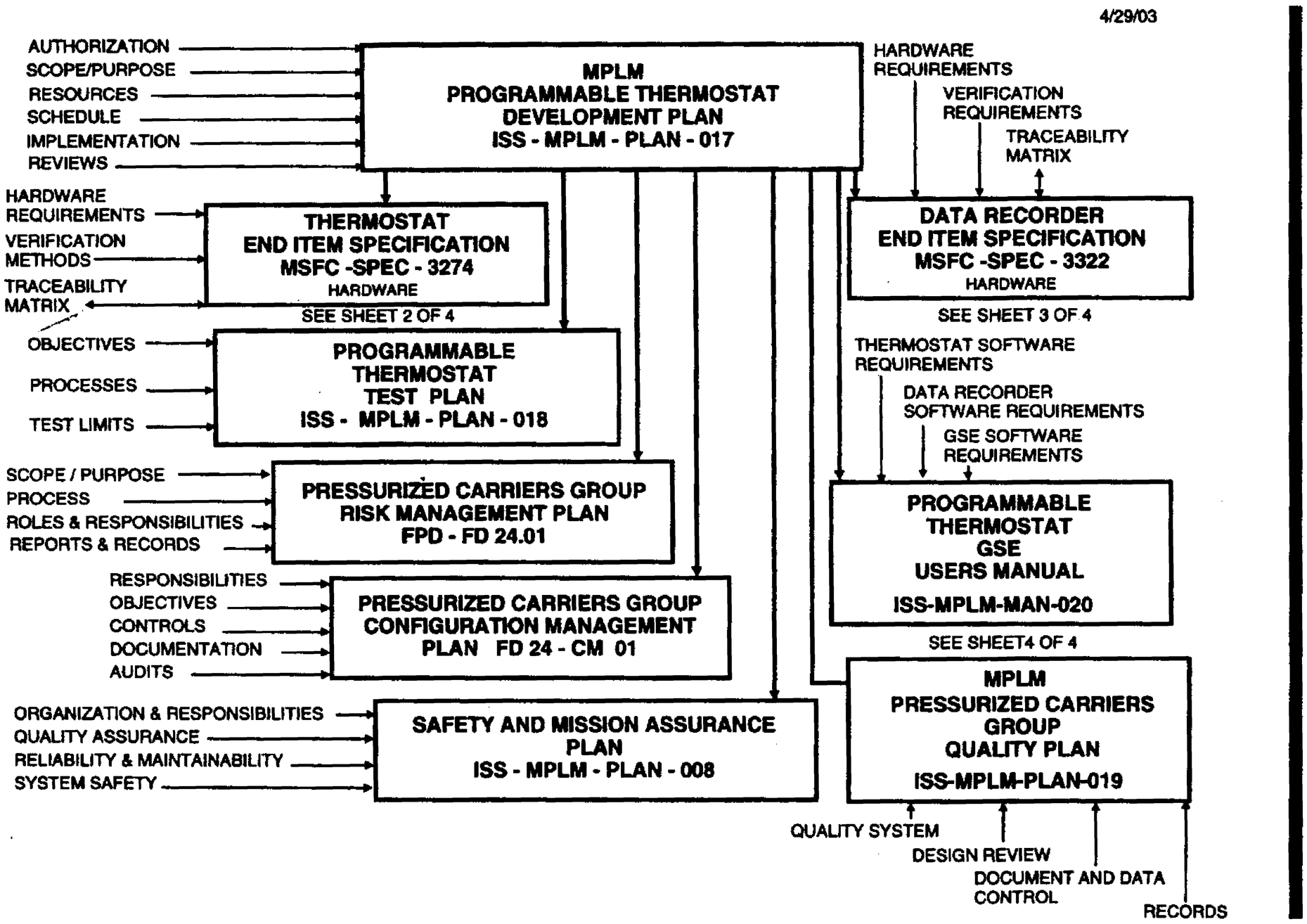

Figure 2 Documentation Tree (1 of 4)

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MSFC - Form 454 (Rev. October 1992)

