INDEPENDENT ORBITER ASSESSMENT

ASSESSMENT
OF THE
MANNED MANEUVERING
UNIT

19 FEBRUARY 1988

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEM ENGINEERING AND OPERATIONS SUPPORT

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INDEPENDENT ORBITER ASSESSMENT ASSESMENT OF THE MANNED MANEUVERING UNIT

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Independent Orbiter Assessment Assessment of the Manned Maneuvering Unit FMEA/CIL

1.0 EXECUTIVE SUMMARY

The McDonnell Douglas Astronautics Company (MDAC) was selected in June 1986 to perform an Independent Orbiter Assessment (IOA) of the Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL). Direction was given by the STS Orbiter and GFE Projects Office to perform the hardware analysis using the instructions and ground rules defined in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986.

The IOA effort first completed an analysis (Reference 6) of the Manned Maneuvering Unit (MMU) hardware, generating draft failure modes and potential critical items. To preserve independence, this analysis was accomplished without reliance upon the results contain within the NASA FMEA/CIL documentation. The IOA results were then compared to the proposed Martin Marietta FMEA/CIL Post 51-L updates (Reference 7). A discussion of each discrepancy from the comparison is provided through additional analysis as required. However, due to the cancellation of the Martin Marietta FMEA/CIL task, and subsequent cancellation of the IOA FMEA/CIL task, the resolution of these discrepancies were not These discrepancies were flagged as issues, and attempted. recommendations were made based on the FMEA data available at the This report documents the results of this comparison for time. the Orbiter MMU hardware.

The IOA product for the MMU analysis consisted of 204 failure mode "worksheets" that resulted in 95 potential critical items being identified. Comparison was made to the NASA baseline (as of January 5, 1987) which consisted of 179 FMEAs and 110 CIL items. The comparison determined if there were any results which had been found by the IOA but were not in the NASA baseline. This comparison produced agreement on all but 121 FMEAs which caused differences in 92 CIL items. Figure 1 presents a comparison of the proposed Post 51-L NASA baseline, with the IOA recommended baseline, and any issues.

The issues arose due to differences between the NASA and IOA FMEA/CIL preparation instructions.

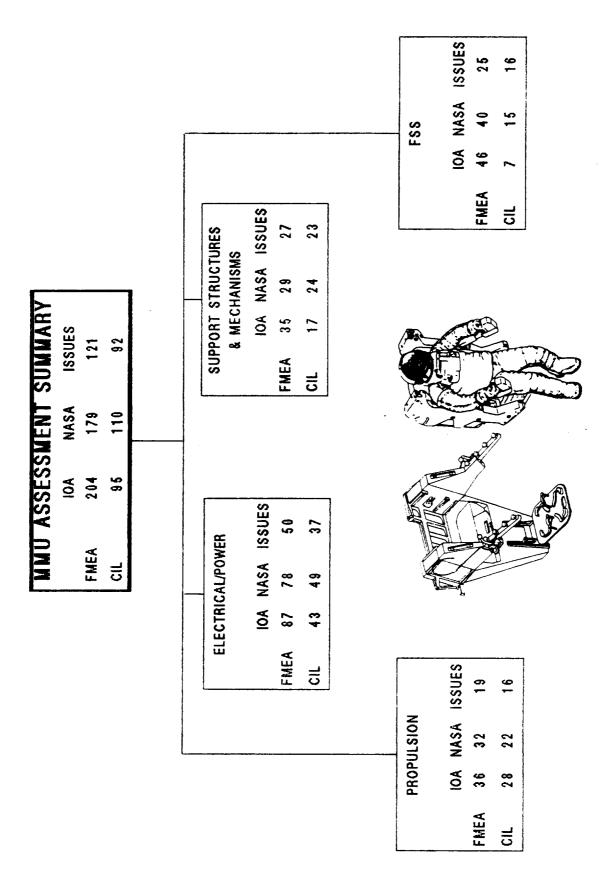


Figure 1 - MMU FMEA/CIL ASSESSMENT

2.0 INTRODUCTION

2.1 Purpose

The 51-L Challenger accident prompted the NASA to readdress safety policies, concepts, and rationale being used in the National Space Transportation System (NSTS). The NSTS Office has undertaken the task of reevaluating the FMEA/CIL for the Space Shuttle design. The MDAC is providing an independent assessment of the Orbiter and Government Furnished Equipment (GFE) FMEA/CIL for completeness and technical accuracy.

2.2 Scope

The scope of the independent FMEA/CIL assessment activity encompasses those Shuttle Orbiter subsystems and GFE hardware identified in the Space Shuttle Independent FMEA/CIL Assessment Contractor Statement of Work. Each subsystem analysis addresses hardware, functions, internal and external interfaces, and operational requirements for all mission phases.

2.3 Analysis Approach

The independent analysis approach is a top-down analysis utilizing as-built drawings to breakdown the respective subsystem into components and low-level hardware items. Each hardware item is evaluated for failure mode, effects, and criticality. These data are documented in the respective subsystem analysis report, and are used to assess the NASA and Prime Contractor FMEA/CIL reevaluation results. The IOA analysis approach is summarized in the following Steps 1.0 through 3.0. Step 4.0 summarizes the assessment of the NASA and Prime Contractor FMEAs/CILs that is performed and documented at a later date.

- Step 1.0 Subsystem familiarization
 - 1.1 Define subsystem functions
 - 1.2 Define subsystem components
 - 1.3 Define subsystem specific ground rules and assumptions
- Step 2.0 Define subsystem analysis diagram
 - 2.1 Define subsystem
 - 2.2 Define major assemblies
 - 2.3 Develop detailed subsystem representations
- Step 3.0 Failure events definition
 - 3.1 Construct matrix of failure modes
 - 3.2 Document IOA analysis results

- Step 4.0 Compare IOA analysis data to NASA FMEA/CIL
 - 4.1 Resolve differences
 - 4.2 Review in-house
 - 4.3 Document assessment issues
 - 4.4 Forward findings to Project Manager

2.4 MMU Ground Rules and Assumptions

Due to the unique functions performed by the MMU, the IOA project determined it necessary to establish groundrules and assumptions applicable solely to the MMU (reference Appendix B). These ground rules and assumptions, in addition to those established project wide (also provided in Appendix B), are intended to both complement and supplement those defined in NSTS 22206. Additionally, they ensure that the IOA MMU analysis is capable of being understood by personnel who did not directly participate in the analysis.

3.0 SYSTEM DESCRIPTION

3.1 Design and Function

The MMU, reference Figure 2, is a modular, self-contained, propulsive backpack designed to attach to the Extravehicular Mobility Unit (EMU) and to be donned and doffed by one unassisted crewmember. When used, the MMU increases the Orbiter crew's Extravehicular Activity (EVA) mobility by extending the range of their activities from the payload bay to other portions of the spacecraft, to appendages of payloads protruding from the cargo bay, or to other spacecraft entirely. When not in use, the MMU is stowed in the forward payload bay on the Flight Support Station (FSS), reference Figure 3. Two MMUs are typically flown on each Orbiter mission.

The IOA analysis has defined the MMU as being comprised of a propulsion subsystem, electrical/power subsystem, support structures and mechanisms, and the FSS. These subsystems and hardware can operate singly or in an integrated manner to perform four primary functions: propulsion, control, system maintenance and stowage, and crewmember restraint/fit.

- <u>Propulsion Subsystem</u> Two independent, identical subsystems 1. are each capable of providing the translational and rotational forces necessary for propulsion. Inert GN2 propellant is stored in two pressure vessels. Activation of a motor-driven isolation valve (open) allows GN2 to flow to a pressure regulator and then to the thruster manifolds which consist of four 3-thruster (triad) assemblies for each of the two subsystems. Based on hand-controller and gyro inputs, electrical power to the thruster solenoid valves result in expansion of the nitrogen gas through a nozzle to produce propulsion. The two systems are isolated but can be interconnected through hand-actuated toggle valves. Quickdisconnect valves provide GN2 recharge capability for the pressure vessels when the MMU is stowed in the FSS. 4 is a schematic of the propulsion subsystem.
- 2. <u>Electrical/Power Subsystem</u> Encompasses the control electronics and the power storage and distribution within the MMU. Figure 5 presents an overview of this subsystem.

The maneuvering control comprises three main elements - two hand controllers and the Control Electronics Assembly (CEA). These operate together to provide signals to the propulsion system for rotational or translational motion. The Rotational Hand Controller (RHC) furnishes switching logic that converts rotary motions of the handle to rotational commands. The RHC also supplies control for the attitude hold function. The Translational Hand Controller (THC) provides switching logic that converts the motions of the handle in three axes to translational commands. The THC also controls the propellant isolation valve.

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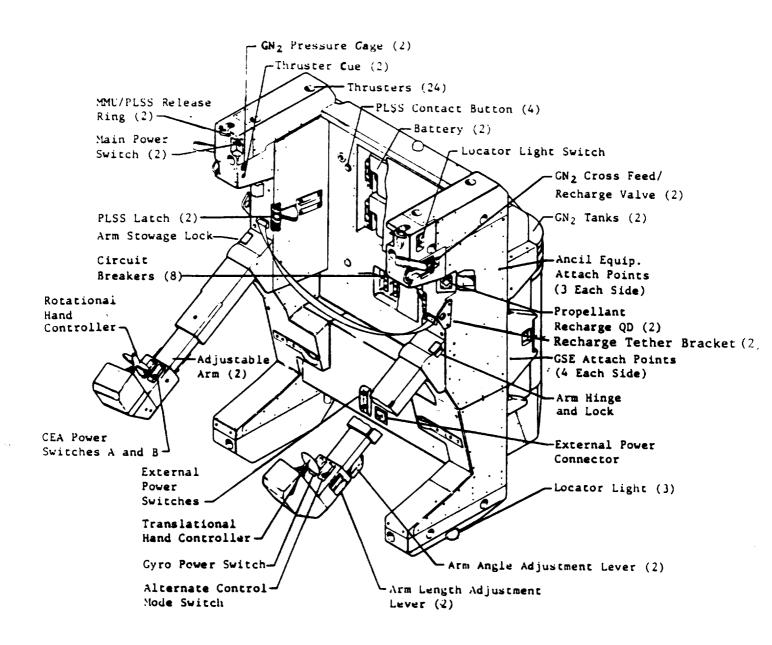


Figure 2 - MANNED MANEUVERING UNIT (MMU)

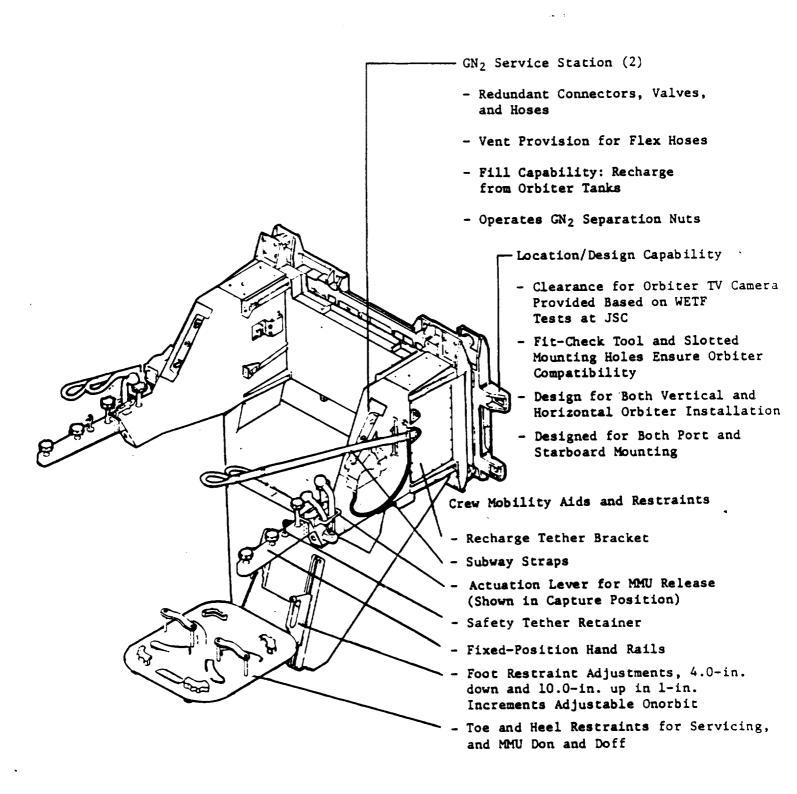


Figure 3 - FLIGHT SUPPORT STATION

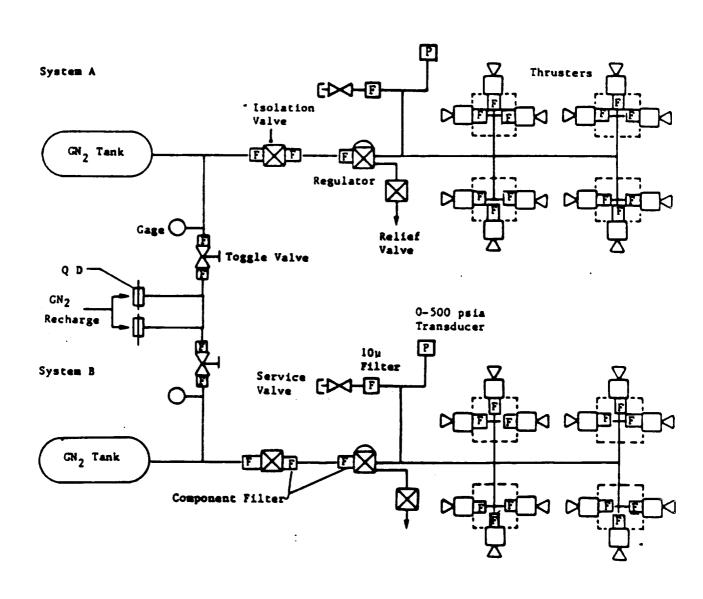


Figure 4 - PROPULSION SUBSYSTEM SCHEMATIC

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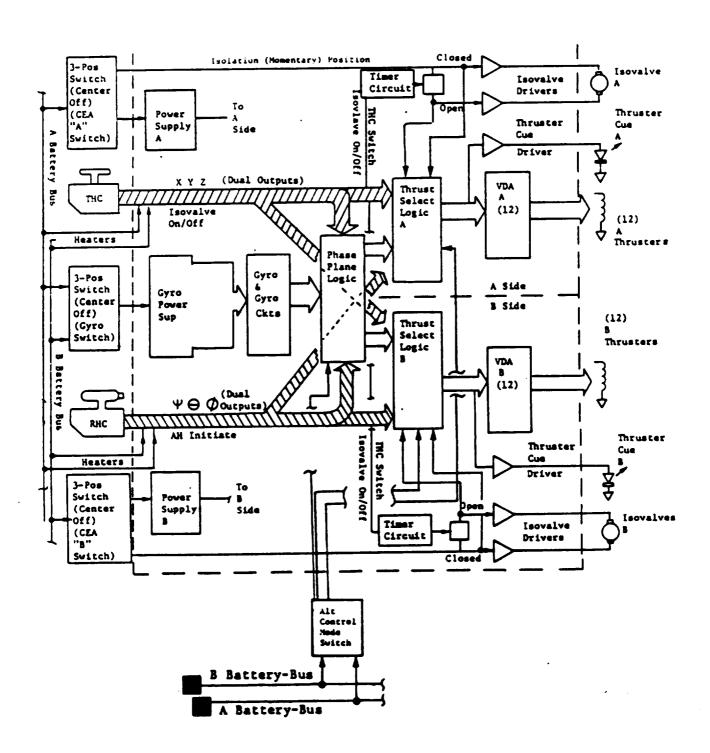


Figure 5 - ELECTRICAL/POWER SUBSYSTEM OVERVIEW

The CEA contains circuitry to operate the thruster valves of the propulsion system, and circuitry to respond to hand-controller commands for translational and rotational control. Gyro circuitry provides attitude and rate information. Phase-plane circuitry furnishes inputs for the thruster select logic for the automatic attitude hold mode of operation.

The thruster select logic uses either or both redundant thruster sets to convert manual and/or attitude hold commands to thrust commands. Valve drive amplifiers amplify the thruster valve signals to levels required for valve operation. Isolation valves, when open, allow GN₂ to flow from the pressure vessels to the pressure regulators.

Thruster cue lights allow a visible indication of thruster commands and isolation valve operation.

The power comprises two silver-zinc batteries and two separate power distribution systems that include the circuit breakers, switches, and relays required for MMU operation. Power conditioners in the CEA, fed from the batteries, supply power to the CEA and hand controllers. Locator lights provide visible indication of the location of the EVA crewmember to an observing crewmember inside the Orbiter. The locator lights consist of a converter assembly and three light assemblies. The batteries also furnish heater power for the propulsion heaters and hand controller case heaters. Heaters are required for both orbital storage and EVA operations. During EVA, skin temperatures can be as low as -120 degrees F, whereas most components must be above -60 degrees F for operation.

3. Support Structures and Mechanisms - The basic MMU structure consists of two side towers connected by the center structure and two arms. The towers support the thrusters and provide mounting for the MMU/FSS retention latches and the propulsion subsystem Quick Disconnects (QDs). The center structure supports the two batteries, eight circuit breakers, the CEA, two pressure vessels, and propulsion equipment. Also supported are the external power connector, and thermal cover, and the thermal covers for the batteries.

In conjunction with the towers, the center structure supports the retention system for the EMU. This EMU/MMU retention system consists of two independent manually activated latches, guide ramps, and back-support points. The arms can be pivoted and extended for flight or located in the stowed position.

4. Flight Support Station (FSS) - The FSS, reference Figure 3, provides MMU stowage, GN2 pressure vessel recharge, and stowage heaters for the MMU on the port or starboard side of the Orbiter near the EVA airlock and hatch.

The FSS structure comprises the side arms, foot restraints, and the Orbiter mounting structure. A locking handle and butterfly latch are provided for flight docking, capture, and release of the MMU. The foot restraints are adjustable on orbit to accommodate the full range of astronaut anthropometry. Shock mounts (vibration isolators) are provided to attenuate the Orbiter launch environment. The MMU is secured in the FSS during launch with four capture bolts and Gas Actuated Nuts (GANs) installed in the MMU. On astronaut operation, the nuts will actuate and MMU bolts release, allowing FSS egress. For contingency operations, the nuts can be manually engaged or disengaged.

The pneumatic portion of the FSS consists of a dual Orbiter interface which routes GN2 to redundant charging systems, either one of which can recharge the MMU propulsion system. Each charging system contains a charging valve, vent valve, flex hose, and one-half of the QD. GN2 can also be supplied to the GANs used for MMU-to-FSS launch attachment.

FSS heaters are supplied 28-Vdc power from the Orbiter through two independent power buses. Breakers in the Orbiter cabin furnish circuit protection. Five temperature sensors are provided for crew temperature monitoring of the MMU during orbital storage.

3.2 Interfaces and Locations

Interfaces occur between the MMU (including the FSS) and other Space Transportation System (STS) Orbiter elements in three specific areas. First, the MMU itself interfaces with the FSS. Second, structural, mechanical, electrical, and nitrogen recharge interfaces exist between the Orbiter and the FSS. Third, mechanical and man/machine interfaces exist between the crewmember in the EMU and the MMU.

When not in use the MMU is stowed in the front of the payload bay of the Orbiter on the FSS. Due to this location the MMU is continually exposed to the space environment when in orbit. The EMU to MMU interfaces are depicted in Figure 6. The MMU to FSS interfaces envelopes in the payload bay are depicted in Figures 7 and 8.

3.3 Hierarchy

Figures 9 through 13 illustrate the hierarchical relationships between the MMU, subsystems, and components employed for the enclosed IOA analysis.

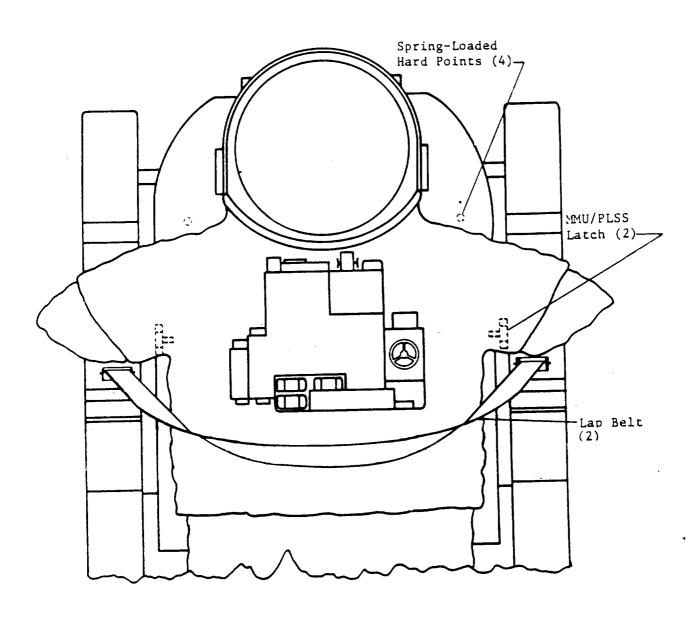


Figure 6 - MMU-EMU INTERFACES

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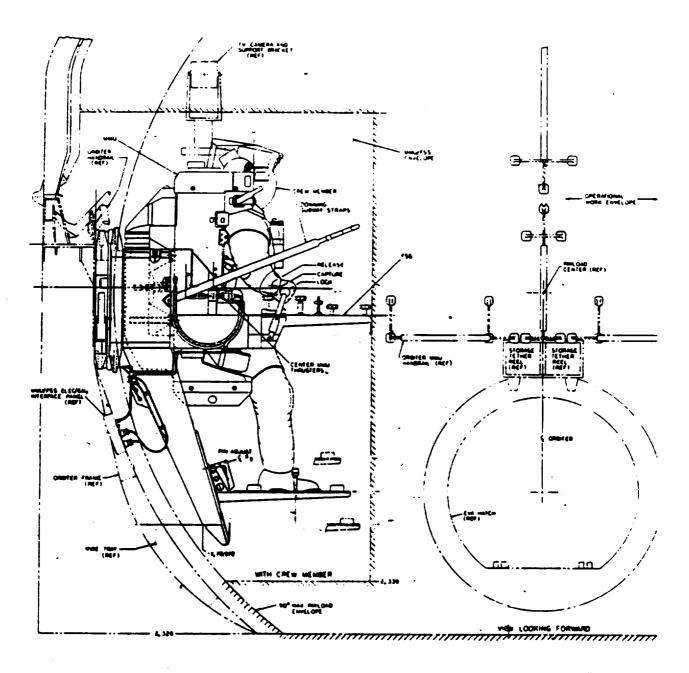


Figure 7 - MMU-FSS ENVELOPE - PORT SIDE

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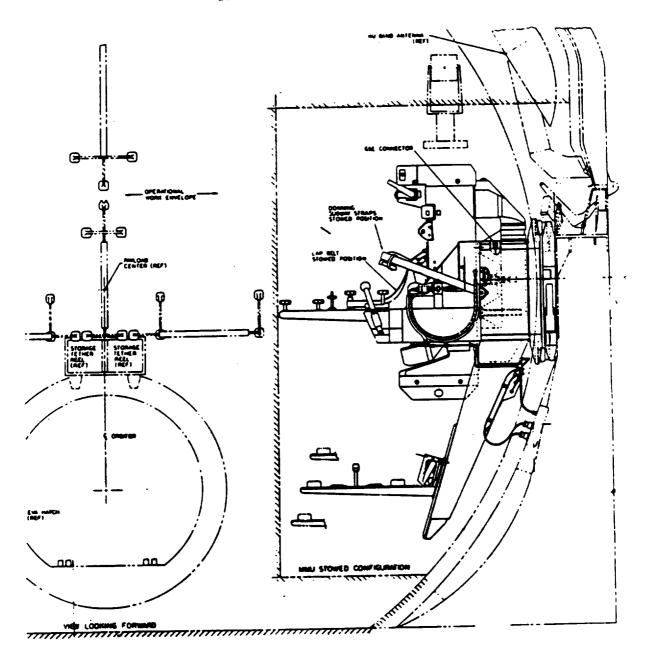