4/29/03

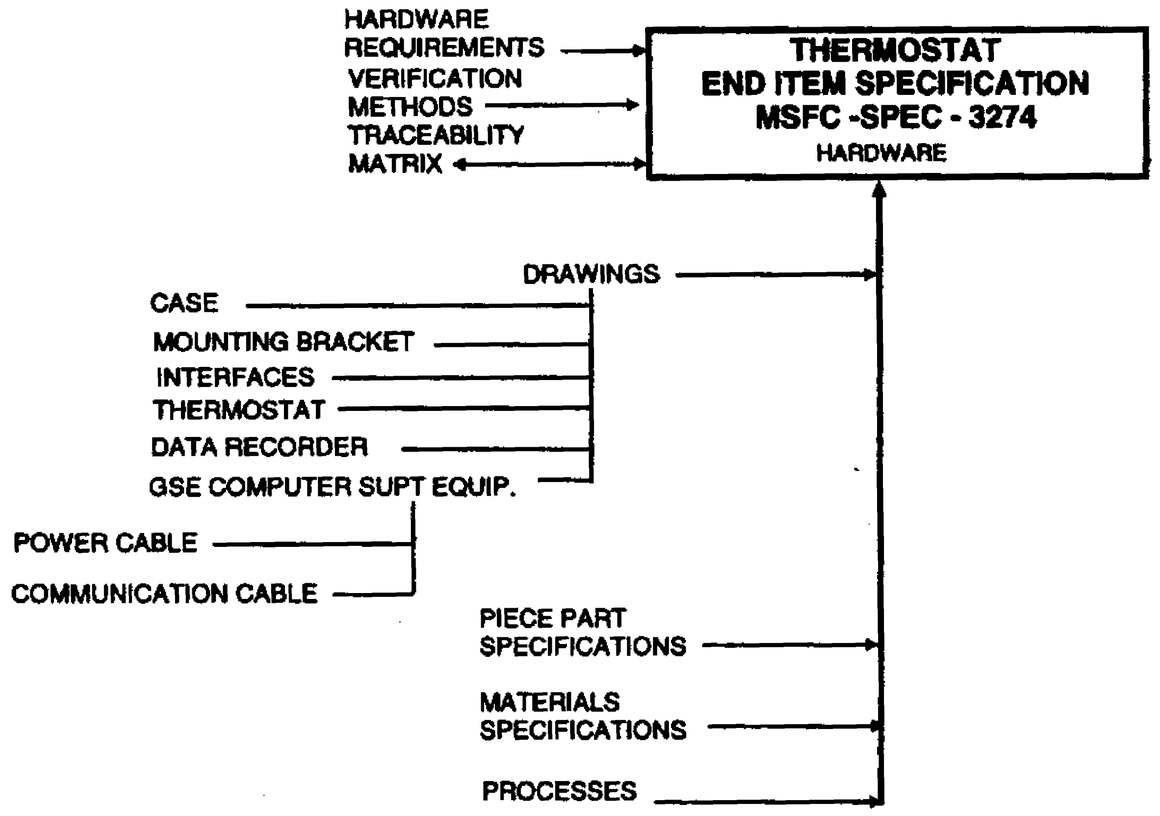

Figure 2 Documentation Tree (2 of 4)

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MSFC - Form 454 (Rev. October 1992)

4/29/03

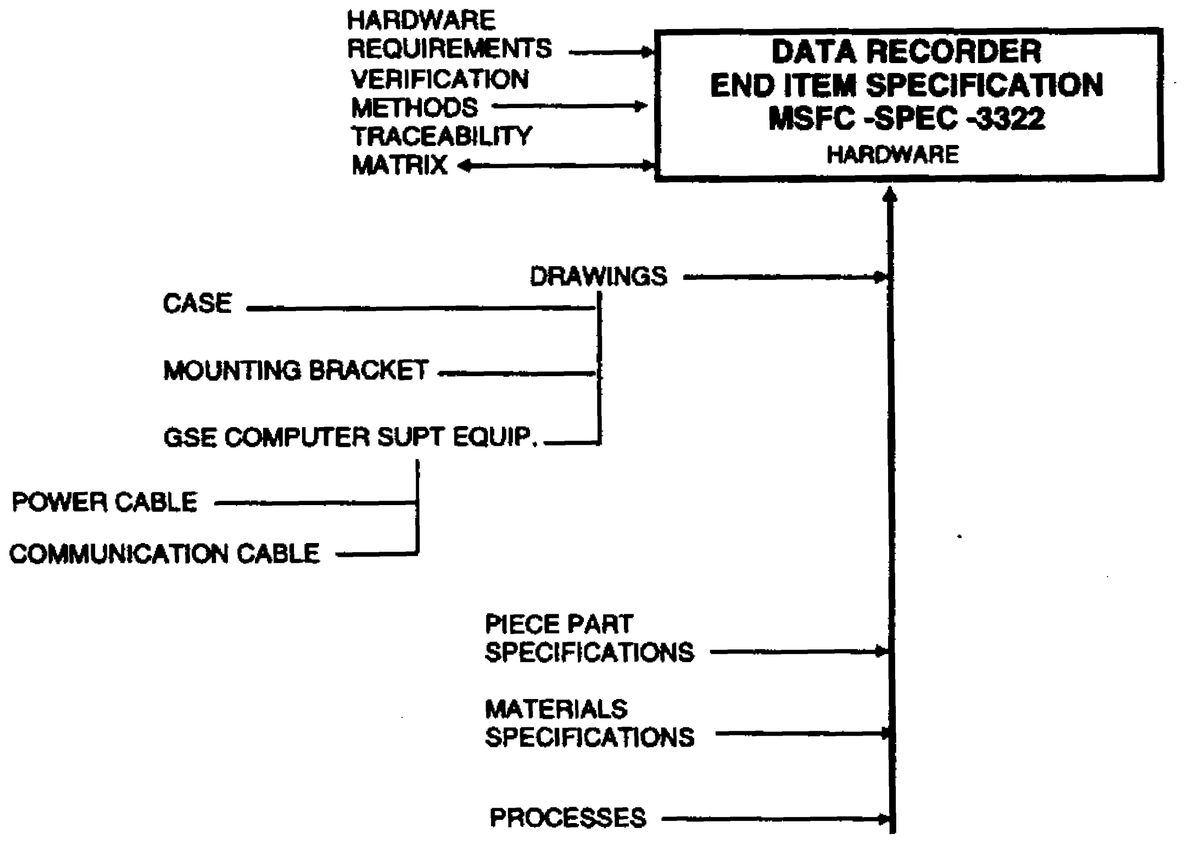

Figure 2 Documentation Tree (3 of 4)

CHECK THE MASTER LIST—
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MSFC - Form 454 (Rev. October 1992)