Figure 8 - MMU-FSS ENVELOPE - STARBOARD SIDE

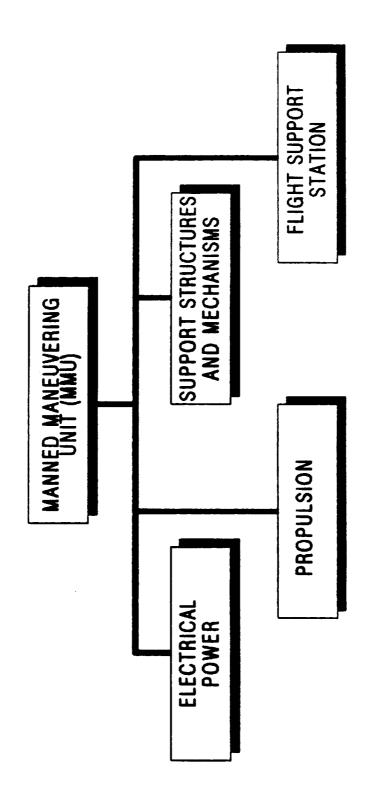


Figure 9 - MMU - TOP LEVEL HIERARCHY

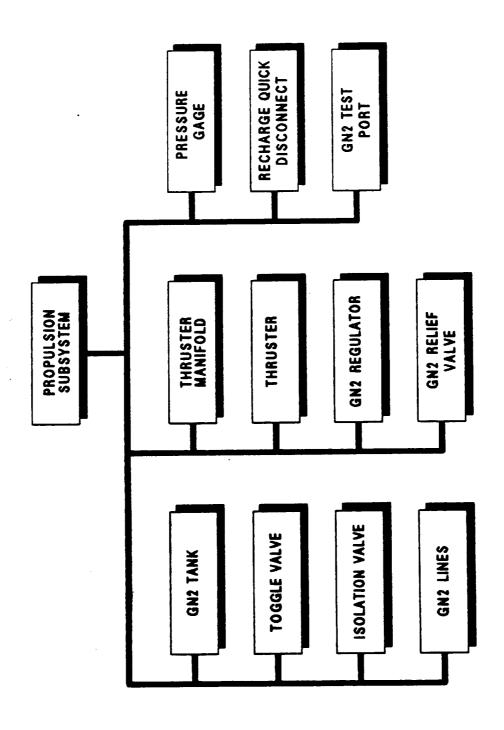


Figure 10 - PROPULSION SUBSYSTEM HIERARCHY

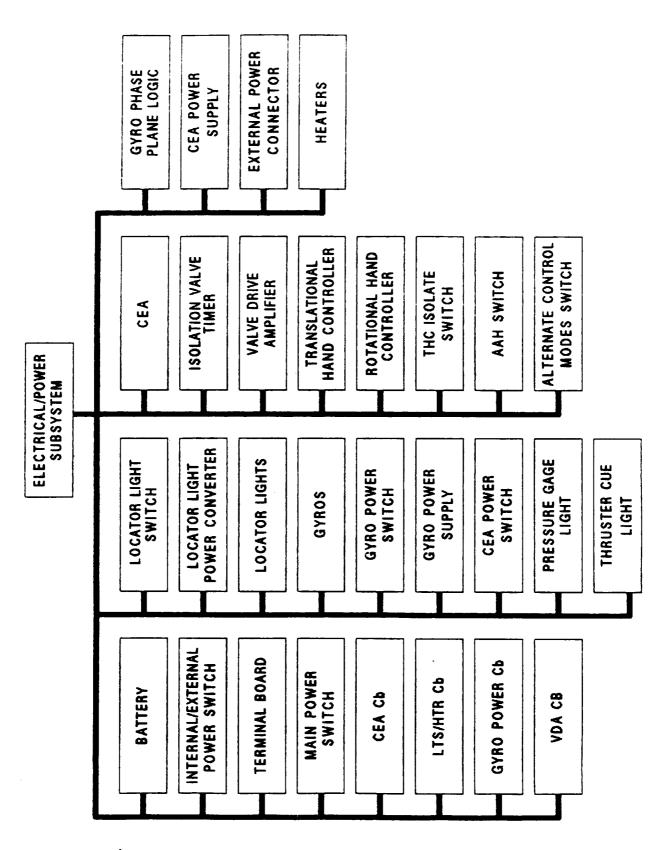


Figure 11 - ELECTRICAL/POWER SUBSYSTEM HIERARCHY

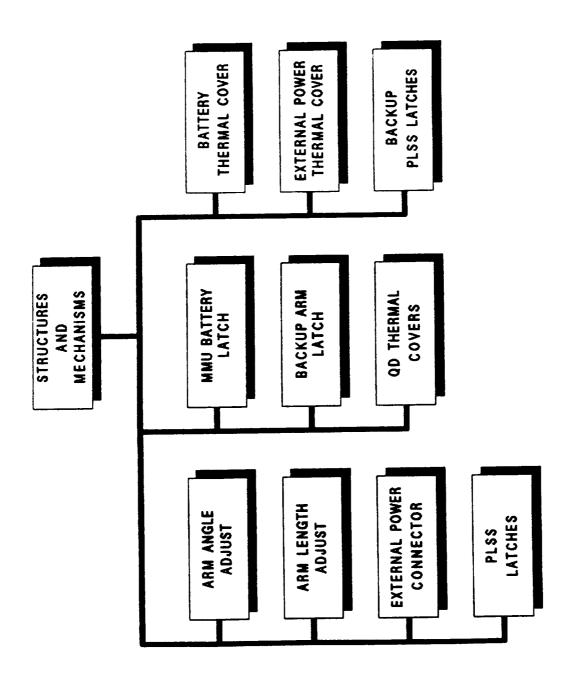


Figure 12 - HIERARCHY OF SUPPORT STRUCTURES AND MECHANISMS

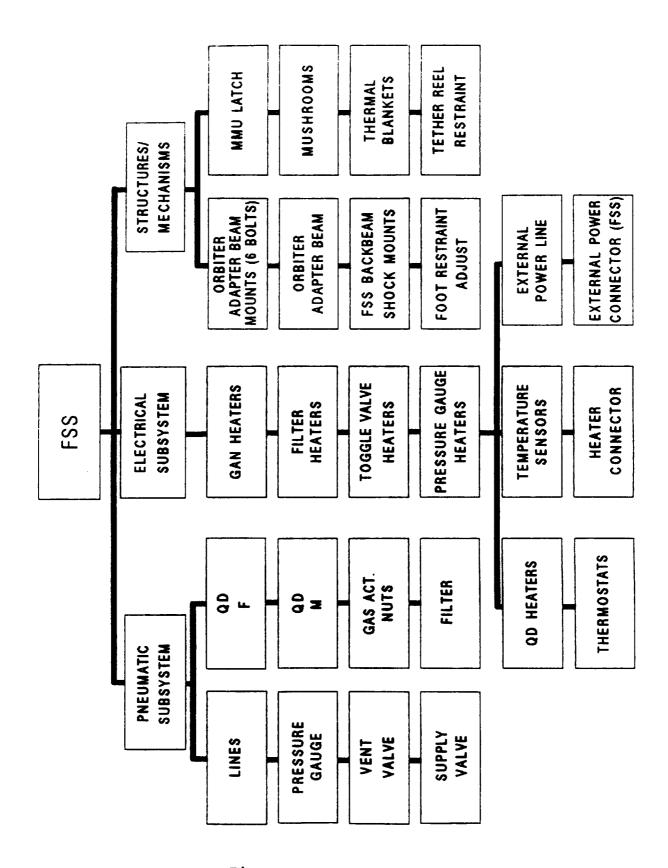


Figure 13 - FSS HIERARCHY

4.0 ASSESSMENT RESULTS

The MMU assessment was done based on the FMEA/CIL data received from Martin Marietta dated January 5, 1987 (Reference 7). Subsequent to the receipt of these data, a meeting was held on April 14, 1987 with Ms. Susan Goudy of the Martin Marietta Corporation and some of the significant issues were discussed. Resolution of these issues remained for a later date, and was not pursued after the cancellation of the Martin Marietta FMEA/CIL task by NASA. In this report, an attempt has been made to compare the IOA analysis results (Reference 6) to those of Reference 7, and bring the assessment process up to date with change 2 of NSTS-22206. Some of the significant issues identified are summarized below:

The Martin Marietta analysis format lacked a comprehensive definition of the flight phases, screens, and the item(s) under study. All the flight phases were not always analyzed for prep, ops, and post ops for each failure mode. The screens A and B were not specifically designated per NSTS-22206. IOA had to interpret their status based on very limited information provided. The screen C was not addressed, and it was therefore left blank throughout the assessment.

The Martin Marietta analysis did not address a specific hardware item in some cases, but used an assembly instead. This made it very difficult to investigate failure modes and effects of a particular item and its impact on the overall system.

- o The MMU PREP and POST-OPS definitions were not too clear and it was consequently difficult to match their criticalities. IOA considered every MMU activity to begin with PRE-OPS activities and end with POST-OPS activities prior to the start of the next MMU OPS. The Martin Marietta definition seems to suggest that the PREP activities start with the first MMU PRE-OPS and stop after the last MMU OPS activity. The period after the last planned MMU OPS will then be POST-OPS.
 - o There were a number of issues related to the treatment of the multi-position switches. The Martin Marietta used a more broad and general failure mode approach, such as open or closed. IOA considered and investigated the failure of single contact positions for open and closed and assigned the worst case criticality. Multi-position switches to fail open or closed were in general considered to be unreasonable.
 - o Electrical items, such as diodes, resistors, relays, etc., associated with an LRU circuit were not studied by Martin Marietta. IOA provided analysis for these items to be incorporated into the final FMEA/CIL study.

The IOA analysis of the MMU hardware initially generated 136 failure mode worksheets and identified 69 Potential Critical Items (PCIs) before starting the assessment process. In order to facilitate comparison, 57 additional failure mode analysis worksheets were generated. These analysis results were compared to the proposed NASA Post 51-L baseline of 179 FMEAs and 110 CIL items, which was generated using the NSTS-22206 FMEA/CIL instructions. Upon completion of the assessment, 121 of the 204 FMEAs remained as issues to be resolved. The explanations for these issues are provided on individual assessment sheets in Apendix C.

Appendix D highlights the NASA Critical Items and corresponding IOA worksheet ID. Appendix E contains the IOA additional analysis worksheets supplementing previous analysis. Appendix F provides a cross reference between the NASA FMEA and corresponding IOA worksheet(s). IOA recommendations are also summarized.

Table I presents a summary of the FMEA and IOA criticalities and the associated issue counts.

Table I Summary of IOA FMEA Assessment Issues								
Component	NASA	IOA	Issues					
Propulsion	32	36	19					
Electrical/ Power	78	87	50					
Structures and Mechanism	29	35	27					
FSS	40	46	25					
TOTAL	179	204	121					

Table II presents a summary of the CIL assessment issues that exist for each component.

Table II Summary of IOA CIL Assessment Issues								
Component	NASA	IOA	Issues					
Propulsion Electrical/ Power Structures and	22 49 24	28 43 17	16 37 23					
Mechanism FSS	15	7	16					
TOTAL	110	95	92					

Table III presents a breakdown of the IOA recommended failure criticalities for the Post 51-L FMEA baseline.

TABLE III Summ	nary of	f IOA R	ecomme	nded Fa	ilure C	ritical	lities
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Propulsion Electrical/ Power	1 9	23 26	2 8	- 6	8 17	2 21	36 87
Structures and Mechanism	-	3	12	_	10 27	10 12	35 46
FSS	-	<u>-</u>	5				
TOTAL	10	52	27	8	62	45	204

Of the failure modes analyzed, ninety-five were determined to be critical items, distributed throughout MMU as shown in Table IV.

TABLE IV S	Summary	y of IO	A Reco	mmended	Critic	al Ite	ms
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Propulsion Electrical/ Power Structures and Mechanism	1 9 -	23 26 3	2 8 12	-	2 - 2	- -	28 43 17
FSS	_	_	5	-	2	_	7
TOTAL	10	52	27	-	6	_	95

The scheme for assigning IOA assessment (Appendix C) and analysis (Appendix E) worksheet numbers is shown in Table V.

	Table V IOA Worksheet Numbers
Component	IOA ID Number
Propulsion	MMU-100 to 127, 106A, 106B, 106C, 125A, 1001X, 1031X, 1051X, 1141X, 1191X, 1211X, 1212X, 1251X, 1252X, 1253X.
Electrical/ Power	MMU-128 to 188, 130A, 131A, 134A, 135A, 144A, 145A, 146A, 151A, 152A, 153A, 154A, 157A, 169A, 171A, 174A, 177A, 178A, 179A, 185A, 1281X, 1681X, 1701X to 1704X, 1721X to 1724X, 1731X, 1861X, 1862X, 4015X.
Structures and Mechanism	MMU-189 to 207, 192A, 196A, 1891X to 1899X, 4000X, 4001X, 4005X, 4006X, 4012X, 4013X, 1981X 4014X.
FSS	MMU-208 to 245, 219A, 2111X, 2141X to 2144X, 2391X, 2392X, 4002X, 4003X, 4004X, 4007X to 4011X.

5.0 REFERENCES

Reference documentation available from NASA was used in the analysis. The documentation used included:

- NSTS 22206, Instructions for Preparation of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL), 10 October 1986
- 2. MMU-SE-17-73, Manned Maneuvering Unit, Space Shuttle Program, Operational Data Book, Volume I, Rev. B, July 1985
- 3. MMU-SE-17-73, Manned Maneuvering Unit, Space Shuttle Program, Operational Data Book, Volume II, October 1984
- 4. 852MM000019, Propulsion Flow Diagrams, Rev C, 15 April 1986
- 5. 852CD0000825, Electrical Check Diagram FSS and MMU, 9 September 1986
- 6. MDAC IOA MMU Working Paper NO.-WP-VA86001-09, 21 November 1986
- 7. Martin Marietta Informal Data, MMU Failure Modes and Effect Analysis, Rev A., January 1987

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APPENDIX A **ACRONYMS**

AAH - Automatic Attitude Hold

CB - Circuit Breaker

CEA - Control Electronics Assembly

- Critical Items List CIL

EMU - Extravehicular Mobility Unit

EVA - Extravehicular Activity

F - Functional

FMEA - Failure Modes and Effects Analysis

FM - Failure Mode

FSS - Flight Support Station

GAN - Gas Actuated Nut

GFE - Government Furnished Equipment

- Gaseous Nitrogen GN₂ HW

Hardware

HC - Hand Controller

HUT - Hard Upper Torso

IOA - Independent Orbiter Assessment

IVA - Intravehicular Activity

JSC - Johnson Space Center

LED - Light Emitting Diode

Lts - Lights

MDAC - McDonnell Douglas Astronautic Company

MMU - Manned Maneuvering Unit

NSTS - National Space Transportation System

PCI - Potential Critical Item

PLB - Payload Bay

PLSS - Portable Life-Support System

OD - Quick Disconnect

RHC - Rotational Hand Controller

Sat Stab - Satellite Stabilization

SMM - Solar Maximum Mission

SOS - Space Operations Simulator

STS - Space Transportation System

TCS - Thermal Control System

THC - Translational Hand Controller TPAD - Trunnion Pin Attach Device

VDA - Valve Drive Amplifier

APPENDIX B

DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

- B.1 Definitions
 B.2 Project Level Ground Rules and Assumptions
 B.3 Subsystem-Specific Ground Rules and Assumptions

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

Definitions contained in NSTS 22206, Instructions For Preparation of FMEA/CIL, 10 October 1986, were used with the following amplifications and additions.

INTACT ABORT DEFINITIONS:

RTLS - begins at transition to OPS 6 and ends at transition
to OPS 9, post-flight

<u>TAL</u> - begins at declaration of the abort and ends at transition to OPS 9, post-flight

AOA - begins at declaration of the abort and ends at transition to OPS 9, post-flight

ATO - begins at declaration of the abort and ends at transition to OPS 9, post-flight

<u>CREDIBLE (CAUSE)</u> - an event that can be predicted or expected in anticipated operational environmental conditions. Excludes an event where multiple failures must first occur to result in environmental extremes

<u>CONTINGENCY CREW PROCEDURES</u> - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

<u>EARLY MISSION TERMINATION</u> - termination of onorbit phase prior to planned end of mission

EFFECTS/RATIONALE - description of the case which generated the
highest criticality

<u>HIGHEST CRITICALITY</u> - the highest functional criticality determined in the phase-by-phase analysis

MAJOR MODE (MM) - major sub-mode of software operational sequence
(OPS)

MC - Memory Configuration of Primary Avionics Software System
(PASS)

MISSION - assigned performance of a specific Orbiter flight with payload/objective accomplishments including orbit phasing and altitude (excludes secondary payloads such as GAS cans, middeck P/L, etc.)

MULTIPLE ORDER FAILURE - describes the failure due to a single cause or event of all units which perform a necessary (critical) function

OFF-NOMINAL CREW PROCEDURES - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

OPS - software operational sequence

PRIMARY MISSION OBJECTIVES - worst case primary mission objectives are equal to mission objectives

PHASE DEFINITIONS:

PRELAUNCH PHASE - begins at launch count-down Orbiter
power-up and ends at moding to OPS Major Mode 102 (liftoff)

<u>LIFTOFF MISSION PHASE</u> - begins at SRB ignition (MM 102) and ends at transition out of OPS 1 (Synonymous with ASCENT)

ONORBIT PHASE - begins at transition to OPS 2 or OPS 8 and ends at transition out of OPS 2 or OPS 8

DEORBIT PHASE - begins at transition to OPS Major Mode
301 and ends at first main landing gear touchdown

<u>LANDING/SAFING PHASE</u> - begins at first main gear touchdown and ends with the completion of post-landing safing operations

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.2 IOA Project Level Ground Rules and Assumptions

The philosophy embodied in <u>NSTS 22206</u>, <u>Instructions for Preparation of FMEA/CIL</u>, <u>10 October 1986</u>, was employed with the following amplifications and additions.

1. The operational flight software is an accurate implementation of the Flight System Software Requirements (FSSRs).

RATIONALE: Software verification is out-of-scope of this task.

2. After liftoff, any parameter which is monitored by system management (SM) or which drives any part of the Caution and Warning System (C&W) will support passage of Redundancy Screen B for its corresponding hardware item.

RATIONALE: Analysis of on-board parameter availability and/or the actual monitoring by the crew is beyond the scope of this task.

3. Any data employed with flight software is assumed to be functional for the specific vehicle and specific mission being flown.

RATIONALE: Mission data verification is out-of-scope of this task.

4. All hardware (including firmware) is manufactured and assembled to the design specifications/drawings.

RATIONALE: Acceptance and verification testing is designed to detect and identify problems before the item is approved for use.

5. All Flight Data File crew procedures will be assumed performed as written, and will not include human error in their performance.

RATIONALE: Failures caused by human operational error are out-of-scope of this task.

6. All hardware analyses will, as a minimum, be performed at the level of analysis existent within NASA/Prime Contractor Orbiter FMEA/CILs, and will be permitted to go to greater hardware detail levels but not lesser.

RATIONALE: Comparison of IOA analysis results with other analyses requires that both analyses be performed to a comparable level of detail.

7. Verification that a telemetry parameter is actually monitored during AOS by ground-based personnel is not required.

RATIONALE: Analysis of mission-dependent telemetry availability and/or the actual monitoring of applicable data by ground-based personnel is beyond the scope of this task.

8. The determination of criticalities per phase is based on the worst case effect of a failure for the phase being analyzed. The failure can occur in the phase being analyzed or in any previous phase, whichever produces the worst case effects for the phase of interest.

RATIONALE: Assigning phase criticalities ensures a thorough and complete analysis.

9. Analysis of wire harnesses, cables, and electrical connectors to determine if FMEAs are warranted will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

10. Analysis of welds or brazed joints that cannot be inspected will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

11. Emergency system or hardware will include burst discs and will exclude the EMU Secondary Oxygen Pack (SOP), pressure relief valves and the landing gear pyrotechnics.

RATIONALE: Clarify definition of emergency systems to ensure consistency throughout IOA project.

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.3 MMU Ground Rules and Assumptions

1. Loss of the MMU's automatic attitude hold capability will not be considered life or vehicle threatening, or a mission impact.

Rationale: To date no normal or contingency MMU operation has been identified or envisioned which would require the automatic attitude hold capability.

2. The availability of the Orbiter to perform a rescue of a stranded crewperson will not be considered in determining the criticality of the applicable failure mode.

Rationale: The IOA project believes such an exclusion is necessary to ensure worst case scenario analysis results in the most appropriate criticality.

3. For all analyses, it is assumed that the MMU may be required for planned or contingency operations anytime up to initiation of the Orbiter deorbit phase.

Rationale: The above assumption ensures that failures occuring subsequent to a MMU mission are analyzed for their effect on subsequent MMU missions.

4. The following MMU flight phase definitions are applicable for the analyses provided in Appendix C:

Pre-Ops: The timeframe extending from installation in the Orbiter to removal of the MMU (on-orbit) from the FSS

Ops: The on-orbit duration of time during which the MMU is manned and not stowed in the FSS

Post-Ops: Any timeframe subsequent to on-orbit stowage of the MMU and prior to Orbiter mission completion

5. Although two (2) MMUs are flown on each mission, criticality assignment is performed without consideration to the availability of the second MMU.

Rationale: The assignment of worst case criticality is ensured by this assumption.

APPENDIX C DETAILED ASSESSMENT

This section contains the IOA assessment worksheets generated during the assessment of this subsystem. The information on these worksheets facilitates the comparison of the NASA FMEA/CIL (Pre and Post 51-L) to the IOA detailed analysis worksheets included in Appendix E. Each of these worksheets identifies the NASA FMEA being assessed, corresponding MDAC Analysis Worksheet ID (Appendix E), hardware item, criticality, redundancy screens, and recommendations. For each failure mode, the highest assessed hardware and functional criticality is compared and discrepancies noted as "N" in the compare row under the column where the discrepancy occurred.

LEGEND FOR IOA ASSESSMENT WORKSHEETS

Hardware Criticalities:

- 1 = Loss of life or vehicle
- = Loss of mission or next failure of any redundant item
 (like or unlike) could cause loss of life/vehicle
- 3 = All others

Functional Criticalities:

- 1R = Redundant hardware items (like or unlike) all of which,
 if failed, could cause loss of life or vehicle
- 2R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of mission

Redundancy Screens A, B and C:

P = Passed Screen F = Failed Screen NA = Not Applicable

NASA Data:

Baseline = NASA FMEA/CIL

New = Baseline with Proposed Post 51-L Changes

CIL Item :

X = Included in CIL

Compare Row:

N = Non compare for that column (deviation)

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COMPARE	[/]	[]	[]	[N]	[]	
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REMARKS:														1	

IOA AGREES WITH THE FMEA.

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:			NASA DAT BASELIN NI	CA: UE [] EW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 102 TOGGLE V	ALVE		
LEAD ANALYST:	DUFFY, H	UYNH, SAIID	I	
ASSESSMENT:				
CRITICA		REDUNDANCY	SCREENS	CIL ITEM
	TUNC .	A B	С	
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COMPARE [/] [] [] [N]	[]
RECOMMENDATIONS	: (If di	fferent fro	m NASA)	
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ASSESSME ASSESSME NASA FME	I TN	D:	MMU-1	03		NASA DATA: BASELINE [] NEW [X]								
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LEAD ANA	LYST	:	DUFFY	, HU	YNH,	SAII	DI							
ASSESSME	NT:													
		ICAL LIGH	ITY	R	EDUN	DANCY	SCI	REENS			CII			
	_		NC	A		В		C	:		111	5M		
NASA IOA	[2 [2	/2 /2]	[F]	[P]	[[P)		[2	x] x]	*	
COMPARE	[/]	[3	[]	[N]		[]		
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NASA DATA:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMII-104		NASA DATA BASELINE NEW	: [x]
SUBSYSTEM: MDAC ID: ITEM:	MMU 104 ISOLATION	VALVE		
LEAD ANALYST:	DUFFY, HUY	NH, SAIIDI		
ASSESSMENT:				
CRITICAL FLIGH	CIL ITEM			
HDW/FU	NC A	В	С	
NASA [2 /1R IOA [2 /2] [P] [P] [F]] [F]	[] [P]	[X] *
COMPARE [/N] [] []	[и]	[]
RECOMMENDATIONS:	(If diff	erent from N	ASA)	
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REMARKS: VALVE FAILED OPE WILL RESULT IN L THRUSTERS IN THE REDUNDANCY DOES FMEA. IOA CONSI SINCE THIS FAILU (EVA CREW BEING THE EVA AND RETU AN ITEM OF MAJOR DETECTED UNTIL A TANK FROM THE TH	OSS OF CAPA EVENT OF A NOT RESULT DERS EVA LO RE ALONE MA STRANDED WI RN TO ORBIT CONCERN IS SUBSEQUENT	ABILITY TO ISO A DOWNSTREAM IN LOSS OF LE OST WITH THIS AY BE ONE STE OTH THIS FAILUTER. S THAT THIS F.	OLATE THE GN2 LEAK. LOSS O IFE AS INDICA HARDWARE CRI P AWAY FROM L URE AND A LEA AILURE WILL N	TANK FROM F FUNCTIONAL TED BY THE TICALITY, OSS OF LIFE K) - CANCEL OT BE

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	MMU-105	BASELINE []									
SUBSYSTEM: MDAC ID: ITEM:	MMU 105 ISOLATION VALV	VE									
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI									
ASSESSMENT:											
CRITICA FLIG	LITY REDUNI	DANCY SCREENS	CIL ITEM								
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-106	1	NASA DATA: BASELINE [] NEW [X]						
	MMU 106 GN2 LINES (ISOI	. VLV - REGUI	LATOR)						
LEAD ANALYST:	DUFFY, HUYNH, S	SAIIDI							
ASSESSMENT:									
CRITICAL: FLIGHT		ANCY SCREENS		CIL ITEM					
	NC A	В	С						
NASA [1 /1 IOA [2 /1R] [P]] [P]	[P] [I] P]	[X] *					
COMPARE [N /N] []	[] []	N]	[]					
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REMARKS: LEAK. THE FMEA (SHARPNEL AFTER L	CRITICALITY ASSU		T FAILURE						

LEAK. THE FMEA CRITICALITY ASSUMES POSSIBLE LOSS OF LIFE DUE TO SHARPNEL AFTER LINE RUPTURE. IOA FEELS THAT FAILURE MODE "RUPTURE" IN THE LINE TO BE NON-CREDIBLE FAILURE. THEREFORE ANY EXTERNAL LEAKAGE WILL FORCE CLOSING THE ISOLATION VALVE, THUS LOSS OF A SYSTEM (MISSION IMPACT). AND WITH LOSS OF BOTH SYSTEMS (TWO LINES LEAK) DURING OPS, THE CREWPERSON IS SUBJECT TO BEING STRANDED-POSSIBLE LOSS OF LIFE.