4/29/03

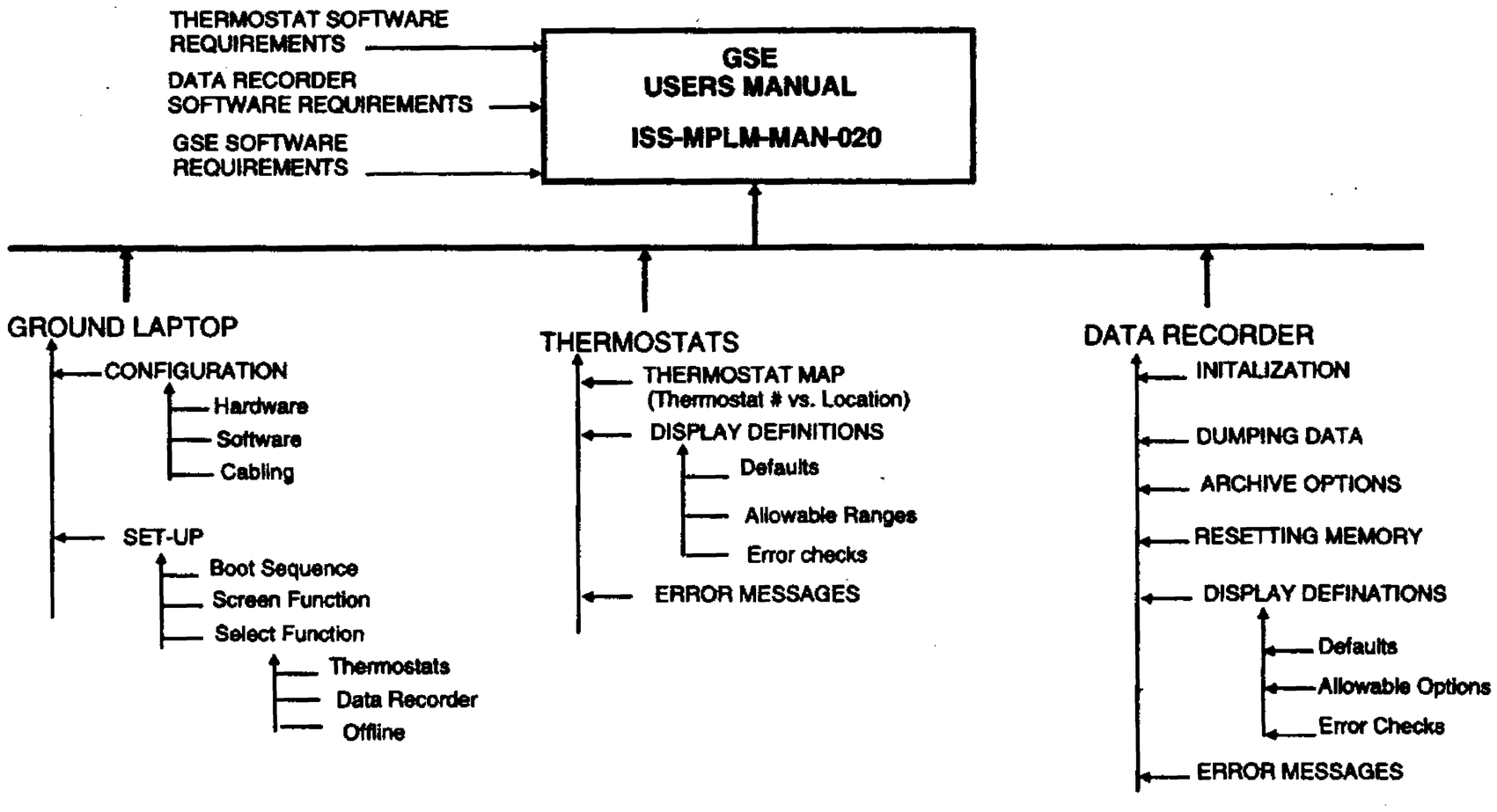

Figure 2 Documentation Tree (4 of 4)

Electronic Thermostat
- •Design - MSFC
  - •Case
  - •Electronics*
  - •Software
  - •Bracket
- •Safety Assess - MSFC
- •Manufacture - MSFC
- •Qual Test - MSFC
- •Accept Test - MSFC
- •ADP - MSFC
- •Deliver KSC - MSFC
- •Install Drng – ALTEC
  - •Thermo Str. Bond
  - •RTD Str. Bond
  - •Thermo Elect Bond

Heater Pads
- •No Chg

Power Harness
- •Modify
- Drawing-ALTEC
- Safety Assess-ALTEC
- Procedure - KSC

Comm Harness
- •Layout - ALTEC
- •Design - TBD
- •Installation Drawing-ALTEC
- •Safety Assess – MSFC/TBD
- •Manufacture - TBD
- •Test –MSFC/TBD
- •ADP-MSFC/TBD

Data Recorder
- •Design - MSFC
  - •Case
  - •Electronics
  - •Software
  - •Bracket
- •Safety Assess - MSFC
- •Manufacture - MSFC
- •Qual Test – MSFC

Accept Test - MSFC
- •ADP - MSFC
- •Deliver KSC - MSFC
- •Install Drng – ALTEC
  - • Str. Bond
  - • Elect Bond

Ground Computer Support Equipment
- •Design - MSFC
- •Software - MSFC
- •User Instruction – MSFC
- •Gnd Safety Assess – MSFC
- •Cabling – MSFC

Figure 3: MPLM Programmable Thermostat Hardware/Software Ownership Matrix

12. ACQUISITION SUMMARY

The Programmable Thermostat acquisition strategy is based primarily on NASA in-house activities and supported, as required, by limited parts procurement from commercial sources.

The thermostat will be designed at MSFC and the thermostat unique drawings will be controlled through the MSFC release system. MSFC's Engineering Directorate will go to an approved machine shop to have the mechanical piece parts manufactured and will go to Soldering Technology (or other approved vender) to have the thermostats assembled and potted to MSFC configuration controlled documentation.

13. PROGRAM/PROJECT DEPENDENCIES

The successful Development and Delivery of the Programmable Thermostats to the ISS will result in significant resource savings.

The NEW thermostats will eliminate the need for an internal MPLM dry air purge before launch, thereby allowing the MPLM to be accessible later in the flow process.

On-orbit the thermostats will maintain control of the MPLM internal environment to a tighter tolerance than the current method. This will result in savings of Orbiter cryo and a reduced number of pre-mission thermal analyses.

14. AGREEMENTS

Additional agreements, if required, will be negotiated during the coordination and review cycle.

15. PERFORMANCE ASSURANCE

The SAFETY AND MISSION ASSURANCE PROGRAM PLAN, ISS-MPLM-PLAN-008 defines the Roles and Responsibilities of the MSFC S&MA Office, for all ASI produced hardware.

The Pressurized Carriers Group Quality Plan, ISS-MPLM-PLAN-019 specifies the Quality Assurance approach to implementing the MSFC Quality System as defined in MPD1280.1 (Marshall Management Manual) for MPLM sustaining engineering projects developed in-house. These functions include inspection, assembly and test activities associated with the design, development and checkout of hardware to be installed on the Flight Modules.

The MSFC S&MA Office (QS30) has the necessary authority to act upon or perform the following:

- Monitor programmatic Risk, mishaps and malfunctions.
- Review and make recommendations to the MPLM Project Office regarding safety Quality, Reliability, Risk Management, waivers, and deviation requirements.
- Analyze system design changes and monitor test activities as necessary to verify these changes.

The MPLM Programmable Thermostats will be designed in accordance with the requirements of SSP50021, "Space Station Safety Requirements Document". The design of the replacement thermostats will be such that swapping the new Programmable Thermostats with the existing Bi-Metallic Thermostats will not affect the functionality of the MPLM. In summary, the new Thermostats will perform the same function as the existing Thermostats and the design goal for the system will be to tolerate one failure in twenty (20) Thermostats.

The MPLM Programmable Thermostat hardware development activity will use MSFC ALERT system to track potential non-conformances related to parts, components, and manufacturing processes.

The new MSFC Programmable Thermostat's wiring diagrams/electrical schematics will be used to generate the formulation of new Reliability Analyses and FMEA work sheets.

16. RISK MANAGEMENT

The Risk Management process applicable to this Development activity is defined in the Pressurized Carriers Group, Risk Management Plan number FPD-FD24.01. The Plan will, as a minimum, address the following:

1.0 Applicability
2.0 Process
3.0 Reports and records

The Risk Management process has been tailored for this Development activity as authorized by the above Plan.

The Systems Engineer, supported by the necessary responsible personnel from other Center organizations will perform the Risk Management process on a continuing basis. The Risks will be identified, mitigation actions developed and resolutions achieved. This

activity will be reviewed and discussed at each weekly meeting. The Risk Management activity will be accomplished through a review of the design, parts selection, schedule, test requirements, and any other pertinent items, which may drive the Successful Development of the End Item. Risks will be identified, tracked, and reported on a Risk matrix as shown in the above Plan. The status of identified Risks will be reported at the FD monthly, and at the ISS quarterly. Records of Risks identified, mitigation actions, closures, Stoplight charts and tracking metrics will be maintained.

17. ENVIRONMENTAL IMPACT

There are no known environmental impacts identified in this development effort.

18. SAFETY

See Section 15.0 Performance Assurance

19. TECHNOLOGY ASSESSMENT

A disclosure of invention has been submitted by the MSFC Engineering Directorate for the programmable thermostat design entitled " Distributed Solid State Programmable Thermostat/ Power Controller". The assigned MSFC case number is MFS 31815-1.

20. COMMERCIALIZATION

This device could be used in any application where precision distributed temperature control is required for single heater elements. For example, this device could be powered from a 12Vdc source and used in the automotive industry as a distributed heater controller or power distribution controller. Similar applications could be used in the commercial and military aircraft industries, applications involving DC brush-type motors, solenoid valves, and thrusters which use sensor input control measurements.

21. REVIEWS

Informal technical reviews will be conducted on a weekly basis with the responsible people from the various disciplines within MSFC.
A similar summary management review will be conducted each week with the responsible personnel from FD24 Pressurized Carriers Group following the above review to discuss the overall status and develop courses of action as required.

Management reviews will be conducted monthly with the FD Personnel, and Quarterly with the ISS Vehicle Office. The reviews will cover the overall status

information and will include schedule, cost, performance status and any other management as well as technical topics as required.

Formal technical reviews, including all off-site participants (KSC, ALTEC, etc..), will be scheduled as required during the life of the Development Activity. A formal "Final Design" review will be conducted prior to initiating qualification fabrication and testing.

A Pre-delivery Acceptance Review will be conducted at MSFC after completion of Development, Fabrication, Qualification Testing and prior to the delivery of Flight hardware to KSC. The results of this review will be documented and approved by the Pressurized Carriers Group (FD 24). An "Integrated System Design Review" will be conducted to ensure design compatability between the Thermostat Hardware Cable.

22. TAILORING

This Plan has been prepared in accordance with NPG 7120.5A, and every effort has been made to implement the intent of that document. The only tailoring that has been performed is in relation to the scope of implementation of the NPG requirements. All disciplines are addressed and have been implemented. In the interest of efficiency (resources), some informal accounting activities, will take the place of formal documentation.