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-106A NASA FMEA #: 1.7.4															ASA DA BASEL		[x]	
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-106B	NASA DATA: BASELINE [] NEW [X]											
SUBSYSTEM: MDAC ID: ITEM:	MMU 106 GN2 LINES (XFEED VLV - XFEED VLV)												
LEAD ANALYST:	DUFFY, HUY	NH, SAIIDI											
ASSESSMENT:													
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C													
HDW/FU	NC A	Б	C										
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COMPARE [N /N] [] [N] [N] []									
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* CIL RETENTION	RATIONALE:		ADEQUATE [NADEQUATE []									
REMARKS: LEAK. A LEAK IN	THIS AREA	(BETWEEN XFEED	VALVES) HAS NO										

LEAK. A LEAK IN THIS AREA (BETWEEN XFEED VALVES) HAS NO IMMEDIATE EFFECT SINCE THE TANKS ARE CHARGED PRELAUNCH, AND THE XFEED VALVES REMAIN CLOSED THROUGHOUT PRE-OPS AND OPS. HOWEVER, DURING POST-OPS RECHARGE CAPABILITY WILL BE LOST IN SUBSEQUENT EVA/MMU ACTIVITIES. ALSO IT WILL CREATE CONDIJTION FOR A POTENTIAL LOSS OF LIFE IF ONE/TWO OR XFEED VALVES WERE TO FAIL OPEN DURING OPS THIS FAILURE IS NOT DETECTED DURING PRE-OPS AND OPS.

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SUBSYSTE MDAC ID:	M:			MMU 106 GN2 L	INES	(T)	ANK-	ıs	ol '	VLV)							
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SUBSYSTEM: MDAC ID: ITEM:	MMU 111 THRUS	TER MANI	FOLD		
LEAD ANALYST:	DUFFY	, HUYNH,	SAIIDI		
ASSESSMENT:					
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HDW,	/FUNC	A	В	С	
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REMARKS:				TNADEĞON	TE []

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-112 NASA FMEA #: 1.6.2							5								DAT ELIE NI			x]		
SUBSYSTI MDAC ID: ITEM:					MMU 112 THR		EI	R													
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				NASA DATA: BASELINE [] NEW [X]				
	MMU 113 THRUSTER							
LEAD ANALYST:	DUFFY, HU	YNH, SA	IIDI					
ASSESSMENT:								
CRITICAL: FLIGH HDW/FU			CY SCREE	ns C	CIL ITEM			
HDW/ FO	NC A	•	В	C				
NASA [3 /2R IOA [2 /1R] [P] [P] P]	[] [P]	[
COMPARE [N /N] [] []	[N]	[N]			
RECOMMENDATIONS:	(If dif	ferent	from NAS	A)				
[2 /1R] [P) [P]	[P]	[A] DD/DELETE)			
* CIL RETENTION	RATIONALE:	(If ap	-) ADEQUATE INADEQUATE				
REMARKS: FAIL CLOSED. LOS MISSION IMPACT OF CREWPERSON STRANT	R EVA LOSS	. FUNC						

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-114		NASA DATA: BASELINE NEW		
MDAC ID:	MMU 114 THRUSTER				
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI			
ASSESSMENT:					
CRITICAL: FLIGH	TY REDUN	IDANCY SCREE	ens	CIL	ī
	NC A	В	С	1111	•
NASA [2 /1R IOA [2 /1R] [P]] [P]	[P] [P]	[] [P]	[X]] *
COMPARE [/] []	[]	[N]	[]
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REMARKS: IOA AGREES WITH '	THE FMEA, BASE	ED ON THE EX		_	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-116		DATA: ELINE [] NEW [X]					
	MMU 116 GN2 REGULATOR							
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI							
ASSESSMENT:								
CRITICAL: FLIGHT		DANCY SCREENS	CIL					
	NC A	В С	ITEM					
NASA [2 /1R IOA [2 /1R] [P]] [P]	[P] [] [P]	[X] * [X]					
COMPARE [/] []	[] [N]	[]					
RECOMMENDATIONS:	(If differen	nt from NASA)						
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* CIL RETENTION I	RATIONALE: (If		UATE []					
ADEQUATE [] INADEQUATE [] REMARKS: IOA AGREES WITH THE FMEA. HOWEVER, THIS FAILURE DURING PRE-OPS AND POST-OPS WILL NOT BE DETECTED, AND DURING OPS PHASE IT CANNOT BE DISTINGUISHED FROM A SIMILAR FAILURE FROM OTHER VALVES IN THE								

LINE.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA: BASELINE [] NEW [X]					
MDAC ID:	MMU 117 GN2 REGULA	TOR						
LEAD ANALYST:	DUFFY, HUY	NH, SAIII)I					
ASSESSMENT:								
CRITICALI FLIGHT		DUNDANCY	SCREENS		CIL	1		
HDW/FU		В	C			-		
NASA [2 /1R IOA [2 /1R] [P] [P] [P] [P] [F)	[X] *		
COMPARE [/] [] [] []	1]	[]		
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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA BASELINE NEW	-					
MDAC ID:	MMU 119 GN2 REGULATOR	19							
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI							
ASSESSMENT:									
CRITICAL FLIGH		ANCY SCREI	ens	CIL					
HDW/FU		В	С	ITEM					
NASA [3 /2R IOA [2 /2		[P] [F]	[] [P]	[] * [x]					
COMPARE [N /N] []	[N]	[и]	[N]					
RECOMMENDATIONS:	(If differen	t from NAS	SA)						
[2 /1R] [P]	[P]		[A] DD/DELETE)					
* CIL RETENTION	RATIONALE: (If	applicable	•						
			ADEQUATE INADEQUATE	•					
REMARKS: LOSS OF PRESSURE LOSS DURING OPS 1									

LIFE. THE FAILURE MODE MAY BE MORE APPROPRIATELY CALLED OUT OF

TOLERANCE (HIGH/LOW RESPONSE) - SEE MMU-1191.

ASSESSMENT ASSESSMENT NASA FMEA	ID:	MMU-12	MMU-120 BASELINE []	
SUBSYSTEM: MDAC ID: ITEM:		MMU 120 GN2 RE	LIE	TAV	VE							
LEAD ANALYS	ST:	DUFFY,	HUY	NH,	SAIII)I						
ASSESSMENT:	:											
	TICAL:	r	RI A	EDUNE	DANCY B	SCREE	ens C		CI II	L EM		
r	IDW/FUI	NC	A		Б		C					
NASA [IOA [2 /1R 2 /1R]	[P [P]	[P]	[[P]	[[X X]	*
COMPARE [/	3	[]	[]	[N]	[]	
RECOMMENDAT	rions:	(If	dif	ferer	nț fro	om NAS	SA)					
[/]	[]	[]	[] (2	[ADD/	/DE		TE)
* CIL RETER	NTION 1	RATIONA	ALE:	(If	appl:	icable	A	DEQUATE DEQUATE	[]	
REMARKS: IOA AGREES FAILURE ANI							THE	CAUSES	OF	тн	Έ	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/8 MMU-121			NASA DATA: BASELINE [] NEW [X]					
MDAC ID:	MMU 121 GN2 REL	IEF VAL	VE						
LEAD ANALYST:	LEAD ANALYST: DUFFY, HUYNH, SAIIDI								
ASSESSMENT:									
CRITICAL FLIGH HDW/FU	T	REDUND A	ANCY SCRE	ENS C	CIL ITEM				
·			r 1	-	r 1 4				
NASA [/ IOA [3 /1R	i	P]	[P]	[P]	[] *				
COMPARE [N /N] [N]	[и]	[N]	[]				
RECOMMENDATIONS:	(If d	ifferen	t from NA	SA)					
[3 /2R] [P]	[F]		[A] ADD/DELETE)				
* CIL RETENTION	RATIONAL	E: (If	applicabl						
				ADEQUATE INADEQUATE	[]				
				LOSED DOES	NOT POSE ANY				
IMMEDIATE PROBLE									

AVAILABLE WHEN NEEDED AFTER A SUBSEQUENT FAILURE, LIKE REGULATOR FAILED OPEN. KNOWING THIS SCENARIO, THIS FAILURE WILL THEREFORE CREATE A CONDITION THAT IS NOT ADVISABLE TO CONTINUE THE MISSION, BECAUSE THIS FAILURE PLUS REGULATOR FAILED OPEN COULD BE CATASTROPHIC DURING OPS PHASE. THIS FAILURE IS FURTHER COMPLICATED BY THE FACT THAT IT IS NOT READILY DETECTABLE UNTIL A SUBSEQUENT FAILURE (REG FAILED OPEN).

ASSESSME ASSESSME NASA FME	NT	ID	:	MM	MU-122					BASELINE [] NEW [X]											
SUBSYSTE MDAC ID:				MM 122 PRI		IRI	€ 6	GAG]	E												
LEAD ANA	LYS	T:		DUI	FFY,	I	{U}	NH	, :	SA:	III	IC									
ASSESSME	ENT:																				
	CRI		CAL				RI	EDUI	ND.	AN	CY	sc	REEN	S				CI		ſ	
	Н		/FUI				A				В			С						•	
NASA IOA	[[2	/1R /1R]]	P P]		[P P]	[P]			[X X]	*
COMPARE	[/]		[]		[]	[N)			[]	
RECOMMEN	TAG	'IC	NS:		(If	d :	if	fer	en	t :	fro	om	NASA)							
	[/]		[]		[]	[]		(A)	[DD/			ETE)
* CIL RI	ETEN	ITI	ON 1	RAT:	IONA	XL:	Ε:	(I	f	ap)	pl:	ica		Al NA	DEQ DEO	UAT UAT	E E	[]	
REMARKS	-	WT	י אירי	тне	FMF	ca.									_ — •	-	-	•		,	

			NASA DATA BASELINE NEW						
123	.23								
LEAD ANALYST: DUFFY, HUYNH, SAIIDI									
ASSESSMENT:									
T				CIL ITEM					
NC A	В		С						
] [P] [P] [P] [F] [P]	[] *					
] [] [N] [и]	[]					
(If dif:	ferent fro	om NASA)							
[P] [P] [[] DD/DELETE)					
RATIONALE:	(If appl:	·	-	[]					
	MMU-123 1.8.2 MMU 123 PRESSURE DUFFY, HU LITY R IT INC A] [P] [P] [P	MMU-123 1.8.2 MMU 123 PRESSURE GAGE DUFFY, HUYNH, SAIII LITY REDUNDANCY IT INC A B [P] [P] [P] [F] [I] [N] (If different from the content of the conten	MMU-123 1.8.2 MMU 123 PRESSURE GAGE DUFFY, HUYNH, SAIIDI LITY REDUNDANCY SCREENS IT UNC A B [P] [P] [F] [] [P] [F] [] [N] [] (If different from NASA) RATIONALE: (If applicable)	MMU-123 1.8.2 MMU 123 PRESSURE GAGE DUFFY, HUYNH, SAIIDI LITY REDUNDANCY SCREENS A B C [P] [P] [P] [P] [P] [P] [N] [N] (If different from NASA) R [P] [P] [P] [P] (AI					

LOSS OF ACCURATE GN2 PRESSURE INDICATION - EVA CREW PERSON WILL NOT KNOW QUANTITY OF PROPELLANT REMAINING TO SUCCESSFULLY CONTINUE EVA. EVA CREW PERSON MUST RELY ON OTHER GAGE OR GROUND INSTRUCTION. ANOMALY IN THE TWO GAGE READINGS WILL INDICATE AN ERROR.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-124			NASA DATA: BASELINE [] NEW [X]					
-	MMU 124 PRESSURI	E GAGE							
LEAD ANALYST:	DUFFY, I	HUYNH, SA	IIDI						
ASSESSMENT:									
CRITICAL: FLIGHT		REDUNDAN	CY SCREE	NS	CIL ITEM				
	NC	A	В	С					
NASA [3 /3 IOA [3 /3] [P] [P] [P] F]	[] [P]	[] *				
COMPARE [/] [] [N]	[и]	[]				
RECOMMENDATIONS:	(If d	ifferent	from NAS	A)					
[3 /2R	1 .	P] [P]	[P] (Al	[] DD/DELETE)				
* CIL RETENTION I	RATIONAL	E: (If ap	plicable		r				
				ADEQUATE INADEQUATE	[]				
REMARKS: LOSS OF ACCURATE GN2 PRESSURE INDICATION - EVA CREW PERSON WILL NOT KNOW QUANTITY OF PROPELLANT REMAINING TO SUCCESSFULLY CONTINUE EVA. EVA CREW PERSON MUST RELY ON OTHER GAGE OR GROUND INSTRUCTION. ANOMALY IN THE TWO GAGE READINGS WILL INDICATE AN									

ERROR.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/8 MMU-125 1.3.2	12/05/86 NASA DATA: MMU-125 BASELINE [] 1.3.2 NEW [X]						
SUBSYSTEM: MDAC ID: ITEM:	MMU 125 RECHARG	E QUICK DI	SCONNECT					
LEAD ANALYST:	NALYST: DUFFY, HUYNH, SAIIDI							
ASSESSMENT:								
דו דכט	יקר		CY SCREENS	CIL ITEM				
HDW/FU	NC	A	В С	1 1 EF1				
NASA [2 /2 IOA [2 /2] [P] [P] [P] [] F]	[X] * [X]				
COMPARE [/] [) [N] [N]	[]				
RECOMMENDATIONS:	(If d	ifferent f	from NASA)					
[3 /3] [] [] []	[D] (ADD/DELETE)				
* CIL RETENTION	RATIONAL	E: (If app		QUATE [] QUATE []				
INADEQUATE [] REMARKS: FAIL OPEN/LEAK. NO IMPACT SINCE THE XFEED VALVES ARE CLOSED, AND FURTHERMORE, THE QD'S HAVE CAP'S INSTALLED AFTER DISCONNECT FROM THE FSS. DURING PRE/POST-OPS, NO IMPACT IS SEEN SINCE THE TANKS CAN BE RECHARGED AND ISOLATED BY THE XFEED VALVES. THIS FAILURE WILL NOT BE READILY DETECTED. THE FMEA SEEMS TO BE IN CONFLICT/INCONSISTENT WHEN COMPARED TO 1.3.5.								

NASA DATA:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-125A			NASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:		QUICK DIS	CONNECT		
LEAD ANALYST:	DUFFY, HUY	NH, SAII	DI		
ASSESSMENT:					
CRITICAL FLIGH	ITY RE	EDUNDANCY	SCREENS		CIL ITEM
	NC A	E	,	С	112.1
NASA [3 /2R IOA [2 /2] [P] [F] [P]	[] * [X]
COMPARE [N /N] [] [N] [n]	[N]
RECOMMENDATIONS:	(If diff	ferent fr	om NASA)		
[3 /3] [] [] [] (AI	[] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl		ADEQUATE ADEQUATE	[]
REMARKS: FAIL OPEN/LEAK. FURTHERMORE, THE	NO IMPACT	SINCE TH	E XFEED	VALVES ARE AFTER DISC	E CLOSED, AND

THE FSS. DURING PRE/POST-OPS, NO IMPACT IS SEEN SINCE THE TANKS

THIS FAILURE WILL NOT BE READILY DETECTED. THE FMEA SEEMS TO BE

CAN BE RECHARGED AND ISOLATED BY THE XFEED VALVES.

IN CONFLICT/INCONSISTENT WHEN COMPARED TO 1.3.5.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-126		NASA DATA: BASELINE [] NEW [X]							
	MMU 126 RECHARGE QUIC	K DISCONNECT								
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI								
ASSESSMENT:										
FLIGH'	ITY REDUN I' NC A	DANCY SCREENS	s c	CIL ITEM						
•		r 1 0 1 r	1	[] *						
IOA [3 /2R] [P]] [P]	[P] [P	[] "						
COMPARE [/] []	[] [N]	[]						
RECOMMENDATIONS:	(If differe	nt from NASA)	1							
[/] []	[] [] (Al	[] DD/DELETE)						
* CIL RETENTION	RATIONALE: (If	'	ADEQUATE ADEQUATE	[]						
REMARKS: IOA AGREES WITH 'CAPABILITY/ACTIV' INDICATED BY THE	ITY IS PART OF	THE EXCEPTION	ON THAT REG	CHARGE						

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-127		1	NASA DATA: BASELINE NEW	
MDAC ID:	MMU 127 GN2 TEST	PORT			
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI		
ASSESSMENT:					
CRITICAL FLIGH		EDUNDANCY	SCREENS		CIL ITEM
HDW/FU		В	•	С	
NASA [/ IOA [2 /1R] [] [P] [P] [] P]	[x] *
COMPARE [N /N] [N	и) [и] [и ј	[N]
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)		,
[2 /1R	t] [P) [P] [P] (AI	[A] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl		ADEQUATE ADEQUATE	[]
REMARKS:			IN.	MULQUATE	į J

ASSESSME ASSESSME NASA FME	MU-128 BASELI											[
SUBSYSTE MDAC ID: ITEM:				MM 12 BA		RY												
LEAD ANA	LYS	ST	:	DU:	FFY,	, 1	HU	YNH,	SA	II	DI							
ASSESSME	NT:	:																
	CRI		ICAL LIGH				RI	EDUNI	DAN	CY	SCF	REEN	S			CII		
	ŀ	HDW/FUNC					A		В				С				•••	
NASA IOA	[2 2	/1R /1R]		[P P]	[]	P P]	[[P]		X]	[]	*
COMPARE	[/]		[]	(]	[N]		[]	
RECOMMEN	DA'	ric	ONS:		(If	d:	ifi	fere	nt	fr	om N	IASA))					
	[/]		[]	(]	[]	(AI	[DD/D		ETE)
* CIL RE								(If	ap	pl:	icab	·		DEQUA'		[]	
IOA AGRE	ES	W]	CTH !	CHE	FME	CA.												

ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #:	E: 12/05/8 MMU-129		NASA DAT BASELIN NE		
SUBSYSTEM: MDAC ID: ITEM:	MMU 129 INTERN	AL/EXTER	NAL POWE	R SWITCH	
LEAD ANALYST:	DUFFY,	HUYNH,	SAIIDI		
ASSESSMENT:					
CRITIC FLI HDW/	GHT	REDUND A	ANCY SCR	EENS C	CIL ITEM
NASA [/ IOA [2 /] 1R]	[] [P]	[] [P]	[] [P]	[x] *
COMPARE [N /	и]	[N]	[N]	[N]	[N]
RECOMMENDATION	s: (If	differen	t from N	ASA)	
[2 /	1R]	[P]	[P]	[P]	[A] ADD/DELETE)
* CIL RETENTIO	N RATIONA	LE: (If	applicab	le) ADEQUATE INADEQUATE	•

REMARKS:

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-130 NASA FMEA #: 3.14.3																ASA DA BASELI N		[x]		
SUBSYSTE MDAC ID:	M:			MN 13 IN		IAI	L/I	EXTE	ERN.	ΑI	i I	POW	ER	sv	VI!	гсн						
LEAD ANALYST: DUFFY, HUYNH, SAIIDI																						
ASSESSME	NT:																					
		FL	IGH	T								SC	REE	NS				CIL ITEM				
	Н	DW.	/FU	NC			A				В				С							
NASA IOA	[2 2	/2 /2]		[P P]		[[P P]		[P]		[X X]	*	
COMPARE	[/]		[]		[]		[N]		[]		
RECOMMEN	DAT	10	ns:		(If	đ	Ĺfí	fere	ent	1	ro	om I	NAS	A))							
	(/]		[]		[]		[]	(Al		/DE	•	ETE)	
* CIL RE	TEN	TI	ои	RAT	IONA	L	2:	(If		pŗ	oli	ca	ble	:)								
REMARKS:														Iì		DEQUAT DEQUAT		[]		
NO EFFEC THE FIRS																					JRING	

ORBITER POWER TO STORAGE HEATERS. IOA CONSIDERED THIS TO RESULT IN LOSS OF CEA/BATTERY DUE TO COLD/UNDER TEMPERATURE CEA LIMIT VIOLATION - THUS LOSS OF ONE SYSTEM. HOWEVER, IOA ALSO RECOGNIZES THAT A POSSIBILITY EXISTS TO PROVIDE POWER TO THE STORAGE HEATERS BY TURNING THE MAIN POWER SWITCH ON WHILE RECHARGING THE BATTERY - THIS OPERATION COULD BE MONITORED IN THE AIRLOCK, BUT THE EFFECT OF 28V POWER TO OTHER ELECTRICAL COMPONENT IS NOT INVESTIGATED. FINALLY, THIS FAILURE HAS NO EFFECT (3/3) ON MISSIONS WITH ONLY ONE MMU ACTIVITY, AND WILL BE LOSS OF MISSION FOR MULTIPLE MMU OPS AS SHOWN ABOVE.

ASSESSME ASSESSME NASA FME							ASA DA BASELI		[x]							
SUBSYSTEMDAC ID:	RNAL	P	OWEF	R SV	VI'I	гсн												
LEAD ANALYST: DUFFY, HUYNH, SAIIDI																		
ASSESSMENT:																		
		ICAL LIGH	ΙΤΥ	RI	EDUNI	DANC	Y	SCRE	EENS	5			CI	L EM				
			NC	A		В			С									
NASA IOA	[2 [2	/2 /2]	[P [P]]	P P]	[[P	-							
COMPARE	ſ	/]	[]	[]	[N]		[]			
RECOMMEN	DATI	ons:	(If	dif	fere	nt f	ro	m N2	ASA)								
	[/]	[]	[3	[]		[DD/] LETE)		
* CIL RE	TENT	ON	RATION	ALE:	(If	app	oli	.cab:	le) II	A NA	DEQUA DEQUA	TE TE	[]			
REMARKS: THE FAIL BY THE F	URE	MODE IS	, ELEC	TRIC	ALLY	FAI THE	LS	WIT	CH	IS	POSIT	LTI	_			ΈD		

POSITION/CONTACT SWITCH AND IT WILL BE ONLY APPROPRIATE TO CONSIDER "A SINGLE CONTACT OPEN" - IN THIS CASE, THE WORST SINGLE CONTACT OPEN IS FOR EXTERNAL POWER TO THE STORAGE HEATERS DURING PRE/POST OPS ACTIVITY, OR MAIN POWER CONTACT OPEN (PINS 5-6) DURING OPS ACTIVITY. EITHER ONE OF THESE FAILURES, CONSIDERED SEPARATELY, WILL RESULT IN LOSS OF A SYSTEM, THUS EVA

TERMINATION AS EXPLAINED BY MMU-130. SEE ALSO MMU-131A FOR A SINGLE CONTACT CLOSED FAILURE MODES. THOSE ANALYSIS MAY HAVE TO

BE RE-WRITTEN TO CLARIFY THE FAILURE MODES.