The thermostat hardware requirements are defined in the Thermostat End Item Specification MSFC-SPEC-3274.

The data recorder hardware requirements are defined in the Data Recorder End Item Specification MSFC-SPEC-3322.

A GSE Users Manual will be developed and provided. The manual will tell the user how to operate the GSE to program the Thermostats and to down load the recorded data.

The test objectives, processes and limits are defined in the Thermostat Test Plan, ISS-MPLM-Plan –018.

The Risk Management approach is defined in the Risk Management section of this document.

The Safety and Mission Assurance approach is defined in the Performance Assurance section of this document.

The Quality approach is defined in the Performance Assurance section of this document.

The Configuration Management approach is identified in a standalone Configuration Management Plan, FD24-CM01.

A documentation tree has been developed and is shown in Figure 5. The documentation tree has been expanded to include a more comprehensive listing of the products, (drawings, specification, etc.), that will be produced in support of this development activity.

23. CHANGE LOG

Changes to this document will be recorded in the document history log.

24. TBD LOG

The following TBDs in this document need to be resolved.

(TBD) will provide the manufacturing drawing of the Thermostat Communication cable.

(TBD) will manufacture test and deliver the Communication cable per the above drawing.

The TBD's were closed 2/5/03 as a result of awarding the cable activity to KSC.

Acronyms

ALTEC	Alenia Logistics Technical Engineering Center
ADP	Acceptance Data Package
ASI	Agenzia Spaziale Italiana (Italian Space Agency)
BCD	Budget Change Document
CR	Change Request
CWC	Collaborative Week Commitments
DC	Direct Current
ED	Engineering Directorate
EMI/EMC	Electromagnetic Interference/Electromagnetic Compatibility
FD	Flight Projects Directorate
FMEA	Failure Modes & Effects Analysis
FY	Fiscal Year
ISS	International Space Station
ITA	Internal Task Assignment
JSC	Johnson Space Center
KSC	Kennedy Space Center
MPLM	Multi-Purpose Logistics Module
MSFC	Marshall Space Flight Center
PTCS	Passive Thermal Control Sub-system
PWA	Printed Wire Assembly
RTD	Resistive Temperature Device

STS	Space Transportation System
S&MA	Safety & Mission Assurance
TBD	To Be Determined

Appendix A

Form Date: 9/18/98

1.Directive No. | 2. Board/Date:
R1 SSCN: 003578 | International Space Station | **SSPCB OSB**
| Program Change Directive |
R1 3. Revision: 1 | 4. Page 1 of **2**

5. Title: MPLM Modifications to Minimize PPRV Operations and Maximize Orbiter Cryo Savings

6. Baseline Documents Affected:
R1 Document Number: **SSP41164, SSP41155, SSP57000, ICDA-21350**
Document Title:

7. a) Direction:
R1 This directive **was** issued to authorize partial implementation of Change
Request 003578 and to provide funding to Marshall Space Flight Center (MSFC) to obtain analytical support from Alenia in the effort to replace the existing thermostats in all three MPLM articles which will prevent undesired activation of the positive pressure relief valves (PPRV's).
R1 Directive R1 is required to authorize implementation of
R1 Change Request 003578 and to provide additional funding to Marshall
R1 Space Flight Center (MSFC) and ASI to design, qualify, procure and
R1 install thermostats that will replace the existing 28Vdc shell
R1 thermostats in the MPLM articles. A revision to this directive
R1 establishing technical agreement among all affected Program Teams is
R1 required prior to update/release of documentation.
b) Program Impact:
The cost impact identified is Non-Prime only and is reflected in block 8
R1 of this directive. **The Non-Prime cost reflected in block 8 includes**
R1 $1.038M for MSFC and $220K for ASI. The ASI cost impact reflects an
R1 estimate and final costs will be negotiated with NASA and ASI.
R1 c) Actions: **See Page 2**
8. Total
Approved
Cost
FY 00 FY 01 FY 02 FY 03 Balance Total
Boeing: $0 $ $ $ $ $ 0
R1 NASA: $60K **$870K* $388K** $ $ $ **60K 1.318M**
R1 Total: $60K **$870K $388K** $ $ **$ 1.318M**
R1 *$650K to ITA MSE-07
R1 *$220K to ASI
9. Background/Reason for Directive:
The MPLM 28Vdc heater circuits currently have setpoints of 84 degrees F. As soon as the MPLM shell heaters are enabled, the heaters remain active until the MPLM shell temperatures reach 98 degrees F. This heater operation causes the MPLM internal temperature to increase until the internal pressure causes activation of the PPRVs. Operation of the PPRV during nominal operations is not desired because failure of the valve to fully re-seat will result in the loss of the MPLM mission. Thermostats using lower open/close setpoints will maintain module