ASSESSME ASSESSME NASA FME		31										asa i Basei		[x						
SUBSYSTE MDAC ID: ITEM:				1	MU 31 NTERI	A.	L/ 1	EXT	ERN	ΙAΙ	L 1	POW	ÆR	sı	WI'	гсн					
LEAD ANA	LY:	ST	:	D	UFFY,	,]	HU	YNH	, s	A]	II	DI									
ASSESSME	NT	:																			
		F	LIGH	T	Y				NDA	NC		sc	REE	ens					IL TE	M	
]	HD	W/FU	NC			A				В				С						
NASA IOA	[2	/2 /1R]]	P P]		[[P P]		[P]]	X X]	*
COMPARE	[/N]		(]		[]		[N]		[]	
RECOMMEN	DA?	ri(ons:		(If	d:	ifi	fer	ent	. 1	rc	om	NAS	A))						
	[2	/1R]		[P]		[P]		[P] ·	(A] DD,	/DI] ELF	ETE)
* CIL RE	TEI	NT:	ION :	RAT	rion <i>a</i>	ΙLI	Ξ:	(I:	f a	pŗ) 1i	ica			Al IAI	DEQUA	TE TE	[]	
NO EFFEC	r I	וטכ	RING	PI	RE/PC	S	r (PS	AC	TI	VI	ΤΥ	SI	NC	Œ	THAT	IS	ľ	rs	NC	MIN#

١L POSITION. DURING OPS AND WITH INADVERTENT SWITCHING TO EXT POSITION (OTHERWISE IT IS NOT APPLICABLE), BATTERY POWER WILL BE DENIED TO ONE SYSTEM - LOSS OF A SYSTEM. MISSIONS WITH SAT-STAT REQUIREMENT CAN NOT BE MET. FUNCTIONAL LOSS MAY STRAND THE CREW WITH NO THRUSTER POWER TO RETURN TO ORBITER.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-131A	NASA DATA BASELINI NEV								
SUBSYSTEM: MDAC ID: ITEM:	MMU 131 INTERNAL/EXTERNAL	L POWER SWITCH								
LEAD ANALYST:	DUFFY, HUYNH, SA	IIDI								
ASSESSMENT:										
	ITY REDUNDANC	CY SCREENS	CIL ITEM							
FLIGH HDW/FU	NC A	A B C								
NASA [2 /2 IOA [2 /1R] [P] [] [P]	P] [] P] [P]	[X] * [X]							
COMPARE [/N] [] [] [N]	[]							
RECOMMENDATIONS:	(If different	from NASA)								
[3 /3] [] [[D] ADD/DELETE)							
* CIL RETENTION	RATIONALE: (If app	plicable) ADEQUATE	[]							
ADEQUATE [] INADEQUATE [] REMARKS: THIS FMEA FAILURE MODE WAS CONSIDERED NON-CREDIBLE, SINCE THE SWITCH IS A MULTI POSITION/CONTACT SWITCH. IT WILL BE MORE APPROPRIATE TO FAIL CLOSED THE SWITCH IN ONE SINGLE CONTACT AT THE TIME. ANY SINGLE CONTACT CLOSED FROM EXT/INT PINS HAS NO EFFECT WHEN THE SWITCH IS AT EXT/INT POSITION ACCORDINGLY - NOMINAL POSITION. A SINGLE CONTACT CLOSED ON EXT PINS WHEN THE SWITCH IS IN INT HAS NO EFFECT ALSO SINCE THE MMU IS DURING OPS AND SEPARATED FROM ORBITER POWER. ON THE OTHER HAND, A SINGLE CONTACT CLOSED FROM INT PINS WHEN THE SWITCH IS IN EXT POSITION WILL HAVE A POSSIBILITY OF DRAINING POWER FROM ORBITER										

WILL TURN OFF BATTERY POWER.

WAS REJECTED SINCE DURING EXT POWER NOMINAL CREW ACTION

AND THE BATTERIES IF THE MAIN POWER SWITCH REMAINS ON. THIS CASE

ASSESSME ASSESSME NASA FME	NT ID:	12/05/8 MMU-132				ASA DATA BASELINE NEW	[x]				
SUBSYSTE MDAC ID:	M:	MMU 132 TERMINA	L I	BOAR	D								
LEAD ANA	LYST:	DUFFY,	HU	YNH,	SAII	DI							
ASSESSME	NT:												
	CRITICAL FLIGH HDW/FU	T	RI A		DANCY B	SCRE	EN	s c			IL FEI	1	
NASA IOA	[/ [2 /1R] [P]	[[P]	[P]	[x]	*
COMPARE	[N /N] [N]	[N]	[N]	[N]	
RECOMMEN	DATIONS:	(If d	if	fere	nt fr	om NA	SA)					
	[2 /1R] [P]	[P]	[P] ,DD			ETE)
* CIL RE	TENTION :	RATIONAL	E:	(If	appl	icabl	•		DEQUATE DEQUATE	[]	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-133		NASA DATA: BASELINE NEW	
	MMU 133 TERMINAL BOAR	D		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI		
ASSESSMENT:				
CRITICAL: FLIGHT HDW/FUI	r	DANCY SCREENS B	c c	CIL ITEM
NASA [/ IOA [2 /1R] []]	[] [[P]	P]	[x] *
COMPARE [N /N] [N]	[N]	N]	[N]
RECOMMENDATIONS:	(If differe	nt from NASA)	
[2 /1R] . [P]	[P] [[A] DD/DELETE
* CIL RETENTION I	RATIONALE: (If		ADEQUATE NADEQUATE	[]

ASSESSMEN	SSESSMENT DATE: 12/05/86 SSESSMENT ID: MMU-134 ASA FMEA #: 3.13.1 URSYSTEM: MMU								IASA D BASEI		[x]	
SUBSYSTEM MDAC ID: ITEM:			MMU 134 MAIN	POW	ER S	WITCH							
LEAD ANAL	rsy	?:	DUFFY	, н	UYNH	, SAI	DI						
ASSESSMEN	T:												
C		CICAL LIGH			REDU	NDANC:	S	CREENS			CI		
			NC		A	в с					11.	LM	
NASA IOA	[2	2 /2 2 /1R]	[P] P]	[]	?] ?]	[[I)		[]	x] x]	*
COMPARE	[/N]	[]	[]	[]	1]		[]	
RECOMMEND	ATI	ONS:	(If	di	ffer	ent f	com	NASA)					
	[2	2 /1R]	[P]	[]	?]	[I)			DEL:	ETE)
* CIL RET	ENT	ION	RATION	ALE	: (I	f app	lic	•	DEOU	m n		,	
DEMARKS -								INA	DEQUA DEQUA	TE	[]	
REMARKS: THE FMEA BATTERY P PERIOD, T CONSIDERE	OWE HE	ER IS INAD	TURNE VERTEN	D O	FF (WITC	SWITCHING A	I O	NG PREF FF). H ION TO	ONLY OWEVE OFF P	WHI R, I	EN S DUR:	THE ING N M	JST BE

ANALYZED BY A SEPARATE FMEA.

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-134A NASA FMEA #: 3.13.2								1	NASA D BASEL				
SUBSYSTEM MDAC ID: ITEM:	M:		MMU 134 MAII	1 POW	ER SW	ІТСН							
LEAD ANA	LYST	:	DUF	FY, H	UYNH,	SAII	DI						
ASSESSMEI	NT:												
(CRITICAL FLIGH				REDUN	DANCY	sc	REENS			CII		
	_	W/FU			A	В		•	C		T T 1	<u>upi</u>	
NASA IOA	[2 [2	/1R /1R]	[P] P]	[P]	[:] P]		[]	x] x]	*
COMPARE	[/]	[]	[3	[]	N]		[]	
RECOMMEN	DATI	ons:	(:	If di	ffere	nt fr	om	NASA)	•				
	[2	/2]	[].	[]	C]	(AD] DELI	ETE)
* CIL RE	TENT	ION	RATI(ONALE	: (If	appl	ica		ADEQUA ADEQUA	TE TE]]	
REMARKS: THIS FAI	LURE	SHO	ULD (ONLY	CONSI	DER A	SI	NGLE	CONTAC	T OF	EN	OR	CLOSE

AT A TIME. A COMPLETE LOSS OF POWER REQUIRES BOTH CONTACTS TO BE OPEN - NON-CREDIBLE. THIS ANALYSIS IS DONE FOR A SINGLE CONTACT OPEN - SEE ALSO MMU-135A FOR A SINGLE CONTACT CLOSED. LOSS OF BATTERY RECHARGE CAPABILITY DURING PRE/POST OPS, OTHERWISE NO EFFECT SINCE THE BATTERY POWER CAN BE MAINTAINED THROUGH A REDUNDANT CONTACT ON THE SWITCH. LOSS OF RECHARGE CAPABILITY WILL PRECLUDE SUBSEQUENT EVA/MMU ACTIVITIES.

ASSESSME ASSESSME NASA FME	ENT	I		MM	Ŭ-1	35	6								DATA LINE NEV] 3	x]	
SUBSYSTE MDAC ID:				MM 13 MA	5	PO	WE	R SI	WITC	н									
LEAD ANA	LY	ST	:	DU	FFY	,	HU'	YNH	, SA	II	DI								
ASSESSME	ENT	:																	
	CR		ICAL LIGH				R	EDUI	NDAN	CY	SCF	REEN	S			_	IL PEN	ſ	
	1	HD	W/FU	NC			A			В			С						
NASA IOA]	3 2	/3 /2]		[P]	[[P]	[[P]		[[x]	*
COMPARE	[N	/N	3		[N]	C	N]	ι	N]		[N	}	
RECOMMEN	IDA!	TI(ons:		(If	d	if:	fer	ent	fr	om N	VASA)						
	[/]	•	[]	[]	[]	(2	DD,	/DI] ELH	ETE
* CIL RE		NT:	ION	RAT	NOI	AL	E:	(I:	f ap	pl	icak		AI IAN	DEQU DEQU	ATE ATE	[]	
IOA AGRE		W	ITH	THE	FM	EΑ	•												

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-135A		NASA DATA: BASELINE NEW	
MDAC ID:	MMU 135 MAIN POWER SW	ІТСН		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI		
ASSESSMENT:				
CRITICAL: FLIGHT		DANCY SCREEN	ıs	CIL ITEM
HDW/FUI		В	С	
NASA [3 /3 IOA [2 /2] [P]] [P]	[P] [[P] [] P]	[x] *
COMPARE [N /N] []	[] [[N]	[N]
RECOMMENDATIONS:	(If differe	ent from NASA	()	
[1 /1] []	[] [[] (AI	[A] DD/DELETE)
* CIL RETENTION	RATIONALE: (If		ADEQUATE	
REMARKS: THIS FAILURE DUR: THE BATTERY. THE POTENTIAL FOR LOS	IS MAY RESULT	PRE-OPS WILI IN BATTERY F	L APPLY A 28	BV POWER TO

	12/05/86 MMU-136 3.9.1			NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 136 LTS/HTR.cl	b			
LEAD ANALYST:	DUFFY, HU	YNH, SAI	IDI		
ASSESSMENT:					
CRITICAL FLIGH	T	EDUNDANC	Y SCREE	ens C	CIL ITEM
HDW/FU					
NASA [2 /1R IOA [2 /1R] [P] [P] P]	[] [P]	[X] * [X]
COMPARE [/] [] []	[N]	[]
RECOMMENDATIONS:	(If dif	ferent f	rom NAS	SA)	
[/] [] []	[] (A)	[] DD/DELETE)
* CIL RETENTION :	RATIONALE:	(If app	olicable	e) ADEQUATE INADEQUATE	[]

IOA AGREES WITH THE FMEA.

NASA DATA:

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-137 NASA FMEA #: 3.9.2													SA DATA: SELINE NEW	[
SUBSYSTEM MDAC ID: ITEM:			13		'n.	. Cì)			•							
LEAD ANAL	YST	!:	DU	FFY,	ŀ	(UF	NH,	SAI	II	ΟI							
ASSESSMEN'	T:																
C						RI	EDUNI	OANC	CY	SC	REENS				L		
			., 10.10					(3								
NASA IOA	[2 [3	/1R]		[P P]]	P P]	[]	P]		[X]	*
COMPARE	[N	/N]		[]	[]	[]	N]	1	[N]	
RECOMMEND	ATI	ons:		(If	đ:	if	fere	nt 1	fro	om :	NASA)						
	[3	/3]	*	[]	(•]	[]) (AI	[\QC	D DI] ELE	TE)
* CIL RET	ENT	MOI	RAT	'IONA	L	E:	(If	app	91 :	ica	ble) IN	ADI ADI	EQUATE EQUATE	[]	
REMARKS: THE FMEA AND ORIGINAL IOA STUDY ASSUMED THAT A FAILURE (OVER CURRENT) HAS ALREADY OCCURED AND THE CB HAS ALSO FAILED CLOSED. THIS SCENARIO IS MULTIPLE FAILURE CASE FOR WHICH THE FAILURES SHOULD BE STUDIED SEPARATELY. THE CB FAILED CLOSED HAS NO CONSEQUENTIAL EFFECT, AND NOT DETECTABLE UNLESS ANOTHER FAILURE OCCURS. AT ANY RATE, POWER TO THE LIGHTS/HEATERS CAN ALSO BE CUT OFF BY EXT/INT SWITCH AND/OR MAIN POWER SWITCH TO COMPENSATE FOR THE BREAKERS.																	

ASSESSMI ASSESSMI NASA FMI	ENT	I		MM	2/05 IU-1 8.1									ASA BASE	ELI		[x]			
SUBSYSTI MDAC ID: ITEM:				MM 13 CE		IR	CU:	ĻT 1	BRE	AK	ŒI	₹										
LEAD ANA	\LY:	ST	:	DU	JFFY	, 1	HU	YNH	, s	ΑI	ΊΙ	ΟI										
ASSESSMI	ENT	:																				
		F	ICAL LIGH W/FU	r	?		RI A	EDUI	NDA	NC	Y B	sc	CREE	NS	S C				CI II	IL TEM	1	
NASA IOA	[2	/1R /1R]		[P P]		[P P]		[[P]			[X X]	*
COMPARE	[/]		[]		[]]	N]			E]	
RECOMMEN	IDA!	ric	ONS:		(If	d :	if	fere	ent	f	rc	m	NAS.	A)	ı							
	[/]		[٠]		[]	•	[]	((AE	[)D/	'DE] ELE	ETE;
* CIL RE		NT:	ION 1	RAT	'ION	AL	Ε:	(Ii	fa	pp	11	ca				EQU EQU			[]	

IOA AGREES WITH THE FMEA.

ASSESSMI ASSESSMI NASA FMI	ENT	II	D:	MMU-1	.00 − 139 .8.2								ASA [BASE]		[
SUBSYSTI MDAC ID: ITEM:				MMU 139 CEA C	CIRC	cu 1	T BR	EAI	KEI	2									
LEAD AN	ALY	ST	:	DUFFY	7, I	YUE	NH,	SA	III	ΟI									
ASSESSM	ENT	:																	
CRITICALITY REDUNDANCY SCREENS FLIGHT									L										
	1			4C		A			В			С		ITEM					
NASA IOA	[2	/1R /2R]	[[P P]	[P P]	[P]		[X]	*	
COMPARE	C	N	/N]	[]	[]	ſ	N]		[N	3		
RECOMME	NDA'	TI(ons:	(11	f d:	ifi	feren	t :	fro	om i	NASA)							
	(3	/3]	[]	[]	[]	(Al	-] ELI	ETE))
* CIL R	ETE	NT:	ION 1	RATION	IAL	E:	(If	apj	pl:	ica			DEQU <i>I</i> DEQU <i>I</i>		[]		
REMARKS															•		•		
FMEA AND WHICH DOMINITIPLE	RAW	S	OVER	CURRE	T I	ANI) THE	C	B 1	HAS	FAI	LE	D CL	OSED.	•	T		ROGI S IS	
PROCEDU			THIS	FAILU	JRE	P	DSES	NO	M	MO	R PR	OB:	LEM I	EXCE	PT	F	OR	LOS	SS
OF ABIL	ITY	T	O DE	NY POV	VER	TO	THE	C	EA	•	HOWE	VE	R, TI	HE PO	CWC	ER	M	AY I	ΒE
DENIED	BY	CE	A OR	MAIN	PO	WEI	R SWI	TC	H :	ΙF	NEED	ED	. TI	HIS I	FA.		JRI	E IS	3

NOT DETECTABLE UNTIL AN OVERCURRENT FAILURE OCCURS.

	12/05/86 MMU-140 3.10.2			A DATA: SELINE [] NEW [X]
MDAC ID:	MMU 140 GYRO PWR o	cb		
LEAD ANALYST:	DUFFY, HUY	YNH, SAIII	DI	
ASSESSMENT:				
CRITICAL: FLIGHT	ITY RI	EDUNDANCY	SCREENS	CIL ITEM
HDW/FUI	NC A	В	С	
NASA [3 /2R IOA [3 /3] [P] [P] [P] [P] [p]	[] *
COMPARE [/N	J [] [] [N]	[]
RECOMMENDATIONS:	(If dif	ferent fro	om NASA)	
[/] [] [] []	[] (ADD/DELETE
* CIL RETENTION I REMARKS: IOA AGREES WITH 7		(If appli	ADE	QUATE [] QUATE []

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-141		SA DATA: ASELINE [] NEW [X]						
	MMU 141 GYRO PWR cb	11 YRO PWR cb							
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI							
ASSESSMENT:									
CRITICAL FLIGH	ITY REDUND	ANCY SCREENS	CIL ITEM						
	NC A	в с							
NASA [2 /2 IOA [3 /2R] [P]] [P]	[P] [P] [X] *] []						
COMPARE [N /N] []	[] [N] [N]						
RECOMMENDATIONS:	(If differen	t from NASA)							
[3 /3	1 [1	[] [] [D] (ADD/DELETE)						
* CIL RETENTION	RATIONALE: (If		POUNTE ()						
			EQUATE [] EQUATE []						
WHICH DREW OVERCE SCENARIO IS MULT	URRENT WHILE TH IPLE FAILURE CA	E CB HAD FAILE SE AND SHOULD	ALREADY IN PROGRESS D CLOSED. THIS NOT BE CONSIDERED. HAS FAILED IN ITS						

NOMINAL POSITION. THE FAILURE WILL HOWEVER DENY CAPABILITY TO OPEN THE CIRCUIT, BUT THIS COULD BE MANUALLY DONE BY GYRO POWER

SWITCH OR MAIN POWER SWITCH.

ASSESSME ASSESSME NASA FME	NT	II		MM	IU-142									DATA LINE NEW	[х]	
SUBSYSTE MDAC ID:				MM 14 VE														
LEAD ANA	LY	ST:	3	DU	JFFY,	HU	YNH,	, SA	ΙI	DI								
ASSESSME	NT	:																
	CR:		CAL LIGH		?	R	EDU	NDAN	CY	SCF	REEN	S				IL Pem	1	
	I	HDV	V/FU	NC		A			В			C						
NASA IOA	[2	/1R /1R]]	P P]]	P P]	[P]		[X X]	*
COMPARE	[/]	(]	[]	[N]		[]	
RECOMMEN	DA!	ric	ons:		(If d	if	fere	ent	fr	om N	IASA)						
•	[/]	(]	[]	[]	(A	•	/DE	-	ETE ;
* CIL RE REMARKS: IOA AGRE							(Ii	f ap	pl:	icak				ATE ATE	[]	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-143		ATA: INE [] NEW [X]
MDAC ID:	MMU 143 VDA cb		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICAL FLIGH		DANCY SCREENS	CIL ITEM
-	NC A	в с	
NASA [2 /1R IOA [3 /2R] [P]] [P]	[P] [] [P] [P]	[X] * []
COMPARE [N /N] []	[] [N]	[N]
RECOMMENDATIONS:	(If differe	ent from NASA)	
[3 /3] []	[] []	[D] (ADD/DELETE)
* CIL RETENTION	RATIONALE: (If	ADEQUA	ATE [] ATE []
PROGRESS WHICH D	RAWS OVERCURRE	OY ASSUMED A FAILURE INT WHILE THE CB HAS SCENARIO AND SHOULD	E ALREADY IN S FAILED CLOSED.

CRITICALITY. THE CB FAILURE ALONE IS ONE STEP AWAY FROM THIS SCENARIO WHICH IS CONSIDERED LOSS OF MISSION. THIS FAILURE POSES NO IMMEDIATE THREAT SINCE THE CB HAS FAILED IN ITS NOMINAL POSITION.

ASSESSME ASSESSME NASA FME	ENT	ID:	•	144]	NASA BASE	LINE]
SUBSYSTE MDAC ID:			MMU 144 LOCA	TOR L	IGH'	r swit	СН					
LEAD ANA	LYS'	T:	DUFF	Y, HU	YNH	, SAII	DI					
ASSESSME	ENT:											
		TICAL FLIGH	YTI. T	R	EDUI	NDANCY	SCI	REENS			CIL	
	H	DW/FU	NC	A		В		•	С			
NASA IOA	[]	3 /3 3 /3]	[P [P]	[P [P]	[]] F]		[] *
COMPARE	[/]	(]	[]	[]	N]		[]
RECOMMEN	IDAT:	ions:	(I	f dif:	fere	ent fro	om 1	IASA)				
	[/]	[]	[]	[]	(Al	[DD/D] ELETE)
* CIL RE	TEN	TION	RATIO	NALE:	(I:	f appl:	icak	1	ADEQU ADEQU] 1
REMARKS: IOA AGRE	EES 1		THE F	MEA, I	BUT	THE S	CREE	ens do	TON C	APP	ΓX -	SHOULD

NASA DATA:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-144A			NASA DATA: BASELINE NEW	[x]	
	MMU 144 LOCATOR	LIGHT SWI	тсн			
LEAD ANALYST:	DUFFY, H	UYNH, SAI	IDI			
ASSESSMENT:						
CRITICAL: FLIGHT	-	REDUNDANC	Y SCREENS		CIL ITEM	
	NC .	A	В	С		
NASA [3 /3 IOA [3 /3] [P] [P] [P] [P] [] F]		*
COMPARE [/] [] [] [и]		1
RECOMMENDATIONS:	(If di	fferent f	rom NASA)			
[/] [] [] [] (AD	[DD/DEI	
* CIL RETENTION	RATIONALE	: (If app		ADEQUATE IADEQUATE]
REMARKS: IOA AGREES WITH 'SCREENS DO NOT ASSHOULD ADDRESS ASPOSITION. THIS OPEN - SEE ALSO	PPLY - SH NY SINGLE FAILURE S	OULD BE I CONTACT EEMS TO B	THE FOLI EFT BLANK FAILED IN E A SINGI	OWING TWO (2) THE FA I EITHER OF LE CONTACT	COMMI LILURI PEN OI	E MODE

ASSESSME ASSESSME NASA FME	ENT :	ID:	12/0 MMU- 3.1	-145					NASA BASE	LIN]
SUBSYSTE MDAC ID:			MMU 145 LOCA	ATOR LI	GHT SV	VIT(СН					
LEAD ANA	LYS	r:	DUF	FY, HUY	NH, SA	III	DI					
ASSESSME	ENT:											
	1	FLIGH			DUNDAN		SCR	EENS			CIL ITE	4
	HI	DW/FU	NC	A		В			С			
NASA IOA	[:	3 /3]	[P [P] [P]	[p]		[[] *
COMPARE	[/]	[) (•]	[N]		[]
RECOMMEN	DAT:	cons:	()	f diff	erent	fro	om N	ASA)				
	(/]	ι) (•]	[]	(F	[\DD/DI] ELETE)
* CIL RE		rion	RATIO	NALE:	(If ap	pl:	icab	·	ADEQU IADEQU		-]
IOA AGRE		HTIW	THE I	MEA, B	UT THE	s	CREE	NS S	HOULD	BE	LEFT	BLANK.

assessmei Assessmei Nasa FME	NT DA NT II A #:	ATE: D:	12/05, MMU-14 3.17.4	MU-145A .17.4				NASA DATA: BASELINE [] NEW [X]							
SUBSYSTE MDAC ID: ITEM:	M:		MMU 145 LOCATO	OR	LIGHT	SWI	TC	CH							
LEAD ANA	LYST	:	DUFFY	, H	UYNH,	SAI	I	Ι							
ASSESSME	NT:														
•		ICAL LIGH	ITY		REDUN	IDANC	Y	SCRE	ENS			CIL ITEM	1		
			NC		A		В			С			-		
NASA IOA	[3 [3	/3 /3]	[[P] P]	[[P P]	[P]	[] *		
COMPARE	[/	1	[]	[]	[N]	C]		
RECOMMEN	DATI	ons:	(If	di	ffere	ent f	r	om NA	ASA)						
	[/]	[]	[]	[] (2	[ADD/DI] ELETE)		
* CIL RE	TENT	ION	RATION	ALE	: (I	f app	1:	icab]		ΑI	DEQUATE	ſ	1		
DEW DVC -									IN	ΑI	DEQUATE	į	i		
REMARKS: IOA AGRE ALSO THE CONTACT	FAI	LURE	MODE	IS	MORE	THE APPR	S(CREEN PRIAT	1S S CELY	HC	OULD BE DEFINED	LEFT AS A	BLANK. SINGLE		

ASSESSME ASSESSME NASA FME	NT I	D:	12/05 MMU-1 3.17.	L46		NASA DATA: BASELINE [] NEW [X]								
SUBSYSTE MDAC ID:			MMU 146 LOCAT	or i	JGH1	SWI	тсн							
LEAD ANA	LYST	:	DUFFY	, HU	YNH,	SAI	IDI							
ASSESSME	NT:													
	F	LIGH	ITY T NC	R			Y SCR		С		CIL			
NASA IOA	[3 [3	/3 /3]	[P	A]	[P] NA]	[[1] NA]		[] *]		
COMPARE	[/	1	[14]	[и ј	[]	и ј		[]		
RECOMMEN	DATI(ons:	(If	dif	fere	nt f	rom N	(ASA)						
	[/]	[]	[]	[]	(AI	[DD/DI] ELETE)		
* CIL RE								INA	ADEQUA ADEQUA	TE	Ĭ]		
IOA AGRE	ES W	ITH !	THE FM	ŒΑ,	BUT	THE	SCREE	NS SI	HOULD	BE I	EFT	BLANK.		