MARSHALL SPACE FLIGHT CENTER
CONTROL BOARD DIRECTIVE (CBD)

1. CBD NUMBER:	2. CONTROL BOARD:	3. DATE:
MP3-00-0065	MPLM Level III CCB	10/11/2003
4. CHANGE NUMBER: FD24-0032		5. PAGE 1 OF 1
6. PROGRAM CONTROL NUMBER: MP00063	7. RESPONSIBLE INDIVIDUAL(S) ORGANIZATION(S): Bessie LEE/ FD24 / PWI phone: 544-7109 e-mail: bessis.lee@msfc.nasa.gov	
8. CHANGE TITLE: Pressurized Carrier Group Multi Purpose Logistic Module Thermostat Development Plan Rev. C	9. BASELINE DOCUMENT(S) OR DATABASE AFFECTED: Basic	
10. CONFIGURATION ITEM (CI)/CSCI NO. AND NOMENCLATURE:	11. EFFECTIVITY (CI/CSCI ONLY): MP01	

12. BASELINE AFFECTED:

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

OTHER: _____

13. IMPACT COST: ☐ YES ☒ NO

☐ COST SPECIFIED IN ATTACHMENT

FY- ____ COST: ____ FY ____ COST: ____

FY- ____ COST: ____ FY ____ COST: ____

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

14. IMPACTS:

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

OTHER: _____

15. CHANGE DISPOSITION:

1.ECR FD24-0032 is approved as written.

2. Pressurized Carriers Group Multi Purpose Logistic Module Thermostat Develovement Plan Rev .C Dated October 2003, is Hereby baseline.

3.Bessie Lee/PWI shall provide a copy of this document ISS-MPLM-PLAN-017 to the MSFC Documentation Repository for file and distribution per the Pressurized Carriers Group Distribution List.

4.All future changes to this Document shall require an ECR.

5.Debbie McWhorter shall put Pressurized Carriers Group Multi Purpose Logistic Module Programmable Thermostat Development Plan Rev. C on the MPLM web sight.

16. BOARD MEMBERS	CONCUR YES	CONCUR NO	BOARD MEMBERS	CONCUR YES	CONCUR NO	17. BOARD CHAIRPERSON
Jon Holladay /FD24	X		Additional Distribution:	X		Randy K McClendon 7 Oct '03
Jon D. Holladay						
						Randy McClendon/FD24 PC/MPLM .
Shawn Reagan/FD24						Chairman
Shawn E. Reagan	X					DATE
						18. SECRETARIAT
Kathy Jones/FD24 K Jones	X					
				X		Bessie Lee
						Bessie Lee/FD24/PWI
Michelle Butler/FD11						MPLM/PC CCB Secretariat
						DATE 7 Oct 03

MSFC Form 2312 (Rev. March 2003) Informed

1. NUMBER:	2. PCN:	**MSFC ENGINEERING CHANGE REQUEST (ECR)** (See Instructions: MSFC Form 2327-2)	3. DATE:	4. PAGE:
FD24-0032	MP00063		10/10/2003	1 OF 1

5. TO:	6. THRU:	7. FROM:
FD24/Randy K. McClendon		FD24Dalas Clarkl

8. TITLE OF CHANGE:

Multi Purpose Logistics Module Programmable Thermostat Development Plan Rev. C Rev.A

9. RECOMMENDED PRIORITY:	10. NEED DATE:
☐ EMERGENCY ☐ URGENT ☒ ROUTINE	10/11/2003
11. PROGRAM(S)/PROJECT(S) AFFECTED:	12. CONFIGURATION ITEM(S) AFFECTED BY NOMENCLATURE:
FD24	Pressurized Carriers/MPLM
13. RECOMMENDED EFFECTIVITY(IES):	14. DOCUMENTATION AFFECTED (Specs, ICD, etc.):
MP01	N/A
15. RELATED CHANGES (ECR, ECP, CR, etc.) BY NUMBER:	15A. INITIATING DOCUMENT NUMBER (e.g., DR, Software Trouble Report, etc.):
N/A	

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

Update Figure 1 to note the replacement of thermal pad & Upedate section 7.0 to reflect design changes.