ASSESSMEI ASSESSMEI NASA FME	NT ID:	MMU-14	6A		NASA DATA BASELINE NEW]
SUBSYSTEM MDAC ID:		MMU 146 LOCATO	R LIGHT	SWITCH			
LEAD ANA	LYST:	DUFFY,	HUYNH,	SAIIDI			
ASSESSME	NT:						
•	CRITICAL		REDUND	ANCY SCRE	ENS	CIL	ſ
	FLIGH HDW/FU	NC	A	В	С	1111	•
NASA IOA	[3 /3 [3 /3]	[P] [NA]	[P] [NA]	[] [NA]]] *
COMPARE	[/	1	[N]	[N]	[N]	ĺ]
RECOMMEN	DATIONS:	(If	differen	t from NA	ASA)		
	[/]	[]	[]	[] (A)	[.DD/DI] ELETE)
* CIL RE	TENTION	RATIONA	LE: (If	applicabl			
					ADEQUATE INADEQUATE	[]
REMARKS: IOA AGRE ALSO, TH	E FAILUR	THE FME E MODE	A, BUT T IS MORE	HE SCREEN APPROPRIA	IS SHOULD BE	LEFT	BLANK.

ASSESSMENT ID:	12/05/86 MMU-147 3.18.1		SA DATA: ASELINE [NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 147 LOCATOR LIGHT	POWER CONVERTE	R	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI		
ASSESSMENT:				
CRITICAL		IDANCY SCREENS	CIL	
FLIGH HDW/FUI		в с	ITEN	1
NASA [3 /3 IOA [3 /2R] [P]] [P]	[P] [P] [] *
COMPARE [/N] []	[] [и] []
RECOMMENDATIONS:	(If differe	ent from NASA)		
[/] []	[] [] [(ADD/DE] ELETE)
* CIL RETENTION I	RATIONALE: (If	AD	EQUATE [EQUATE []
IOA AGREES WITH	THE FMEA, BUT	THE SCREENS SHO	ULD BE LEFT	BLANK.

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-148 NASA FMEA #: 3.19.1									ASA I BASEI	INE]				
SUBSYSTE MDAC ID: ITEM:	M:			MMU 148 LIG	}											
LEAD ANA	LEAD ANALYST: DUFFY, HUYNH, SAIIDI															
ASSESSME	NT:	:														
	CR:		ICAL LIGH			R	EDUI	IDAN	CY	SCI	REEN	S			CIL ITEN	ſ
	1	_	W/FU			A			В			С			112.	•
NASA IOA	[[3	/3 /3]	[[P P]	[[P P]]	P]		[] *
COMPARE	[/]	[]	[]	[N]		[]
RECOMMEN	DA!	ri(ons:	((If d	if	fere	ent	fr	om 1	NASA)				
	(/]	[]	. []	[]	(A	[.DD/DI] ELETE)
* CIL RE		NT:	ION	RAT]	IONAL	E:	(I	f ap	pl:	ical			DEQU <i>I</i>		[]
IOA AGRE		W	ITH	THE	FMEA	,	BUT	THE	S	CRE	ENS	SH	OULD	BE	LEFT	BLANK.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-149	MU-149 BASELINE [] .16.1 NEW [X]							
	MMU 149 GYRO POWER SWITCH								
LEAD ANALYST:	DUFFY, HUYNH, SAI	IDI							
ASSESSMENT:									
CRITICAL FLIGH	ITY REDUNDANCY	Y SCREENS	CIL ITEM						
HDW/FU	NC A I	В С							
NASA [3 /3 IOA [3 /3] [P] [1] [NA] [1	P] [] NA] [NA]	[] *						
COMPARE [/] [N] [1	и] [и]	[]						
RECOMMENDATIONS:	(If different fi	rom NASA)							
[3 /2R] · [P] [1		[] ADD/DELETE)						
* CIL RETENTION	RATIONALE: (If app)	licable) ADEQUATE INADEQUATE	[]						
REMARKS: IOA RECOMMENDS THE ABOVE CRITICALITY BASED ON THE FMEA EXPLANATION GIVEN FOR THE GYROS CIRCUIT BREAKER 3.10.2, THAT IS: - COMPLETE LOSS OF GYROS WILL ALSO NEGATE THE FUNCTION OF AAH & ALT ATTITUDE CONTROL SWITCHES WHICH IS NECESSARY FOR SOME MISSIONS.									
- CREW MAY MAINT.	AIN ALTITUDE MANUAI	LLY AS A BACK-UP R	REDUNDANCY TO						

AUTOMATIC CONTROL.

ASSESSME ASSESSME NASA FME								SA D BASEI	INE]									
SUBSYSTE MDAC ID:	M:			150	GYRO POWER SWITCH															
LEAD ANALYST: DUFFY, HUYNH, SAIIDI																				
ASSESSMENT:																				
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM																				
	F		/FU				A				В				С				•	
NASA IOA	[3 3	/3 /3]		[[P P]		[P P]		[[N.]]]	*
COMPARE	[/]		[]		[]		[N]		[]	
RECOMMEN	'DA'I	rio	ons:		(If	di	fſ	ere	∍nt	: 1	fro	om N	IAS	A)	1					
•	[•	/]		[]		[]		[]	(A	[.DD/DI] ELE	TE)
	(ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []																			
REMARKS:		W	ITH	THE	FME	ΞA,	I	BUT	TH	Œ	S	CREE	ens		SHO	OULD	BE	LEFT	ві	ANK.

ASSESSMI ASSESSMI NASA FMI	ENT	D:	151									ASA DAT. BASELIN NE	E	((x]			
SUBSYSTIMDAC ID				MMU 151 GYRO	PO	WE:	R SU	PPL	Y									
LEAD AND	ALYS	ST:	:	DUFF	Υ,	HU'	YNH,	SA	III	ΟI								
ASSESSMENT:																		
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM																		
	FLIGHT HDW/FUNC								В				С		•	LIEF		
NASA IOA]	3 3	/3 /3]	[P P]	[P P]		[[:	NA]		[] *]	
COMPARE	[/]	[]	[]	[[]	N]	١	[]	
RECOMMEN	IADN	'IC	ons:	(I	f d	if:	fere	nt i	fro	om N.	AS?	A)						
•	[3	/2R	1	[P]	[P]	(P		l ADI	[D/DE] :LETE	Ξ)
* CIL RI	ETEN	T	ON F	RATIO	NAL	Ε:	(If	app) 1i	cab	le)							
											1	N	AD AD	EQUATE EQUATE	[[]	
REMARKS: THIS FAI CONTROL HOWEVER,	LUR IS	ΑV	/AIL	ABLE	THRO	OUC	H RI	HC]	O	COM	, E PEN	BU'S	Γ, AT	MANUAI	L A PHE	ATTI	TUDE	

CONJUNCTION WITH THE ALT CONTROL SWITCH. LOSS OF THIS FUNCTION AND RHC WILL PRECLUDE Y,R,P SEQUENCE, THUS LOSS OF MISSION AND RETURN TO THE ORBITER - SEE ALSO 3.10.2 FOR FURTHER EXPLANATION.

ASSESSMENT ASSESSMENT NASA FMEA	:	MMU-15	1A								SA DATA: ASELINE NEW	[
SUBSYSTEM: MDAC ID: ITEM:			MMU 151 GYRO P	WO	ER	SUPP	LY	?							
LEAD ANALY	ST:		DUFFY,	Н	UY	NH, S	AI	II	Ι						
ASSESSMENT															
CR	ITI FL	TY		RE	DUNDA	NC	CY	SCRE	ENS	3		CIL			
	iC		A			В			С			•			
NASA [IOA [3	/3 /3]]	P P]	[P P]	[NA]	[]	*
COMPARE [/]	[]	[]	[N]	[]	
RECOMMENDA	TIC	ns:	(If	di	ff	erent	: 1	fro	om NAS	SA))				
(3	/2R]	[P]	[.	P]	[P] (AI	[DD/DE		TE)
* CIL RETE	RTI	ON I	RATIONA	LE	:	(If a	ıpı	91	icable	e) II	AC IAN	EQUATE	[]	
REMARKS: THIS FAILU CONTROL IS HOWEVER, S CONJUNCTIO AND RHC WI RETURN TO	AV OME ON V	AIL MIS VITH PRE	ABLE TH SSIONS THE AI CLUDE Y	IRC (S T	OUG OL CO	H RHO AR MA NTROI SEOU	XX	ro) v sw: nci	COMPI VILL I TCH. E. THI	BI ENS RE(TT, SAT QUI LOS	MANUAL TE FOR TH TRE AAH (SS OF TH)	ATTI HE LO PERA IS FU	TU SS ATI JNC	ON IN TION AND

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-152		NASA DATA: BASELINE [NEW [
SUBSYSTEM: MDAC ID: ITEM:	MMU 152 CEA POWER	R SWITCH		
LEAD ANALYST:	DUFFY, HU	YNH, SAIIDI		
ASSESSMENT:				
CRITICAI FLIGH		IL PEM		
HDW/FU		В	С	1 11.11
NASA [2 /1F IOA [2 /1F	[P	P] [P]	[] [[P]	X] *
COMPARE [/] [] []	[N],]
RECOMMENDATIONS:	(If dif	ferent from NA	.SA)	
[2 /2] [] []] /DELETE)
* CIL RETENTION	RATIONALE:	(If applicabl	e) ADEQUATE [INADEQUATE []
REMARKS: IOA ACCEPTS THE FOR THE FLIGHT F MODE "MECHANICAL SWITCH IS PLACED AND NO MORE CREW ASSUMES A FAILUR SWITCHING ACTION POSITION. THIS WITH THE NSTS-22	HASE DUE T LY JAMS IN IN "ON" P ACTION IS E ALREADY FROM "ON" IS MULTIPL	O FOLLOWING REVISION ISON IS NOT FOSITION THROUGH ANTICIPATED/FOR IN PROGRESS WE TO "ISO", AND TO "ISO", AND TO FAILURE SCEN	ECTS THIS FAILMARKS: 1) THE INTERPOLATION THE FLIGHT EQUIRED, 2) THE ICH WOULD WARRANTED THEN JAMMING TARIO, AND INCOME.	JRE MODE FAILURE SE THE P PHASE, E FMEA ANT IN "ISO" VSISTENT

DOES NOT APPLY EITHER BECAUSE IN ORDER TO ARRIVE AT A 2/1R CRIT,

THEREFORE, FLIGHT CRITICALITY IS NOT APPLICABLE, AND PREP CRIT IS

RIGHT AFTER INADVERTENT OPERATION WHICH WOULD PREVENT THE EVA

THE SWITCH MUST GO THROUGH TWO FAILURES: A. INADVERTENT OPERATION FROM "ON" TO "ISO", B. "ISO" POSITION JAMMED

CREW FROM REACTIVATING/SWITCHING BACK TO "ON" POSITION.

ACCEPTED WHICH WOULD PREVENT FLIGHT PHASE MMU OPS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-152A		NASA DATA: BASELINE NEW	
MDAC ID:	MMU 152 CEA POWER SW	ITCH		
LEAD ANALYST:	DUFFY, HUYNH	, SAIIDI		
ASSESSMENT:				
	TTY REDU	NDANCY SCREE	NS	CIL ITEM
FLIGHT HDW/FUI	NC A	В	С	
NASA [2 /1R IOA [2 /1R] [P]] [P]	[P] [P]	[] [P]	[X] * [X]
COMPARE [/] []	[]	[и]	[]
RECOMMENDATIONS:	(If differ	ent from NAS	(A)	
[/] []	[]	[] (A	[] DD/DELETE)
* CIL RETENTION	RATIONALE: (I	f applicable	e) ADEQUATE INADEQUATE	[]
REMARKS: IOA AGREES WITH ' FOR A SINGLE CON' SINGLE CONTACT C' HOWEVER, THE POSITION (DURING POSITIONS SHOULD	TACT OPEN AND LOSED IN ISO SIBILITY OF T FLIGHT) AND	CLOSED. THE PINS DUE TO THE SWITCH BE HAVING A SHO	IIS FMEA SEE: CONTAMINATIC ZING IN "ON" ORT ACROSS "	M TO BE A ON/CORROSION: ISO" OR "OFF"
ISOLATION VALVE	POSITION.	· · · · · · · · · · · · · · · · · · · · · · ·		

(. <u>Z</u>

ASSESSMENT ASSESSMENT NASA FMEA	r ID:	MMU-153				ASA DATA: BASELINE NEW								
SUBSYSTEM: MDAC ID: ITEM:		MMU 153 CEA POW	VER SWIT	:CH										
LEAD ANALY	YST:	DUFFY,	HUYNH,	SAIIDI										
ASSESSMENT:														
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM														
		NC	A	В	С		ITEM							
NASA []	[X] * []												
COMPARE [[N /N] []	[]	[N]	[N]							
RECOMMENDA	ATIONS:	(If d	lifferen	t from	NASA)									
(3 /3] []	[]	[] (AD	[D] D/DELETE)							
* CIL RETE	ENTION	RATIONAL	E: (If	applic	ÅΓ	DEQUATE DEQUATE	[]							
THE FAILUR POSES NO I POSITION. CEA DUE TO	MMEDIA HOWEV A FAI AIN POW RN OFF	TE PROBL ER, IT W LURE - T ER SWITC MAIN POW	EM SINC ILL DEN HIS ACT H OR TH ER SWIT	E IT FACE ION CALLES THE INCHES T	AILED IN BILITY F N BE COM HANDLE (NORMAL (FOR CLOSI MPENSATED (SHUTS OF:	NG A SYSTEM FOR, F BOTH ISO							

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				ASA DATA: BASELINE NEW	
MDAC ID:	MMU 153 CEA POWE	ER SWITCH			
LEAD ANALYST:	DUFFY, H	TUYNH, SAII	DI		
ASSESSMENT:					
CRITICA FLIG		REDUNDANCY	SCREENS		CIL ITEM
HDW/F	JNC	A F	C C		
NASA [2 /11 IOA [3 /3] [P] [H)]	[X] * []
COMPARE [N /N] [] [] [N]	[и]
RECOMMENDATIONS	(If di	ifferent fr	com NASA)		
[3 /3] [] [] [[D] DD/DELETE)
* CIL RETENTION	RATIONALE	E: (If appl	Δ.	DEQUATE DEQUATE	[]
REMARKS: THE FAILURE (ELI IDENTIFIED AS A POSITIONS. THE EFFECT AS THE SV - MMU-153.	SINGLE CO	ONTACT OPEN TO TURN O	FOR EITH	ER "ISO" WILL HAVE	OR "OFF" THE SAME

ASSESSMI	ENT DATE: ENT ID: EA #:					TA: TNE [] NEW [X]
SUBSYSTI MDAC ID: ITEM:	•	MMU 154 CEA POWE	R SWIT	гсн		
LEAD AND	ALYST:	DUFFY, H	UYNH,	SAIIDI		
ASSESSMI	ent:					
	CRITICAL FLIGH		REDUNI	DANCY SC	REENS	CIL ITEM
	HDW/FU	NC .	A	В	С	
NASA IOA	[2 /1R [2 /1R] [P] P]	[P] [P]	[] [P]	[X] * [X]
COMPARE	[/] []	[]	[N]	[]
RECOMMEN	NDATIONS:	(If di	fferer	nt from 1	NASA)	
	[2 /2] []	[].	[]	[] (ADD/DELETE)
* CIL RI		RATIONALE	: (If	applical	ble) ADEQUAT INADEQUAT	
IOA ACCI	EPTS THE				, BUT REJECT FION GIVEN F	S THE OPS/FLT OR MMU-152.

ASSESSMEN ASSESSMEN NASA FME	NT ID):	MMU-15	4A				NASA DATA BASELINA NEV				
SUBSYSTEMDAC ID:	1:		MMU 154 CEA PO									
LEAD ANALYST: DUFFY, HUYNH, SAIIDI												
ASSESSME	NT:											
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM												
	HDW	/FUN	IC	A		В		С				
NASA IOA		/1R /1R]	[P [P]	[P]	[] [P]	[X] * [X]			
COMPARE	[/]	[]	[]	[N]	[]			
RECOMMEN	DATIC	ons:	(If	diff	erent	fr	om NAS	SA)				
	[/]	[]	[3	[]	[] ADD/DELETE)			
* CIL RE	rent]	ON I	RATIONA	LE:	(If a	appl	icable	e) ADEQUATE INADEQUATE				
REMARKS:												

IOA ACCEPTS THE CRITICALITY, BUT SUGGEST THAT THE FAILURE MODE BE IDENTIFIED AS A SINGLE CONTACT CLOSED (IN THIS FMEA, PINS "OFF"). HOWEVER, DURING OPS WHEN THE SWITCH IS ON, AND THE "OFF" PINS ARE CLOSED - THE FAILURE MUST BE INVESTIGATED.

ASSESSME ASSESSME NASA FME	NT	ID		12/0 MMU-	•	6									: [[X]	
SUBSYSTE MDAC ID: ITEM:				MMU 155 CEA	POW:	ER	swi	тсн									
LEAD ANA	LYS	T:		DUFF	Υ, 1	HUY	ZNH,	SA	[II	ΟI							
ASSESSMENT:																	
CRITICALITY REDUNDANCY SCREENS FLIGHT HDW/FUNC A B C													CIL				
NASA IOA] [3 ,	/]	[P]	[[P]]	P]		[]	*
COMPARE	[N,	/N]	(N]	[N)	[N]		[]	
RECOMMEN	DAT	'IO	NS:	(I	f d	ifí	fere	nt i	fro	om 1	NASA)					
	[•	/]	[]	[)	C]	(Al	[DD/D] ELI	ETE)
* CIL RE		TI	on i	RATIO	NAL	E:	(If	app) 11	Lcal	•		DEQUA	ATE ATE	[]	
REMARKS: THIS FAI OFF" AS ANALYSIS	LUR STU	DI	ED I	BY MM	U-1	53									? "F. TH		LED IN

ASSESSME ASSESSME NASA FME							ASA I BASEI		[]						
SUBSYSTE MDAC ID: ITEM:			MMI 156 PRI		E G	AGE	LIG	нт	:							
LEAD ANALYST: DUFFY, HUYNH, SAIIDI																
ASSESSMENT:																
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C																
FLIGHT HDW/FUNC A B																
NASA IOA	[3	3 /2R 3 /3]] [P P]	[[P P]	[P]		[[]	*
COMPARE	[/N]	[]	[]	[N]		[]	
RECOMMEN	DAT	cons:		(If d	iff	ere	nt f	ro	om N	IASA)					
	(·	1]	[]	ſ]	[]	(A	[DD/I) DELI	ETE)
* CIL RE	TENT	rion :	RAT:	IONAL	E:	(If	app	1 i	icab		Al NA	DEQUI	ATE ATE	[]	
REMARKS:		WITH '	THE	FMEA	, s	SINC	E TH	E	TOT							GAGES

WILL RESULT IN LOSS OF CREWPERSON ABILITY TO DETECT GN2 LEVEL AND GN2 LEAK; WHICH MAY JEPARDIZE THE CREWPERSON'S SAFETY. THEREFORE, IOA AGREES TO CANCEL THE MMU AFTER FUNCTIONAL LOSS AND RETURN TO THE ORBITER. HOWEVER, IOA RECOGNIZES THAT THIS DECISION WILL BE MOST LIKELY MADE REAL TIME DEPENDENT UPON THE CIRCUMSTANCES.