17. EFFECTS ON:

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

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

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

Update Figure 1 to note the replacement of thermal pad & Upedate section 7.0 to reflect design changes in ISS-MPLM-PLAN-017 Rev. C. C

19. MOD KIT INFORMATION:

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

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

20. SIGNATURE OF ORIGINATOR:	DATE:	TELEPHONE NUMBER:	OFFICE SYMBOL:
Shawn E. Reagan for Dallas Clark	10/8/03	(256) 544-9521	FD24

21. **CONCURRENCE**

SIGNATURE	ORG. CODE	DATE	SIGNATURE	ORIG. CODE	DATE

22. **TECHNICAL APPROVAL**

SIGNATURE	ORG. CODE	DATE	SIGNATURE	ORIG. CODE	DATE

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

PROGRAM/PROJECT:
PC/MPLM

CEI NUMBER:	NOMENCLATURE: Pressurized Carriers Group Mutli Purpose Logistics Module Thermostat Development Plan Rev. C
ECR NUMBER: FD24-0032	CCBD NUMBER: MP3-00-0065
PCN NUMBER: MP00063	DATE PREPARED: 10/09/2003

DRAWING / DOCUMENT NUMBER	DRL / EPL NUMBER	EO NUMBER
1SS-MPLM-PLAN-017	204	

SUBMITTED BY ENGINEERING AREA:	BASIC RELEASE ☐ ; PARTIAL ☐ COMPLETE ☒
	CHANGE RELEASE ☐ ; PARTIAL ☐ COMPLETE ☐

THIS SUBMITTAL CLOSES ACTION ON ABOVE CCBD BY:
☒ YES ☐ NO

PREPARED BY: FD24/Bessie Lee	DATE: 10/09/2003	TRANSMITTAL DATES
SUBMITTED BY: FD24/Bessie Lee	DATE: 10/09/2003	TO RELEASE: 10/09/2003
CONCURRENCE: FD24/Shawn Reagan	DATE: 10/09/2003	TO MSFC REPOSITORY:

REMARKS:

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:
PressurizedCarriers Group/MPLM	ISS-MPLM-PLAN-017	MP00063	10/09/2003	10-13-03

6. DOCUMENT/DRAWING TITLE:	7. REPORT TYPE:
Pressurized Carriers Group/Mutli Pourpose Logistics Module Programmable Thermostat Develoment Plan Rev. C	Plan

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

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

14. SPECIAL INSTRUCTIONS:

Send Bessie Lee 6 copies Bld 4610 rm 4028 (attached)

IF ANY QUESTIONS CALL BESSIE LEE 544-7109

15. CONTRACTOR/SUBMITTING ORGANIZATION, ADDRESS AND PHONE NUMBER:	16. ORIGINATING NASA CENTER:
MSFC	MSFC
	17. OFFICE OF PRIMARY RESPONSIBILITY: Kathy Jones/ FD24

18. PROGRAMMATIC CODE (5 DIGITS): 477-72-61	19. NUMBER OF PAGES: 2431

II. ENGINEERING DRAWINGS

20. REVISION:	21. ENGINEERING ORDER:	22. PARTS LIST:	23. CCBD:
~~B~~ C	NA	N/A	MP3-00-0065

III. REPORTS, SPECIFICATIONS, ETC.

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

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

35. APPENDIX:	36. ADDENDUM:	37. CCBD:	38. CODE ID:	39. IRN:
		MP3-00-0065		

IV. EXPORT AND DISTRIBUTION RESTRICTIONS

- ☐ Privacy Act (see MWI 1382.1)
- ☐ Proprietary (see MPD 2210.1)
- ☐ Patent (see MPG 2220.1)
- ☐ ITAR (see MPG 2220.1)
- ☒ EAR (see MPG 2220.1)
- ☐ Other ACI (see NPG 1620.1 and MPG 1600.1) _____
- ☐ No statutory or institutional restrictions applicable -- material may be electronically distributed to user in the NASA domain

V. ORIGINATING ORGANIZATION APPROVAL

40. ORG. CODE:	41. PHONE NUMBER:	42. NAME:	43. SIGNATURE/DATE:
FD24	(256) 544-3559	Randy K.McClendon	Randy K McClendon 9 Oct '03

VI. TO BE COMPLETED BY MSFC DOCUMENTATION REPOSITORY

44. RECEIVED BY:	45. DATE RECEIVED:	46. WORK ORDER:
G Bevilacqua	10/10/03	02-000644