ASSESSM ASSESSM NASA FM	05/8 -157 .4	6								DA' ELI N	NE		x]					
SUBSYST MDAC ID ITEM:	CUE	LT.																
LEAD AN	HU	YNH	, SA	II	DI													
ASSESSM	ENT:	:																
		FL	JIGH			RI	EDUI	NDAN	CY	sci	REEN	s				CII		
	I	HDW	/FU	INC		A			В			С						
	HDW/FUNC NASA [3 /3] IOA [3 /3]					P P]	[P P]	[P]			[]	*
COMPARE	[/]	[]	[]	[N]			[]	
RECOMME	NDAT	rio	NS:	(:	If d	if	fere	ent	fr	om 1	NASA)						
	[/]	C]	[]	[]		(AI	[DD/I	DEL.	ETE)
* CIL R	ETEN	NTI	ON	RATIO	ONAL	E:	(I:	f ap	pl:	ical	•			JATI JATI]	
REMARKS IOA IS : BLANK.			•						HOU	LD	BE	LE	FT					

ASSESSME ASSESSME NASA FME	ENT II	D:	MMU-15	57A					NASA D	INE]	
SUBSYSTE MDAC ID:			MMU 157 THRUST	ER	CUE	LT.							
LEAD ANA	ALYST	:	DUFFY,	HU	YNH,	SAII	DI						
ASSESSMI	ENT:												
CRITICALITY REDUNDANCY SCREENS CIL ITEM													
	HD	W/FU	NC	A	L	В			С				
NASA IOA	[3 [3	/3 /3]	[F))	[P]	[[p]] [] *	
COMPARE	[/]	[]	[]	[и ј		[]	
RECOMMEN	NDATI	ons:	(If	dif	fere	nt fr	om	nasa))				
	[/]	[]	[]	[]		[D/DE] ELETE)	
* CIL RI		ION :	RATION	ALE:	(If	appl	ica		ADEQUA NADEQUA	TE TE	[]	
REMARKS: IOA IS : BLANK.	IN AG		ENT WIT				BUT	THE	SCREEN	SHC	ULD	BE LEFT	

ASSESSMI ASSESSMI NASA FMI	ENT	I			2/05/ IU-15		6							ASA DA: BASELII NI			x]	
SUBSYSTI MDAC ID: ITEM:				MN 15 CC	58	ΟL	E	LECI	RON	IC	S A	SSEM	BL	Y					
LEAD ANA	LY	ST	:	DU	JFFY,	, 1	HU	YNH,	SA	III	ΟI								
ASSESSMI	ENT	:																	
		F	ICAL LIGH W/FU	r			RI A		IDAN(CY B	sc	REEN	s c				IL PEM	1	
NASA IOA	[2	/ /1R]		[P]	[P]]	P]		[x]	*
COMPARE	[N	/N	J		[N]	[N]	[N]		[N]	
RECOMMEN	IDA	TI	ons:		(If	d :	if	fere	ent :	fro	o m	NASA	.)						
	[2	/1R]		[P]	[P]	[P		(ADI		A 'DE		ETE
* CIL RI		NT	ION :	RAI	ION?	XL	Е:	(If	apı	pl:	ica	•		DEQUATI DEQUATI		[]	
REMARKS:	i																		

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-159			NASA DATA: BASELINE NEW	
MDAC ID:	MMU 159 CONTROL E	ELECTRON	IICS ASSE	MBLY	
LEAD ANALYST:	DUFFY, H	JYNH, SA	AIIDI		
ASSESSMENT:					
CRITICAL FLIGH	ITY 1	REDUNDAM	ICY SCREE	ens	CIL ITEM
	NC A	A	В	С	
NASA [2 /1R IOA [2 /1R] []	P] P]	[P] [P]	[] [P]	[X] * [X]
COMPARE [/] [1	[]	[и]	[]
RECOMMENDATIONS:	(If di	fferent	from NAS	SA)	
[/] []	[]	[] (A	[] DD/DELETE)
* CIL RETENTION	RATIONALE	: (If a	pplicable	e) ADEQUATE INADEQUATE	[]
REMARKS: IOA IS IN AGREEM ELECTRONIC EQUIP ITS FAILURE MODE	MENT IN T	HE CEA	SHOULD B	ER. EACH PIE	CE OF

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-160			NASA DATA BASELINE NEW	[]
SUBSYSTEM: MDAC ID: ITEM:	MMU 160 CONTROL E	ELECTRONIC	S ASSEMB	LY	
LEAD ANALYST:	DUFFY, HU	JYNH, SAII	DI		
ASSESSMENT:					
CRITICALI FLIGHT	_	REDUNDANCY	SCREENS		CIL ITEM
HDW/FUN	IC A	А В	(С	1101
NASA [2 /2 IOA [2 /1R		P [P] [] P]	[X] *
COMPARE [/N] [) [] [1	N]	[]
RECOMMENDATIONS:	(If dif	ferent from	om NASA)		
[2 /1R] [P) [P] []		[] D/DELETE
* CIL RETENTION R	ATIONALE:	(If appl:	1	ADEQUATE	[]
REMARKS: THE ERRATIC RESPO CREWPERSON TO SHU CONTROL. LOSS OF LEAVE THE EVA CRE	TDOWN A S' BOTH SID	YSTEM IN O ES UNDER S	TERS MAY DRDER TO SEVER ERF	MAINTAIN	EVA ATTITUDE

ASSESSMENT DATE: 12/05/80 ASSESSMENT ID: MMU-161 NASA FMEA #: 3.3.3													ASA DA BASELI N		[
SUBSYSTE MDAC ID:				MMU 161 CONTE	ROL	EI	LECT	[RO]	NIC	S AS	SEM	BL	č					
LEAD ANA	LYS	T:	:	DUFF	, I	(UI	NH,	, si	AII	DI								
ASSESSME	ENT:	3																
	CRI		CAL	TY r		RI	EDUI	NDA	NCY	SCF	REEN	S				CL CEN	4	
	ł			IC		A			В			С					•	
NASA IOA	[[2	/2 /1R]	[P P]		[P]] [P]		[X X]	*
COMPARE	[/N]	[]		[)	[N]		[]	
RECOMMEN	'ADI	CIC	ons:	(1:	f d:	if	fere	ent	fr	om N	IASA)						
	[2	/1R]	[P	1		[P	1	[P]				ELI	ETE)
* CIL RI	ETE	T	ON I	RATIO	NALI	Ξ:	(I :	f a	ppl	icat		3.1	>E </td <td>nto</td> <td>r</td> <td></td> <td>1</td> <td></td>	nto	r		1	
											I	NA NA	DEQUAT DEQUAT	ľE	[]	
THE ERRA CREWPERS CONTROL LEAVE TH	ATION	TO LOS	SHT SS OI	JTDOWI F BOTI	N A H S	S: IDI	YSTI ES (EM UND	IN ER	ORDI SEVI	ER T	O I	MAINTA ATIC F	AIN RESI	A'. 201	TT: ISK	ITU E 1	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-162		NASA DATA: BASELINE NEW	
	MMU 162 ISOLATION VA	LVE TIMER		
LEAD ANALYST:	DUFFY, HUYNH	, SAIIDI		
ASSESSMENT:				
CRITICAL FLIGH HDW/FU	r	NDANCY SCREENS B	c	CIL ITEM
		_	1	r 1 +
IOA [2 /2] [P]	[] [[F] [P]	[] * [X]
COMPARE [N /N] [N]	[N]	и]	[N]
RECOMMENDATIONS:	(If differ	ent from NASA)		
[2 /2] []	[] [[A] D/DELETE)
* CIL RETENTION	RATIONALE: (I		ADEQUATE	[]

REMARKS:

ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #:	E: 12/05/86 MMU-163			BASELINE NEV	
SUBSYSTEM: MDAC ID: ITEM:	MMU 163 ISOLATION	VALVE 1	TIMER		
LEAD ANALYST:	DUFFY, HU	YNH, SA	IDI		
ASSESSMENT:					
CRITIC FLI HDW/	GHT	EDUNDANG	CY SCREE	ens C	CIL ITEM
NASA [/ IOA [2 /] [2] [P] [F]	[] [P]	[x] *
COMPARE [N /	и] [и] [N]	[N]	[N]
RECOMMENDATION	s: (If dif	ferent :	from NAS	SA)	
[2/	2] [] [1	[]	[A] ADD/DELETE)
* CIL RETENTIO	N RATIONALE:	(If ap	plicable	ADEQUATE	-

REMARKS:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-164		NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 164 ISOLATION VALVE	TIMER		
LEAD ANALYST:	DUFFY, HUYNH, S	AIIDI		·
ASSESSMENT:				
CRITICAL FLIGH	T	NCY SCREENS		CIL ITEM
HDW/FU	NC A	В	С	
NASA [/ IOA [2 /1R] []]]	[] [[F] [] P]	[] * [x]
COMPARE [N /N] [N]	[и]	и]	[N]
RECOMMENDATIONS:	(If different	from NASA)	•	
[2 /1R] [P]	[F] [[A] DD/DELETE)
* CIL RETENTION	RATIONALE: (If a	- ,	ADEQUATE	[]
REMARKS: CONTINUOUS SIGNA MAY BURN THE MOT		ON VALVE MO	ADEQUATE NADEQUATE OTOR TO CLO	•
inii Doldi IIII Mol	ON WALD DIVERTIN THE	DALLERI.		

ASSESSME ASSESSME NASA FME	NT I			J-16				NASA DATA: BASELINE [] NEW [X]									
SUBSYSTE MDAC ID: ITEM:			MMT 166 VAI	5	DR:	CVEI	R AMP	LI	FIEF	₹							
LEAD ANA	LYST	:	DUI	FFY,	н	INYU	H, SA	II	DI								
ASSESSME	NT:																
		ICAL]	REDI	JNDAN	CY	SCF	REENS	3		CIL	4			
	_	W/FU			1	A		В			С		+12.	•			
NASA IOA	[2	/1R /1R]		[]	P]]	F F]	[P]	[X] *			
COMPARE	ι	/]		[]	C]	[N	1	[]			
RECOMMEN	DATI	ons:		(If	di	ffe	rent	fr	om N	NASA))						
	[/]		[]	[]	[] (A)	[[D/DC] ELETE)			
* CIL RE		NOI	RAT:	IONZ	ALE	: (If ap	pl	icak			DEQUATE DEQUATE]			
REMARKS:		REEM	ENT	WIT	rH '	THE	FMEA	. –	SEI	E ALS	30	REMARKS	FOR	MMU-159.			

ASSESSMEN ASSESSMEN NASA FMEN	T	I		12/0 MMU-		6							ASA D BASEL	[]	
SUBSYSTEM MDAC ID:	M:			MMU 167 VALV	E Di	RI	VER	AM P	LI	FIEF	t						
LEAD ANA	LYS	ST	:	DUFF	Y , 1	HU:	НИУ	, SA	II	DI							
ASSESSME	NT:	:															
(CRI		ICAL: LIGH:			R	EDU	NDAN(CY	SCF	REEN	s			[L [EN	4	
	F	IDI	W/FUI	NC		A			В			С				-	
NASA IOA	[2	/ /1R]]	P]	[P]	[P]	[X]	*
COMPARE	[N	/N]	[N]	E	N]	[N]	C	N]	
RECOMMENI	CAC	ri(ONS:	(I	f d:	if	fer	ent :	fro	om N	ASA)					
	[2	/1R]	[P]	[P]	[P]	[/QC			ETE
* CIL RET	ľEN	T	ION I	RATIO	NAL	E:	(I :	f ap) 1:	icab	·		DEQUA'	[]	
REMARKS: FAIL ON																	

ASSESSMENT D ASSESSMENT I NASA FMEA #:	•	•		NASA DAS BASELII NI	
SUBSYSTEM: MDAC ID: ITEM:	MMU 168 VALVI	DRIVER	AMPLIFIER		
LEAD ANALYST	: DUFF	, HUYNH,	SAIIDI		
ASSESSMENT:					
	ICALITY LIGHT	REDUN	DANCY SCR	EENS	CIL ITEM
HD	W/FUNC	A	В	С	
NASA [IOA [2	/] :/1R]	[] [P]	[] [P]	[] [P]	[] * [X]
COMPARE [N	л /и]	[N]	[N]	[N]	[и]
RECOMMENDATI	ons: (I	f differe	ent from N	ASA)	
Ι	/ 1	[]	[]	[]	[(ADD/DELETE)
* CIL RETENT	CION RATIO	NALE: (If	applicab	ADEQUAT	
REMARKS:				INADEQUAT	E []

THIS ANALYSIS MAY BE WITHDRAWN.

ASSESSMEN ASSESSMEN NASA FMEA	T ID:	: 12/0 MMU- 3.2.	169					ASA DAT. BASELIN NE		x]	
SUBSYSTEM MDAC ID:	1 :	MMU 169 TRAN	ISLATI(ONAL	HAND	CON	TROLLI	ER			
LEAD ANAI	LYST:	DUFF	Y, HU	YNH,	SAIII)I					
ASSESSMEN	T:										
C	CRITICA FLIG		RI	EDUNE	ANCY	SCR	EENS		CI	L	
	HDW/F	UNC		В		С					
NASA IOA	•]	[P [P]	[P]	[[P]	[[х ј х ј	*
COMPARE	[/]	Ţ]	[3	[N]	ſ]	
RECOMMEND	DATIONS	: (1	f dif	feren	nt fro	om N	ASA)				
	[/]	[1	[]	ľ] (.		DELE	ETE)
* CIL RET	TENTION	RATIO	NALE:	(If	appl:	icab	ΑI	DEQUATE DEQUATE	-]	
REMARKS:							INAL	JEQUATE	l	J	
FAIL ON 1	L-3 AXE	S									

ASSESSMEN ASSESSMEN NASA FME	T ID:	E: 12/05 MMU-3 3.2.2	L69A			NASA DATA BASELINI NET		
SUBSYSTEM MDAC ID:	1 :	MMU 169 TRANS	SLATIONAL	. HAND	CONTR	OLLER		
LEAD ANA	LYST:	DUFF	Y, HUYNH,	SAIII)I			
ASSESSME	NT:							
•	CRITIC FLI	ALITY GHT	REDUN	IDANCY	SCREE	ns	CIL ITE	
	HDW/	FUNC	A	В		С		
NASA IOA	[2 /	1R] 1]	[P] [P]	[P [P]	[] [P]	[X [X] *
COMPARE	[N /	и ј	[]	[]	[и]	[]
RECOMMEN	DATION	ıs: (I	f differe	ent fr	om NAS	SA)		
	[1/	1]	[P]	[P	1	[P]	[ADD/D] ELETE)
* CIL RE	TENTIC	N RATIO	NALE: (I	f appl	icable	e) ADEQUATE INADEQUATE	[]
REMARKS:								

FAIL ON 1-3 AXES

ASSESSM ASSESSM NASA FM	ENT	I			2/05/ IU-17		5							ASA BASE		[]	
SUBSYST MDAC ID ITEM:				MM 17 TF	70	ΡĀ	!I	ONZ	AL H	ANI	o co	ONTRO	LL	ER					
LEAD AN	ALY	ST	:	DU	JFFY,	H	U.	YNI	H, S	AI]	DI								
ASSESSM	ENT	:																	
	CR		ICA LIGI		?		RI	EDU	UNDAI	1C3	S	CREEN	s				I L PEI		
		HD	W/F	JNC			A			F	3		С					•	
NASA IOA	[1	/ /1]		[[P]	[·] [A]	[N] A]		[x]	*
COMPARE	[N	/N]		[N]	(N]	[N]		[N]	
RECOMME	NDA'	TI	ons:	:	(If	li	f1	eı	ent	fr	OM.	NASA)						
	[/]		[]]	[]	(AI	[)D/	/DI] ELF	ETE)
* CIL RI	ETE	NT:	ION	RAT	IONA	LE	:	(I	fap	pl	ica	able)							
REMARKS:	•											I		DEQU <i>I</i> DEQU <i>I</i>		[]	
THIS ASS	ERC	SMI EEI	ENT DED	AND BY	CORI	RE:	S F MM	ON U	DING 1701	W X,	ORK 17	SHEE' 02X,	rs 17	ARE	VOII)E[). .70	1 4 X	HEY

ASSESSME ASSESSME NASA FME	NT I	D:	MMU-	171		nasa da Baseli 1	ATA: INE [] IEW [X]
SUBSYSTE MDAC ID: ITEM:			MMU 171 ROTA	TIONAL H	AND CONTRO	OLLER	
LEAD ANA	LYST	:	DUFF	Y, HUYNH	, SAIIDI		
ASSESSME	ENT:						
		ICAL LIGH		REDU	NDANCY SCI	REENS	CIL ITEM
			NC	A	В	С	
NASA IOA	[1	/1 /1]	[P] [P]	[P] [NA]	[] [AA]	[X] * [X]
COMPARE	[/]	[]	[N]	ן א ן	[]
RECOMMEN	NDATI	ONS:	(:	If differ	ent from 1	NASA)	
	(/]	[]	[]	[]	[] (ADD/DELETE)
* CIL RI	etent	NOI	RATIO	ONALE: (]	[f applica]	ble) ADEQUA INADEQUA	TE [] TE []
REMARKS FAIL ON	-	AXI	ES)				

ASSESSMI ASSESSMI NASA FMI	ENT	I	D:	MM	J-171A				NASA DA BASELI 1		
SUBSYSTE MDAC ID:				MM(17) RO		L HA	ND CO) N'TI	ROLLER		
LEAD ANA	LYS	ST	:	DUI	FFY, HU	(NH,	SAII	DI			
ASSESSME	NT:	:									
		F	LIGH	T		EDUNI	DANCY	S	CREENS	CI	
	I	IDI	W/FU	NC	A		F	3	С		
NASA IOA	[[2 1	/1R /1]	[P [P]	[F) [A]	[] [NA]	[]	X] * X]
COMPARE	[N	/N]	C]	[N	ı j	[N]	[]
RECOMMEN	DA'I	PI.	ons:	(If diff	erer	nt fr	om	NASA)		
	[1	/1]	[]	[]	[]] DELETE)
* CIL RE	TEN	T)	ON 1	RATI	ONALE:	(If	appl	ica	able) ADEQUAT INADEQUAT	E []
REMARKS: FAIL ON RESCUE R	(1- EOU	.3 IIF	AXES	S).	FAILUR	E CA	ANNOT	BE	ISOLATED.	ABORT	REQUIRED

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA BASELINE NEW	
MDAC ID:	MMU 172 ROTATIONAL HAN	ND CONTROLLER	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
FLIGH'	ITY REDUNI I NC A	DANCY SCREENS B C	CIL ITEM
NASA [/ IOA [1 /1] [p]	[] [] [NA] [NA]	[x] *
COMPARE [N /N] [N]	[N] [N]	[и]
RECOMMENDATIONS:	(If differe	nt from NASA)	
[/] []	[] []	[] ADD/DELETE)
* CIL RETENTION	RATIONALE: (If	applicable) ADEQUATE INADEQUATE	[]
REMARKS: FAIL OFF (1-3 AX WORKSHEETS ARE V 1722X, 1723X, AN	OIDED. THEY AR	ESSMENT AND CORRESPOND E REPLACED WITH ITEMS	OING ANALYSIS MMU-1721X,

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-173 3.2.7			NASA DATA: BASELINE NEW		
SUBSYSTEM: MDAC ID:						
LEAD ANALYST:	DUFFY, H	UYNH, SA	AIIDI			
ASSESSMENT:						
FLIGH'				NS C	CIL ITEM	
HDW/FOI	NC	A	В	C		
NASA [2 /1R IOA [1 /1] [P] [P] [P]	[] [NA]	[X]	*
COMPARE [N /N] [] [[N]	[N]	[]	
RECOMMENDATIONS:	(If di	fferent	from NAS	A)		
[/] [] [1	[] [A)	[] DD/DELE	
* CIL RETENTION	RATTONALE	: (If an	plicable	1		
		. (ADEQUATE INADEQUATE	[]	
REMARKS: IF THE FAILURE IS ALTERNATE SYSTEM CLOSED. THE PILA ACCEPTS THE CRIT	. IF THE	FUNCTIO	N IS LOS	T, THE ISO	VALVES	ARE

	MMU-174		ATA: INE [] NEW [X]
	174	WITCH	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
		DANCY SCREENS	CIL ITEM
UBSYSTEM: MMU DAC ID: 174 TEM: THC ISOLATE SWITCH EAD ANALYST: DUFFY, HUYNH, SAIIDI SSESSMENT: CRITICALITY REDUNDANCY SCREENS FLIGHT HDW/FUNC A B C NASA [2 /1R] [P] [P] [] IOA [2 /2] [P] [NA] [NA] COMPARE [/N] [] [N] [N] ECOMMENDATIONS: (If different from NASA) [1 /1] [] [] [] CIL RETENTION RATIONALE: (If applicable) ADEQUA INADEQUA		2.2	
NASA [2 /1R IOA [2 /2] [P]] [P]	[P] [] [NA] [NA]	[X] *
COMPARE [/N] []	[N] [N]	[]
RECOMMENDATIONS:	(If differe	nt from NASA)	
[1 /1	1 []	נ ז נ ז	[] (ADD/DELETE)
* CIL RETENTION	RATIONALE: (If	ADEQUA	
REMARKS:		INADEQUA	[]

THE THC ISOLATE SWITCH IS ONLY USED DURING CONTINGENCY SITUATIONS DURING FLIGHT. UNDER THIS SCENARIO, THE PILOT HAS NO OTHER BACKUP TO STOP THE EXISTING PROPULSION/LEAK. ORBITER RESCUE IS NOT CONSIDERED AS CONTINGENCY FOR COMPONENT FAILURE MODE EFFECTS ANALYSIS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-174A	1	NASA DATA: BASELINE [NEW [
SUBSYSTEM: MDAC ID: ITEM:	MMU 174 THC ISOLATE	E SWITCH		
LEAD ANALYST:	DUFFY, HUYN	H, SAIIDI		
ASSESSMENT:				
CRITICAL: FLIGH		DUNDANCY SCREENS		L EM
	NC A	В	2	. EPI
NASA [2 /1R IOA [2 /2] [P]	[P] [[NA] [1	4 y] [X] * X]
COMPARE [/N] []	[N] [1	4] []
RECOMMENDATIONS:	(If diffe	erent from NASA)		
[1 /1] []	[] [] 'DELETE)
* CIL RETENTION 1	RATIONALE: (ADEQUATE [ADEQUATE []
REMARKS: FAIL OFF. THE TI SITUATIONS DURING OTHER BACKUP TO S IS NOT CONSIDERED MODE EFFECTS ANAL	FLIGHT. USTOP THE EXICORY AS CONTING	WITCH IS ONLY US INDER THIS SCENAI STING PROPULSION	SED DURING CRIO, THE PILEN/LEAK. OTH	CONTINGENCY OT HAS NO

ASSESSMENT DA ASSESSMENT ID NASA FMEA #:	: MMU-175			ASA DATA: BASELINE [NEW [X	
SUBSYSTEM: MDAC ID: ITEM:	MMU 175 AUTOMAT	ric Attitui	E HOLD SWI	гсн	
LEAD ANALYST:	DUFFY,	HUYNH, SAI	IDI		
ASSESSMENT:					
	CALITY LIGHT	REDUNDANC	Y SCREENS	CIL	
		A	в с	110	
NASA [3 IOA [2	/3] /2]	[P] [[P] [P] [F] [F] [x] *]
COMPARE [N	/N]	[] [и] [и] [N	1
RECOMMENDATIO	NS: (If	different 1	from NASA)		
ι	/]] []] [] [(ADD/D	
* CIL RETENTI	ON RATIONA	LE: (If app			1
			INA	DEQUATE [DEQUATE []
REMARKS: FAIL ON. THE POWER IS ON. TURNING GYRO FMEA.	EXCESSIVE	USE OF PRO	PELLANT CA	S ACTIVE WHE N BE AVOIDED ERS. IOA AC	BY

ASSESSME ASSESSME NASA FME	NT	II	D:	12/05 MMU-1 3.1.7		5									DATA LINE NEW	[]
SUBSYSTEM MDAC ID:	M:			MMU 176 AUTOM	ATI	c	AT?	rit	UD	E	HOL	D SI	WI'	гсн			
LEAD ANA	LY:	ST	:	DUFFY	, F	ĮU)	YNH,	, s	ΑI	II	Ι						
ASSESSME	NT	:															
1		F	LIGH!	ITY I NC		RI A	EDUI	ADA		Y B	SCR	EEN	s c			CIL	M
NASA IOA	[3	/3 /3]]	P]		[P]	[P]		[] *]
COMPARE	[/]		N				N			N			[]
RECOMMEN	DA'	ric	ONS:	(If	di	fi	fere	ent	f	rc	om N	ASA)				
·	[3	/2R	1	[P]		[P]	[P]	(A)	[DD/DD] ELETE)
* CIL RE	TE	NT:	ION 1	RATION	ALE	E :	(II	f a	pp	1 i	cab	•		DEQU DEQU		[]
FAIL OFF	•	TI	HE P	JRPOSE	OF	ר י	THE	ΑU	го	MA	TIC	AT:	ri:	TUDE	HOL	D IS	TO EAS

FAIL OFF. THE PURPOSE OF THE AUTOMATIC ATTITUDE HOLD IS TO EASE THE PILOT WORKLOAD WHILE SAVING GAS. THIS IS DONE BY AUTOMATICALLY CONTROLLING THE PITCH, YAW, AND ROLL OF THE MMU. THE FAILURE OF THIS ITEM MAY HAVE MISSION IMPACT. THE DEGREE OF SEVERITY HAS TO BE JUDGE REAL TIME DEPENDING ON TIME OF FAILURE, REMAINING MISSION DIFFICULTY, AND AMOUNT OF GAS LEFT IN THE TANKS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-177		NASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 177 ALTERNATE	CONTROL MODES	SWITCH	
LEAD ANALYST:	DUFFY, HUY	NH, SAIIDI		
ASSESSMENT:				
CRITICAL		DUNDANCY SCREE	INS	CIL ITEM
FLIGH HDW/FU		В	С	
NASA [3 /3 IOA [2 /2] [P]] [P]] [F]	[] [F]	[x] *
COMPARE [N /N	j [] [N]	[N]	[N]
RECOMMENDATIONS:	(If dif	ferent from NAS	SA)	
[3 /2F	l] [P] [P]		[] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If applicable	e) ADEQUATE INADEQUATE	
REMARKS: THIS FAILURE MOI INCREASED BY THI ADDITION, SATELL	E INABILITY TTTE STABIL	MC LINICACEN AAM	BE PERFORME	D DUE TO THE

INABILITY TO ENGAGE THE THRUSTER LOGIC. FURTHER, BOTH

A GO/NO GO DECISION MADE REAL TIME.

OPERATIONS PERFORMED MANUALLY WILL REQUIRE MORE TIME AND GAS. THE COMBINATIONS OF UNCERTANINTIES WILL HAVE TO BE EVALUATED AND

ASSESSMI ASSESSMI NASA FMI	ent	' I	D:	M	2/05/8 MU-177 .15.4											A DATA SELINI NEV	E []	
SUBSYSTI MDAC ID: ITEM:				1	MU 77 LTERNA	TE	c	ONTF	20:	L 1	MO	DES	s	WI	TCI	H				
LEAD ANA	\LY	ST	:	D	JFFY,	HU	YNF	i, s	A	II	DI									
ASSESSME	ENT	:																		
		F	LIGH	T	Ž.	R	EDU	INDA	N	CY	S	CREI	ΞN	S				IL TEI		
		HD	W/FU	NC		A				В				С			_		•	
NASA IOA	[3 2	/3 /2]	[P P]		[[P F]		[F]		[x]	*
COMPARE	[N	/N]	[]		[N]		[N]		[N]	
RECOMMEN	'DA'	ΓΙ	ons:		(If di	lfi	fer	ent	Í	rc	m	NAS	A))						
	[3	/2R]	ſ	P]		[P]		[P]	(A	[DD/	/DE] ELE	TE)
* CIL RE	TEI	T	ON 1	RAT	IONALE	: :	(I	f a	gq	li	ca	ble	:)							
REMARKS:													-			UATE UATE]]	
THE FAIL	URI D I	E N By	ODE THE	IS IN	FAIL" ABILIT	S Y	IN TO	NOI ENG	RM GA	o. Ge	A	THE AH	F WT	II HT	TO.	WORK	LOA	D	MA	Y BI

ADDITION, SATELLITE STABILIZATION CANNOT BE PERFORMED DUE TO THE INABILITY TO ENGAGE THE THRUSTER LOGIC. FURTHER, BOTH OPERATIONS PERFORMED MANUALLY WILL REQUIRE MORE TIME AND GAS. THE COMBINATIONS OF UNCERTAINTIES WILL HAVE TO BE EVALUATED AND A GO/NO GO DECISION MADE REAL TIME.

ASSESSMENT DATE: 12/05/86

NASA DATA:

ASSESSME NASA FME	ENT EA #	II :):	MM 3.	U-17 15.1	8 L								В	ASELINE NEW	[[]			
SUBSYSTE MDAC ID: ITEM:				MM 17 AL		ľAI	re	CON	rroi	. P	I OD	es s	SW:	ΙT	СН				
LEAD ANA	LYS	T:	:	DU	FFY,	·	IUY	NH,	SAI	ΙI	Ι								
ASSESSME	ENT:	;																	
	CRI		CAL				RE	DUN	DANC	Y	sc	REE	NS			CII			
	F	_	LIGH V/FU				A			В				С		111	3141		
NASA IOA	[[3	/2R /3]		[P P]	[P F]		[[F]	[[]	*	
COMPARE	Ε		/N]		[]	[N)		[N	1	[]		
RECOMMEN	NDA?	ric	ons:		(If	đ:	if1	ere	nt 1	fro	om	NAS	A)						
	(/]		[]	[.]		[] (A	[\DD/I) DELI		
* CIL RI	ETEI	NT:	ION	RAI	ION	AL	E:	(If	app) 1:	ica			AI AI	EQUATE	[]		
REMARKS: FAIL ON DUE TO T RATE OF SIDE TO	SA! THE GA!	P: S I	ILOT USED	IN	ABI)	LI: OT	ry 's	TO ACT	CONT	rro Is	OL S F	ILU TRA EQU	RE NS IR	L#	MAY TERM ATIONS A D TO TUR	INA! AND ! O NS	re i rhe ff (HIG	H

DOES NOT OPERATE, WHICH ITSELF IS A MISSION IMPACT DUE TO HIGHER RATE OF GAS USED (SEE MMU-176) AND INABILITY TO USE AXIS INHIBIT.

THE MISSION SCENARIO WILL HAVE TO BE EVALUATED AND A GO/NO GO

DECISION MADE REAL TIME. IOA AGREES WITH THE FMEA.

ASSESSME ASSESSME NASA FME	NT I	D:	MMU-1	78A						A DATA SELINE NEW]	
SUBSYSTE MDAC ID: ITEM:			MMU 178 ALTER	NATE	CON	TROL	MOD	es sw	ITC	H			
LEAD ANA	LYST	:	DUFFY	, HU	YNH,	SAI	IDI						
ASSESSME	NT:												
		ICAL: LIGH	ITY T	R	EDUN	DANC'	Y SCI	REENS	}		CIL		
	_		NC	A]	В		С		111	11.1	
NASA IOA	[3 [3	/2R /3]	[F]	[]	P] F]]] F]		[]	*
COMPARE	[/N]	[]	[]	N]	[N]		[]	
RECOMMEN	DATI	ons:	(If	dif	fere	nt f	rom 1	NASA)					
	[/	1	[.]	C]	[3	(A	[DD/D] ELE	TE)
* CIL RE	TENT	ION 1	RATION	ALE:	(If	app:	lical		ADE	QUATE QUATE	[j	
REMARKS: FAIL ON WITH THE			E STAB	ILIZ	ER.	SEE	REM				-	=	AGREES

ASSESSMEI ASSESSMEI NASA FME	T	ID	:	MM	/05/8 J-179 15.5	9							1		SA DATA ASELINE NEW	[]	
SUBSYSTEMDAC ID:	M:			MM 17: AL		ΑT	Έ	CONT	ro1	L M	IOD	ES S	sw	TI	СН				
LEAD ANA	LYS	ST:	1	DU:	FFY,	H	UΥ	NH,	SA	[I[I								
ASSESSME	NT:	:																	
	CR]			LITY			RE	ומטם	OAN	CY	SC	REE	NS	;			IL TE		
	I	_	JIGH V/FU				A			В				С					
NASA IOA	[3	/3 /3]		[P P]	[P F]		[[F]	(· :]	*
COMPARE	[/]		[]	[N]		[N]	-	[]	
RECOMMEN	IDA'	TI	ONS	:	(If	d:	ifi	fere	nt	fr	om	NAS	A))					
	[3	/2	R]		[P]	[P]		[P] (AD	[D/D	ELE	TE)
* CIL RI	ETE	NT	ION	RAT	NOI	AL	E:	(If	ap	pl	ica	able			DEQUATE DEQUATE		[]	

REMARKS: FAIL ON IN "AXIS INHIBIT". THE SYSTEM FAILS TO FLY AAH IN THE SELECTED AXIS AND ENGAGE SATELLITE STABILIZATION WHEN NEEDED. THERE MAY BE MISSION IMPACT DUE TO INCREASED PILOT WORKLOAD, AND USE OF GAS. THE MISSION SCENARIO WILL HAVE TO BE EVALUATED AND A GO/NO GO DECISION MADE REAL TIME.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-179A	NASA DAT BASELIN NE	
SUBSYSTEM: MDAC ID: ITEM:	MMU 179 ALTERNATE CON	TROL MODES SWITCH	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
FLIGH		DANCY SCREENS	CIL ITEM
HDW/FU	NC A	В С	
NASA [3 /3 IOA [3 /3] [P]] [P]	[P] [] [F]	[] *
COMPARE [/] []	[N] [N]	[]
RECOMMENDATIONS:	(If differe	nt from NASA)	
[3 /2R] [P]		[] ADD/DELETE)
* CIL RETENTION	RATIONALE: (If	applicable)	
REMARKS:	·	ADEQUATE INADEQUATE	
THE SYSTEM FAILS SATELLITE STABIL	IZATION WHEN NI PILOT WORKLOAI		D ENGAGE MISSION IMPACT HE MISSION

SCENARIO WILL HAVE TO BE EVALUATED AND GO/NO GO DECISION MADE

REAL TIME.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-180		NASA DATA: BASELINE NEW]
MDAC ID:	MMU 180 GYRO PHASE PLA	NE LOGIC			
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI			
ASSESSMENT:					
CRITICAL FLIGH	ITY REDUND	ANCY SCREEN	S	CIL ITEM	r
T	NC A	В	С	11Er	•
NASA [/ IOA [3 /3] []] [P]] [] [] [AN]	NA]]] *
COMPARE [N /N] [N]	[N] [N]	[]
RECOMMENDATIONS:	(If differen	t from NASA)		
[3 /2R] [P]	[P] [[DD/DE] ELETE)
* CIL RETENTION	RATIONALE: (If		ADEQUATE NADEQUATE	[]
REMARKS: FAILS OFF 1-3 CH THIS ITEM, SEE M					WITHOUT

ASSESSMENT I ASSESSMENT I NASA FMEA #:	D:								SA DA ASELI	NE		x]	
SUBSYSTEM: MDAC ID: ITEM:		MMU 181 GYRO I	PHASI	E PLAI	NE	LOGIC							
LEAD ANALYST	r:	DUFFY,	, HU	YNH,	SAI	IDI							
ASSESSMENT:													
	CICALI FLIGHT	TY	RI	EDUNDA	ANC	Y SCR	EENS	5			CII		
		1C	A			В		С			111	LM	
NASA [IOA [3	3 /3]	[[P]	[NA]	[NA]		[]	*
COMPARE [N	1 /N]	[N]	[и ј	[N]		[]	
RECOMMENDATI	ons:	(If	dif	ferent	t f	rom N.	ASA))					
[3	3 /2R]	[P	1	[P]	[P]	(AI		DELI	ETE)
* CIL RETENT	I NOI	RATIONA	ALE:	(If a	qqs	licab	le)				_	_	
							I	AD NAD	EQUAT EQUAT	E E	[]	
REMARKS: NOISY/FALSE AAH, SEE MMU			THIS	FAIL	JRE	WILL	FOI	RCE	THE	SHU	JTDO	NWC	OF

ASSESSME ASSESSME NASA FME	TK	IE		12/ MMU 3.3	-18		;						N	IASA BASI	ELIN			x]	
SUBSYSTEMDAC ID:				MMU 182 CEA	:	R	SI	PLY												
LEAD ANA	LYS	ST:	:	DUF	FY,	H	W	NH,	SA	ΙΙ	DI									
ASSESSMI	ENT	:																		
	CR		ICAL:				RI	EDUN	MAC	ICY	SCI	REEN	S				CI	L EN	ſ	
	1		W/FUI				A			В	}		(C						
NASA IOA			/1R /1R]	P P]		F)]	(P]			[X X]	*
COMPARE	[/]		[]	1]	(. 1	N]			[]	
RECOMME	NDA'	TI	ons:	((If	d:	if:	fere	nt	fr	om 1	NASA	١)							
	.[/]		נ]	!	[.]	[)	. '	(AI] OD,	/DI] ELH	ETE)
* CIL R	ETE	NT:	ION :	RAT:	ION	AL	E:	(If	a	pp]	.ica			ADEQ ADEQ			[]	

REMARKS:

ASSESSM ASSESSM NASA FM	ENT	I		M	2/05, MU-18 4.1		6									ASA DA BASEL		[]	
SUBSYST MDAC ID ITEM:				MN 18 W]		HA]	RN:	ESS	5												
LEAD AN	ALY	ST	:	DU	JFFY	, 1	HU	YNH	I, S	SA:	III	DI									
ASSESSM	ENT	:																			
		F	ICAL LIGH W/FU	r	?		Ri A		NDA	AN(CY B	sc	CREEI		c				IL PEN		
NASA IOA			-			[P P]		[P P]	!	[P]		[X X]	*
COMPARE	[/]		[]		[]	I	[N]		[)	
RECOMME	VDA:	ric	ons:		(If	đ	if	fer	ent	: 1	fro	o m	NAS <i>I</i>	A)							
	[/]		[]		[]	(•]	(AI	رود	'DF] ELF	ETE
* CIL RI		VT:	ION I	RAT	IONA	L	Ξ:	(I	fa	pp) l i	ica	·			EQUAT		[_]	

SHORT OR OPEN CIRCUIT.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-184			BASELINE NEW	
MDAC ID:	MMU 184 EXTERNAL	POWER C	CONNECTO	R	
LEAD ANALYST:	DUFFY, HU	YNH, SA	AIIDI		
ASSESSMENT:					
CRITICAL: FLIGH		EDUNDAN	NCY SCRE		CIL ITEM
HDW/FU	NC A		В	С	
NASA [2 /2 IOA [2 /2] [] [P] [[] [P]	[] [F]	[X] * [X]
COMPARE [/] [N] [[и]	[и]	[]
RECOMMENDATIONS:	(If dif	ferent	from NA	SA)	
[/] [] [[]	[]	[] ADD/DELETE)
* CIL RETENTION :	RATIONALE:	(If ag	pplicabl	e) ADEQUATE INADEQUATE	
FAIL OPEN, 1 OR	MORE PINS.				

	12/05/86 MMU-185 4.1.1		NASA DATA: BASELINE NEW	
MDAC ID:	MMU 185 HEATERS			
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI		
ASSESSMENT:				
CRITICALI FLIGHT		ANCY SCREENS	5	CIL ITEM
HDW/FU	NC A	В	С	
NASA [2 /1R IOA [2 /2] [P]] [P]	[F] [[P] [F]	[X] *
COMPARE [/N] []	[N] [n j	[]
RECOMMENDATIONS:	(If differen	•		
[/] []	[] [] (AD	[] DD/DELETE)
* CIL RETENTION F	RATIONALE: (If		ADEQUATE NADEQUATE	
REMARKS: FAIL OFF. HEATER STRUCTURE AND COM		AN ACCEPTAE	BLE TEMPERA	TURE RANGE

FAILURE OF A HEATER WILL BE NOTICED BY THE PILOT DUE TO SLUGGISH PERFORMANCE OR FREEZE UP, WITH EXCEPTION OF THE CIRCUIT BREAKER PANEL, CEA CASE, AND LOCATOR LIGHT CONTROL (FOR THIS REASON SCREEN B IS FAILED). SECOND SYSTEM HEATER FAILURE IS LIFE THREATENING. IOA AGREES WITH FMEA.

ASSESSME ASSESSME NASA FME	NT):	MM	U-18	86 5A									DATA: ELINE NEW						
SUBSYSTE MDAC ID:				18	U 5 ATER	s														
LEAD ANA	LYS	ST:	:	DU	FFY,	H	UY	NH,	SAI	ΞI	Ι									
ASSESSMI	ENT	:																		
	CR		ICAL LIGH				RE	DUN	DANC	CY	SC	REEN	S				L EN			
	3	HDV	W/FU	NC			A			В			С							
NASA IOA																	X X]	*	
COMPARE	[/]		[]	[N]	[N]		[]		
RECOMME	NDA'	TI	ons:		(If	d:	iff	ere	nt :	fro	om	NASA	(،							
	[2	/1R	.]		[P]	[F]	(P]	(AI		/DI		ETE))
* CIL R	ETE:	NT:	ION	RAI	NOI	ΑLJ	Ξ:	(If	ap	p1 :	ica		A	DEQI DEQI	UATE UATE	[]		
REMARKS FAIL OF STRUCTU FAILURE PERFORM PANEL, SCREEN	F. RE OF ANC	AN A E	D CO HEA OR B	MPC TEI TREI	NENT R WII EZE U	rs LL JP	WI BI , V CAS	ITHI E NO WITH FOR	N A	N . ED CE: HT	ACC BY PT] CC	TAIN CEPTA THE CON C	THABLE POF	E MIE TILOTHE	MU ANI EMPERA T DUE CIRCU R THIS	O ATI T(UI'	FS: UR! O : I' :	S E SL BR AS	UGG: EAKI ON	ISH

THREATENING.

ASSESSMENT ASSESSMENT NASA FMEA	ID:	12/05/ MMU-18							SA DATA BASELINE NEW	[
SUBSYSTEM: MDAC ID: ITEM:		MMU 186 HEATER	es.										
LEAD ANALYS	T:	DUFFY,	HU	YNH,	SAII	DI							
ASSESSMENT:													
CRI	TICALI FLIGHT	TY	R	EDUND	ANCY	SCRE	ENS	3			IL		
H	IDW/FUN	=	A		В			С		I'	ΓEI	M	
NASA [IOA [2 /1R]	[[P]	[[P]	[P]	[x]	*
COMPARE [n /n]	[N]	[N]	[N]	[N]	
RECOMMENDAT	IONS:	(If	dif	feren	t fro	om NAS	SA)						
1	/]	[]	[]	[] (AI		/DE		ETE)
* CIL RETEN	TION R	ATIONA	LE:	(If	appli	cable	≥)						
		-							EQUATE EQUATE]	
REMARKS: FAIL ON (CE THERMOSTAT COVERED WIT	FOR TH	E CEA	HEA'	TERS.	THI	S ITE	M	AN	D FAILUE	R.	AF	E	Œ

ASSESSME	SSESSMENT DATE: 12/05/86 SSESSMENT ID: MMU-187 ASA FMEA #: 3.3.9 UBSYSTEM: MMU													[x			
SUBSYSTE MDAC ID: ITEM:			MMU 187 GYRO	s													
LEAD ANA	LYST:		DUFF	Y, F	ΙUΥ	NH,	SAI	ΊΙ	Ι						•		
ASSESSME	:TN																
	CRITI	CAL:			RE	DUN	DANC	Y	SCR	EEN	S			CIL			
			NC		A			В			С				_		
NASA IOA	[3	/3 /3]	[[P]	[[F]]	F]		[]	*	
COMPARE	[/	1	ſ	N]]	N	3	[N]		[]		
RECOMMEN	IDATIO	NS:	(I	f di	lff	ere	nt i	Erc	om N	IASA)						
	[3	/2R]	[P]	[P]	[P]	(2	[ADD/D		TE)	
* CIL RE	ETENTI	ON :	RATIO	NALI	Ξ:	(If	app	pl:	icab		A.		UATE UATE]		
REMARKS: DRIFT WI 176.	: LTH DE	GRA	DED G	YRO	PF	ERFC	RMAI	NC]	E AA	ин с	AN.	тои	OPE	RATE,	SE	E M	MU

ASSESSME ASSESSME NASA FME	ENT ID:	MMU-	188					SA DATA ASELINE NEW		; ;
SUBSYSTE MDAC ID:		MMU 188 GYRO	S							
LEAD ANA	LYST:	DUFF	Y, HU	YNH,	, SAII	DI		•		
ASSESSME	ENT:									
	CRITICA	ALITY SHT	R	EDUI	NDANCY	SCF	REENS		CII	_
	HDW/I	FUNC	A		В		С			
NASA IOA	. ,	3] 3]	[[P]	[[F]	[[F]	[] *]
COMPARE	[/]	[N]	[и]	[N		[
RECOMMEN	DATIONS	S: (I:	f dif	fere	ent fro	om N	IASA)			
	[3 /2	2R]	[P]	[P]	[P		[DD/E] ELETE)
* CIL RE		RATION	VALE:	(If	appli	icab	AD:	EQUATE EQUATE	[]
REMARKS: FAIL OFF		T GYROS	S AAH	DOE	S NOT	OPE	RATE,	SEE MMU	-176	· .

NASA DATA:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DA BASELI N	TA: NE [] EW [X]
MDAC ID:	MMU 189 ARM ANGLE ADJU	JST	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICAL FLIGH		DANCY SCREENS	CIL ITEM
	NC A	в с	
NASA [/ IOA [3 /3] []]]	[] [] [P] [P]	[] *
COMPARE [N /N] [N]	[N] [N]	[]
RECOMMENDATIONS:	(If differer	nt from NASA)	
[/] []	[] []	[] (ADD/DELETE)
* CIL RETENTION	RATIONALE: (If	applicable) ADEQUATION INADEQUATION ADEQUATION ADE	re [] re []
REMARKS: ARM DOES NOT LAT LATCHED WORKSITE	CH TO FLIGHT PO	OSITION (UNLATCHED,	LATCHED STOWEL

WORKSHEET ASSOCIATED WITH IT (MMU-189 AND 189, RESPECTIVELY) ARE

VOIDED AND SUPERCEEDED BY WORKSHEETS 1891X THRU 1899X; AND

ASSESSMENTS MMU-1891X THRU 1899X RESPECTIVELY.

ASSESSMI	ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-190 NASA FMEA #: 2.1.9 SUBSYSTEM: MMU														DATA LINE NEW	[x]	
SUBSYSTI MDAC ID: ITEM:				19	0	EN	GT	н аг	JUS	T									
LEAD AND	LY	ST	:	DU	FFY	,	HU'	YNH,	SA	II	DI								
ASSESSMI	ENT	:																	
	CR		ICAI LIGH		•		R	EDUN	DAN	CY	SCF	REEN	S			C			
	1		W/FU				A			В			С			Τ.1	CEN	1	
NASA IOA	[2	/2 /2]		[P]]	P]	[P]		[X X]	*
COMPARE	(/	3		[N]	(N]	[N]		[]	
RECOMMEN	IDA'	ric	ons:		(If	d:	if	fere	nt	fro	om N	IASA))						
	(/]		(]	[]	[]	(A)	[DD/			TE)
* CIL RE	TEI	VT:	ION	RAT	ION	ALI	Ξ:	(If	ap	pl:	icab	ole)	ΑI	DEQU	ATE	[]	
DEMADEC.												I	IAV	DEQU	ATE	Č		j	

FAIL UNLATCHED

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-191	NASA DAT BASELIN NE	
MDAC ID:	MMU 191 ARM LENGTH ADJUS	ST	
LEAD ANALYST:	DUFFY, HUYNH, SA	AIIDI	
ASSESSMENT:			
CRITICAL: FLIGH		NCY SCREENS	CIL ITEM
HDW/FU	NC A	ВС	
NASA [/ IOA [2 /2] [] [] [P]	[] [] [P] [P]	[
COMPARE [N /N] [N]	[и] [и]	[и]
RECOMMENDATIONS:	(If different	from NASA)	
[2 /2] [P]	[P] [P]	[A] (ADD/DELETE)
* CIL RETENTION	RATIONALE: (If ag	pplicable) ADEQUATI INADEQUATI	2 [] 2 []
REMARKS: FAIL LATCHED SHO	RT		

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-192		1	NASA DATA: BASELINE NEW	
MDAC ID:	MMU 192 ARM LENGTH	I ADJUST			
LEAD ANALYST:	DUFFY, HUY	NH, SAIII	DI		
ASSESSMENT:					
CRITICAL: FLIGHT	ITY RE	EDUNDANCY	SCREENS		CIL ITEM
HDW/FUI	NC A	В	(С	
NASA [1 /1 IOA [2 /2] [] [P] [] [P] [:] P]	[X] * [X]
COMPARE [N /N] [N] [N] []	N]	[]
RECOMMENDATIONS:	(If diff	erent fro	om NASA)		
[2 /2] [] [] [] (AD	[] DD/DELETE)
* CIL RETENTION 1	RATIONALE:	(If appli		ADEQUATE ADEQUATE	
REMARKS:	ENGE DOOR	ETE AND			
PILOTS INCONVENIE CONTROLS FOR TRAI					
THE SMALLEST PIL	OT CAN OPER	PATE A FIII	LLY EXTE	NDED ARM.	

ASSESSMENT ASSESSMENT NASA FMEA #	ID:	MMU-19					N	ASA DATA: BASELINE NEW	[
SUBSYSTEM: MDAC ID: ITEM:		MMU 192 ARM LE	NGTH	ADJUS	ST							
LEAD ANALYS	T:	DUFFY,	HUY	NH, SI	AIII)I						
ASSESSMENT:												
	TICALI FLIGHT	[TY	RE	DUNDA	NCY	SCREE	NS		C]	L EN	4	
		1C	A		В		C	:			•	
NASA [IOA [2 /1R 2 /2]	[P [P]	[P]	[[F)]	X X]	*
COMPARE [/N]	[]	(]	[]	1]	[]	
RECOMMENDAT	ions:	(If	diff	erent	fro	om NAS	A)					
τ	2 /2	1	[]	(]	[] (A)	[DD/	/DI] ELE	ETE)
* CIL RETEN	TION I	RATIONA	LE:	(If a	ppl:	icable	7	DEQUATE	[]	
REMARKS: PILOTS INCO CONTROLS FO THE SMALLES	R TRAI	NSLATIO	NS C	R ROT	ATIC	ONS.	THE	DESIGN	ATI IS	e T	rhi JCI	E H THAT,

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-194 NASA FMEA #: 3.6.1													ASA D BASEI		[x]	
SUBSYSTI MDAC ID: ITEM:				MMU 194 EXT	ERNA	L.	POWE	R CO	NN	ECTO)R							
LEAD AND	ALY	ST	:	DUF	FY,	HU	YNH,	SAI	ΙĽ	I								
ASSESSMI	ENT	:																
		F	LIG	LITY HT JNC		R A		DANC	Y B	SCRE	EN:	s c				IL PEM	1	
NASA IOA	[2	/2 /2]	[P P]	[P P]	[P]		[X X]	*
COMPARE	[/]	[]	[]	[N]		[]	
RECOMMEN	NDA'	TI	ons:	: (If d	if	fere	nt f	ro	m NA	SA)						
	[/]	[]	[]	[]	(A	[DD/	/DF] ELE	ETE)
* CIL RI		NT	ION	RATI	ONAL	E:	(If	app	li	.cabl	·		DEQUA DEQUA		[]	
	•																	

FAIL CONNECTED

ASSESSMEN ASSESSMEN NASA FMEA	T II):	MMU-19								SA D BASEL		[
SUBSYSTEM MDAC ID: ITEM:	:		MMU 195 EXTERN	NAL I	POWER	co	NN	ECTOR	ļ							
LEAD ANAL	YST	:	DUFFY	, HU	ZNH,	SAI	IĽ	Ι								
ASSESSMEN	T:															
C	F	LIGH						SCREE	NS				C]	[L PEN	ſ	
	HD	W/FU	NC	A			В			С						
NASA IOA	[2	/2 /2]	[P]	[P P]]	F]		[[X X]	*
COMPARE	[/]	[]	[3	[N]		[)	
RECOMMEND	ATI	ons:	(If	dif	feren	it 1	fro	om NAS	SA)						•
	[/]	[1	[]	[]	(A] ELE	ETE)
* CIL RET	TENT	ION	RATION	ALE:	(If	app) 1:	icable	≥) I	Al NAI	DEQUA	ATE ATE	[]	
REMARKS: FAIL DISC	CONN	ECTE	:D													

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-196 NASA FMEA #: 2.5.1														DA' ELII N		[x]			
SUBSYST: MDAC ID ITEM:				MM 19 PL	-	LA'	TC	HES													
LEAD AND	ALY	ST	:	DU	FFY	, 1	HU	YNH,	, s	A]	[I]	DI									
ASSESSMI	ENT	:																			
		F	ICAL LIGH	T					IADN	NC		SC	REEN					CI II	IL PEM	1	
	•	HD	W/FU	NC			A				В			С							
NASA IOA			/1R /1R]]	P P]		[P F]	[[P]			[X X]	*
COMPARE	[/]		[]		[N]	[N]			[]	
RECOMMEN	IDA'	ΓI	ons:		(If	d:	if:	fere	ent	f	ro	om 1	NASA)							
	[/]		[]	1	[].	[]	(AD	[D/	'DE] LE	TE,
* CIL RE REMARKS: FAIL OPE		NT:	ION 1	R AT :	ION <i>I</i>	LI	€:	(If	ar	ge	1i	.cal	•			JATE JATE		[]	

ASSESSMENT I NASA FMEA #:					SA DATA ASELINE NEW	[
SUBSYSTEM: MDAC ID: ITEM:		MMU 196 PLSS I	ATC	HES						
LEAD ANALYST	P:	DUFFY,	HU	YNH,	SAII)I				
ASSESSMENT:										
	CALI LIGHT		R	EDUN	DANCY	SCRE	ENS		CII	
	W/FUI		A		В		С			
NASA [2 IOA [2	2 /2 2 /1R]	[P]	[P [F]	[P]		K]	() * ()
COMPARE [/N]	[]	[N	1	[N]		[]
RECOMMENDATI	cons:	(If	dif	fere	nt fr	om NA	SA)			
[2	2 /1R]	[P]	[P]	[P]] (A] DELETE)
* CIL RETENT	rion i	RATIONA	LE:	(If	appl	icabl	ADI	EQUATE EQUATE	[]
REMARKS: FAIL OPEN										

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-197				ASA DATA: BASELINE NEW	-	
MDAC ID:	MMU 197 PLSS LATO	CHES					
LEAD ANALYST:	DUFFY, HU	JYNH, SA	IIDI				
ASSESSMENT:							
CRITICAL: FLIGHT	ITY R	REDUNDAN	ICY SC	REENS		CIL	r
HDW/FUI		\	В	С		TILL	
NASA [2 /1R IOA [3 /2R] [F	?] [?	P]	[[P]	[X]] *
COMPARE [N /N] [) (и ј	[N]	[1
RECOMMENDATIONS:	(If dif	ferent	from	NASA)			
[3 /2R] [F	?] [P]	[P		[D DD/DE] LETE)
* CIL RETENTION 1	RATIONALE:	(If ap	plica	· AI	DEQUATE	ָנ ב	ļ
REMARKS: FAIL CLOSED. ON IF ALL LATCHES FA ATTACHED AND SUBS	AIL CLOSED	, CREWM	EMBER	OPERATI	AIRLOCK	S RE	

ASSESSME ASSESSME NASA FME	TM	ID	TE:	12/ MMU	05/86 -198	5									DAT. ELIN NE	E]	
SUBSYSTE MDAC ID:				MMU 198 MMU		ref	RY I	LATO	HE	ES										
LEAD ANA	ALYS	T:		DUF	FFY, I	tU1	NH	, SA	\I]	[D	I									
ASSESSMI	ENT:																			
	CRI			ITY		RI	EDU	NDAI	IC?	ľ	SCF	REEN	S				CI		ſ	
	H		IGH /FU			A			I	В			С						-	
	HDW/FUNC NASA [/] IOA [2 /2]]	[[]	P]	[P]			[[X]	*
COMPARE	[N	/N]	[N]	ļ	[]	N]	(N]			[N]	
RECOMME	NDAT	ric	NS:		(If d	if	fer	ent	f	r	om 1	NASA	۲)							
·	.[3	/3]	[ě]		[3	(]	((AI		'DI		ETE)
* CIL R	ETEI	N T]	CON	RAT	IONAL	E:	(I	f a	pp	1:	ica		A	DEQ DEQ	UATI UATI	E E	[]	
REMARKS FAIL UN LAUNCH/	LAT	DI	NG.	TH	E LAT	'CH	FA	ILU	81 RE	; (FOR ONO	ANZ RBI	r (SIS	DUI -OP:	RII S,	NG OI	?S	, ;	AND

ASSESSME ASSESSME NASA FME	INT	ID:	12/0 MMU- 2.3.	199	5						ASA BASE] :]	
SUBSYSTE MDAC ID:			MMU 199 MMU	ВАТТ	'ER	Y LATO	CHE	s								
LEAD ANA	LYS'	T:	DUFF	Ү, н	UY.	NH, SA	\II	DI								
ASSESSME	NT:															
CRITICALITY REDUNDANCY SCREENS FLIGHT HDW/FUNC A B C														IL PEN		
	HI	DW/FU	NC		A		В			C						
NASA IOA	[2	2 /2 2 /2]]	P] [P]	[P]		[X X]	*
COMPARE	[/]	[N]) [N]	[N]		[]	
RECOMMEN	DAT]	IONS:	(I :	f di	ffe	erent	fro	om N	IASA))						
	[/]	[[]	[]	(A	[DD/	'DE] :LF	ETE)
* CIL RE									IN	IAI	EQU <i>I</i>	ATE	[]	
FAIL LAT	CUEL). F	HITOKI	SHO	JUI	ID BE	"FA	ILS	TO	UN	ILATO	CH"				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-200			[x]
SUBSYSTEM: MDAC ID: ITEM:	MMU 200 BACKUP ARM LA	ATCH		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI		
ASSESSMENT:				
CRITICAL FLIGH		IDANCY SCREENS	5	CIL ITEM
HDW/FU	NC A	В	С	
NASA [/ IOA [2 /2] []]]	[] [[P]	p]	[x] *
COMPARE [N /N] [N]	[N] [N]	[N]
RECOMMENDATIONS:	(If differe	ent from NASA)	
[2 /2] []	[] [] (AI	[A] DD/DELETE)
* CIL RETENTION REMARKS: FAIL LATCHED	RATIONALE: (I1		ADEQUATE NADEQUATE	[]

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-201	NASA DATA: BASELINE [] NEW [X]
	MMU 201 BACKUP ARM LATCH	
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI	
ASSESSMENT:		
CRITICAL FLIGH	CREENS CIL ITEM	
HDW/FU	NC A B	С
NASA [/ IOA [2 /2] [] []] [P] [P]	[] [] * [P] [X]
COMPARE [N /N] [N] [N]	[и] [и]
RECOMMENDATIONS:	(If different from	NASA)
[2 /2] [] []	[] [A] (ADD/DELETE)
* CIL RETENTION :	RATIONALE: (If applica	able) ADEQUATE [] INADEQUATE []
	SCREENS ARE NOT REQUI	IRED WITH THIS CRITICALITY.

ASSESSMENT ASSESSMENT NASA FMEA	r I	D:			5								DATA: LINE NEW	[-	
SUBSYSTEM MDAC ID: ITEM:	:		MMU 202 QD THE	ERM	1AI	r co.	VER	S									
LEAD ANAL	YST	:	DUFFY	. F	{U}	ZNH,	SA	III	ΟI								
ASSESSMEN	T:																
C		ICAL:	ITY T		RI	EDUN	DAN	CY	SCR	REEN	S				IL PEN		
				A			В			С					_		
NASA IOA	HDW/FUNC NASA [2 /1R] IOA [3 /2R]				P P]	[P P]	[P]		[X]	*
COMPARE	[N	/N]	[]	(]	[N]		[N]	
RECOMMEND	ATI	ons:	(If	d:	if	fere	nt	fr	om N	IASA)						
	[3	/2R]	[P]	[P]	[P	1	(A		D /DI		ETE)
* CIL RET	ENT	ION I	RATION	ALI	E:	(If	ar	pl	icak		Al NA	DEQU DEQU	ATE	[]	
REMARKS: FAIL OPEN										_		_ ~ -		•		•	

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:					ASA DATA BASELINE NEW) k]
MDAC ID:	MMU 203 BATTERY T	'HERMAI	COVER	l.			
LEAD ANALYST:	DUFFY, HU	YNH, S	SAIIDI				
ASSESSMENT:							
CRITICA FLIG	LITY R	EDUNDA	ANCY SO	REENS		CII	
	INC A		В	С		ITE	7M
NASA [2 /11 IOA [2 /2	?] [P))	[P] [P]	[[P]	[}	X] * X]
COMPARE [/N	J []	[]	[N]	[]
RECOMMENDATIONS	(If dif	ferent	from	NASA)			
[2 /2] [1	[]	['DD\I] DELETE)
* CIL RETENTION	RATIONALE:	(If a	applica	ĀI	DEQUATE DEQUATE]
REMARKS: FAIL OPEN DURING RECOMMENDED CRIT		SCREE	ens are			-	•

ASSESSME ASSESSME NASA FME	ENT	II):	12/05 MMU-2 4.6.1	04	•							N		SA DAT ASELII NI		[]	
SUBSYSTE MDAC ID: ITEM:				MMU 204 BATTE	RY	TH	IERM	I AL	C	:OV	ER									
LEAD ANA	LYS	ST	:	DUFFY	, H	UY	NH,	, si	ΑI	I	I									
ASSESSME	ENT	:																		
	CR		ICAL:			RE	OUN	NDA	NC	Y:	sc	REEN	is					L CEM	ſ	
	1		N/FUI			A				В			(3					-	
NASA IOA]	2	/1R /3]]	P P]		[[P F]	[]	F]		[X]	*
COMPARE	[N	/N	1	[]		[N]	(1	N]		•	N]	
RECOMME	NDA'	TI	ons:	(If	đ:	Ĺfí	fere	ent	1	r	m	NASA	١)							
	[3	/3]	[]		[]	(]	(Al		D /DI		ETE)
* CIL R	ETE:	NT	ION :	RATION	IALI	Ξ:	(I :	f a	pį	1:	Lca		i		EQUAT EQUAT		[]	
REMARKS FAIL OPERECOMME	EN					\$	SCR!	EEN	s	Al	RE	NOT	R	EQ	UIRED	F	OR	TI	ΗE	

ASSESSME ASSESSME NASA FME									DA ELI N		[]						
SUBSYSTE MDAC ID:				MMU 205 EXT		R.	TH	ERMA	L	COVI	ER								
LEAD ANA	LY	ST	:	DUI	FFY, I	U	YNH	, SA	ΙΙ	DI									
ASSESSME	NT	:																	
	CR:		ICAL LIGH			RI	EDUI	NDAN	CY	SCI	REEN	S					IL TEM	4	
	1	HD	W/FU	NC		A			В			С						_	
NASA IOA	[2	/1R /3]	[P P]	[P P]	[F]			[x]	*
COMPARE	C	N	/N	3	[]	(]	(N]			[N]	
RECOMMEN	DA'	ric	ons:	((If di	Ĺfí	fere	ent	fr	om N	IASA	.)							
	[3	/3]	[]	[]	(]		(AI		D DE		ETE)
* CIL RE	TEI	T.	ION I	RATI	ONALE	Ξ:	(I 1	f ap	pl:	icak	ole)	A	DEQ	UAT:	E	[]	
REMARKS:													-	UAT:		٠		j	
FAIL OPE RECOMMEN	N I	נטכ כ	RING CRIT	FLI ICAI	GHT. LITY.	S	SCRI	EENS	Al	RE N	TO	RE	QUI	RED	FC	R	TH	Œ	

ASSESSME ASSESSME NASA FME	NT I	D:			,							ASA DA BASELI 1		[x]	
SUBSYSTEMDAC ID:	M:		MMU 206 BACKUI	P P	LS	S LA	тсн	ŒS	S (LA	P E	3EI	LTS)					
LEAD ANA	LYSI	: :	DUFFY	, н	UY	NH,	SAI	ΊΙ	οI								
ASSESSME	NT:																
('ICAL			RE	EDUND	ANC	Y	SCRE	ENS	3			CI IT		ſ	
	HD	W/FU	NC		A			В			С						
NASA IOA	[2	/1R /1R]	[P P]	[P P]	[P]]	X X]	*
COMPARE	[/]	[]	[]	[N]		[]	
RECOMMEN	DATI	ons:	(If	di	fí	feren	t 1	r	om NA	SA)						
	[/	1	[]	Ĺ		1	[]	(Al] ELE	ETE)
* CIL RE	TENI	NOI!	RATION	ALE	E:	(If	app	1:	icabl	e) Il	IA IAV	DEQUA' DEQUA'	TE TE	[]	
REMARKS: FAIL OPE	N DU	RING	FLIGH	r													

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-207	NASA D BASEL	
SUBSYSTEM: MDAC ID: ITEM:	MMU 207 BACKUP PLSS LA	ATCHES	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICAL: FLIGH: HDW/FUI	T	DANCY SCREENS B C	CIL ITEM
NASA [/ IOA [2 /2] []]	[] [] [P] [P]	[
COMPARE [N /N] [N]	[N] [N]	[N]
RECOMMENDATIONS:	(If differen	at from NASA)	
[2 /2] []	[] []	[A] (ADD/DELETE)
* CIL RETENTION I	RATIONALE: (If	applicable) ADEQUA INADEQUA	-

FAIL CLOSED

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-208 1.9.1		INE [] NEW [X]
MDAC ID:	MMU 208 GN2 LINES		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICALI FLIGHT		IDANCY SCREENS	CIL ITEM
HDW/FU		в с	
NASA [1 /1 IOA [3 /2R] []] [P]	[] [] [P]	[X] *
COMPARE [N /N] [N]	[и] [и]	[N]
RECOMMENDATIONS:	(If differe	ent from NASA)	
[3 /2R] [P]	[P] [P]	[D] (ADD/DELETE)
* CIL RETENTION	RATIONALE: (I1	A 11W(1114	ATE [] ATE []
REMARKS: LEAK. RUPTURE I EXTERNAL LEAK IN CHARGE THE MMU T	THE FSS LINES	STIC FAILURE FOR THE S MAY LIMIT THE CHAI	ESE LINES. AN

ASSESSM ASSESSM NASA FM	ENT	I		12/0 MMU-								N	ASA BASE	LINE) x]	
SUBSYSTIMDAC ID				MMU 210 GN2	LIN	ES											
LEAD AN	ALY	ST	:	DUFF	Υ,	HU	YNH	, SA	ΙI	DI							
ASSESSMI	ENT	:															
	CR	IT F	ICAL: LIGH:	ITY C		R	EDUI	NDAN	CY	SCI	REEN	s			CII		
]	HD	W/FUI	NC.		A			В			С			111	M.I	
NASA IOA]	3	/ /2R]	[[P]	[P]	[P]		[]	*
COMPARE	[N	/N]	[N]	[N]	[N]		[]	
RECOMMEN	IDA'	ric	ONS:	(I	f d:	ifi	fere	ent i	fro	om N	IASA)					
	[3	/2R]	[P]	[P]	ι	P]	(A	[DD/D) ELE	TE)
* CIL RE	TEN	VT]	ON F	RATIO	NALI	፤:	(If	app	ol i	.cab	•		DEQUA		[]	
FSS BLOC	KEL) [LINES	HAS	ron	. E	BEEN	ASS	ES	SED	BY	A	NASA	FM:	EA.		

ASSESSMEI ASSESSMEI NASA FME	NT II):	MMU-21	11				1	NASA I BASEI		[]	
SUBSYSTEM MDAC ID:			MMU 211 PRESSU	JRE (G AUG :	E							
LEAD ANA	LYST	:	DUFFY,	, HU	YNH,	SAII	DI						
ASSESSME	NT:												
•	CRIT	ICAL: LIGH		R	EDUN	DANCY	SCR	EENS			CIL		
			NC	A		В		(C			•	
NASA IOA	[3 [3	/2R /2R]	[P]	[P]	[]	P]		[] *]	
COMPARE	[/]	[]	[]	[]	и ј		[]	
RECOMMEN	DATI	ons:	(If	dif	fere	nt fr	om N	ASA)					
	[/	1	[]	[ĵ .	[1	(Al	[DD/D] ELETE)	
* CIL RE	TENT:	ION :	RATION	ALE:	(If	appl	icab		ADEQUA ADEQUA]	
REMARKS: FSS PRES SWITCH T FAILURE.	SURE O TH	GAU E RE	GE LEA! DUNDAN!	K WH I SY	ILE STEM	CHARG LO	ING SS 0	THE DEFENSE	MMU TA	ANKS CY I	WIL S MI	L FORC	E A

ASSESSME	ENT DATE: ENT ID: EA #:	MMU-21	2				N	ASA DAT BASELII NI		-	
SUBSYSTE MDAC ID:	}	MMU 212 VENT V	ALVI	2							
LEAD ANA	ALYST:	DUFFY,	HUY	NH,	SAII	DI					
ASSESSME	ent:										
	CRITICAL FLIGH		RI	EDUNI	DANCY	SCRE	ENS		CIL		
		NC	A		В		c	!	ITE	M	
NASA IOA	[3 /3 [3 /2R]	[P]	[P]	[[F]	[[] *	
COMPARE	[/N)	[]	[]	[N]	[]	
RECOMMEN	IDATIONS:	(If	diff	ere	nt fr	om NA	SA)				
	[/]	[]	[]	[']	[(ADD/D] ELETE)	
* CIL RE	ETENTION	RATIONA	LE:	(If	appl	icabl		DEQUATI	E [j	
INCONVEN	TAM OT TA	IOA AGR	EES	WITE			PRE	SSURE I	LINE,		ıs

ASSESSME ASSESSME NASA FME	NT I	D:	12/05/ MMU-21 1.12.1	.3					ASA DA BASELI N				
SUBSYSTE MDAC ID: ITEM:			MMU 213 VENT V	ALV	E								
LEAD ANA	LYST	:	DUFFY,	HU	YNH,	SAII	DI						
ASSESSME	NT:												
	F	ICAL	r			DANCY B		ENS C	ı		CIL ITE		
		W/FUI		A		_					r	1 ±	
NASA IOA	[3	/2R /2R]	[F)	[P]	[P]		[[]	
COMPARE	[/]	[]	[]	[N]		[]	
RECOMMEN	IDAT]	cons:	(If	dii	fere	nt fr	om NA	SA)					
	[/]	(]	C]	[]	(AD	[D/D] ELETE	:)
* CIL RI	eten:	rion :	RATION	ALE:	(If	appl	icabl	P	DEQUA'		[]	
REMARKS	:												

ASSESSM	ESSMENT DATE: 12/05/86 ESSMENT ID: MMU-214 A FMEA #: 1.12.2 EYSTEM: MMU												1		DATA ELINI NEV			
SUBSYSTEMDAC ID				2		VA	LV	E										
LEAD AN	ALY	ST	:	D	UFFY	,	HU	уин,	, SA	II	DI							
ASSESSMI	ENT	:																
		F	ICAI LIGI W/FU	łΤ	Y		R:		IDAN	CY B	sc	REE	is C	2		CI II	L EM	
NASA IOA	[3	/21	2]		<u>[</u>	P	j	[P]	{]		[]	*
		3					þ	J	Ĺ	Р]	[. F	']		[]	
COMPARE	[/]		[]	[]	[N	[]		[]	
RECOMMEN	IDA:	ri(ONS:		(If	d :	if	fere	nt	fr	om	NASA	(۱					
	[/]		[]	[]	[]	(A	[DD/	DEL.	ETE)
* CIL RE		VT:	ION	RA?	rion.	ALI	Ξ:	(If	ap	pli	ica	·	A		JATE JATE]]	

ASSESSMI ASSESSMI NASA FMI	ENT 1	[D:	MMU-	215]	NASA BASE	DATA: LINE NEW	[
SUBSYSTI MDAC ID: ITEM:			MMU 215 QD-H	OSE E	ND								
LEAD ANA	ALYST	r:	DUFF	Y, HU	YNH,	SAII	DI						
ASSESSMI	ENT:												
		rical Fligh	ITY	R	EDUN	DANCY	SCR	EENS			CIL		
		OW/FU		A		E	3	(С		111	11	
NASA IOA	[3	3 /2R 3 /3]	[P]	[F))	[] P]		[] *	
COMPARE	[/N]	[]	[]	[]	и]		[]	
RECOMME	NDAT:	ions:	(I:	f dif	fere	nt fr	om N	ASA)					
. ,	[/	1	[]	[]	[]	(A)	[DD/D] ELET:	E)
* CIL R	eteni	rion	RATIO	NALE:	(If	appl	icab.		ADEQU ADEQU]	
REMARKS LOSS OF FAILS.	RECI		CAPAI ES WI'				F MI	SSIO	N IF	REDU	NDAN	T SY	STEM

ASSESSME ASSESSME NASA FME	NT	ID:		MM	:/05/ IU-21 3.3		5									DATA LINI NEV	E	[x]	
SUBSYSTE MDAC ID:				MM 21 QE		SE	El	ND													
LEAD ANA	LYS	T:		DU	IFFY,	, I	UL	YNH,	SA	II	DI										
ASSESSME	NT:																				
	CRI	TIC FLI			7		RI	EDUN	DAN	ICY	sc	REEN	ıs					CI		r	
		DW/		_			A			В				С					E.F.		
NASA IOA	[3 / 3 /	2R 2R]		[P P]	(P P]	[:	P]			[[]	*
COMPARE	[/	,]		[]	(]	(•	N	3			[]	
RECOMMEN	DAT	ION	s:		(If	d:	if	fere	nt	fr	om 1	NASA	L)								
·	Ì	/	•]		[]	(]	[•]	(1	ΑD	[D/] LE	ETE)
* CIL RE	TEN	TIO	N I	RAT	'ION	ALI	€:	(If	aŗ	pl:	ical	-			_	ATE ATE		[]	
REMARKS:																		L		,	

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	: 12/05/8 MMU-217 1.3.2	6		NASA DAT BASELIM NI	ra: NE [] EW [X]
MDAC ID:	MMU 217 QD-FIXE	D HALF			
LEAD ANALYST:	DUFFY,	HUYNH,	SAIIDI		
ASSESSMENT:					
FLIG					CIL ITEM
HDW/F	UNC	A	В	С	
NASA [2 /2 IOA [3 /2] [R] [P] P]	[P] [P]	[] [P]	[X] * []
COMPARE [N /N] [1	[]	[N]	[N]
RECOMMENDATIONS	: (If d	liffere	nt from N	IASA)	
[3 /2	R] ([P]	[P]	[P]	[D] (ADD/DELETE)
* CIL RETENTION	RATIONAL	LE: (If	applicat	ole) ADEQUAT INADEQUAT	E [] E []
REMARKS: LEAK, FAILED OF	PEN				
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ASSESSMI ASSESSMI NASA FMI	ent	I	D:	M	2/05 MU-2 .3.3	18								ASA DA BASELI N		[x]	
SUBSYSTI MDAC ID ITEM:				MI 2: QI		ΧE	D 1	HALI	F										
LEAD AND	ALY	ST	:	DŪ	JFFY	, 1	HU'	уин,	, si	II	DI								
ASSESSMI	ENT	:																	
		F	ICAL	Г	Ž.			EDUI	IDAI			REEN				CI	L	ſ	
		יעח	W/FUI	NC.			A			В			С						
NASA IOA	[3	/2R /2R]		[P P]	[[P]	[[P]		[]	*
COMPARE	[/]		[]	(]	[N]		[]	
RECOMMEN	IDA:	ri	ons:		(If	d:	ifi	fere	ent	fr	om 1	NASA)						
	[/]	•	[]	(]	[(AE	[)D/] LE	ETE)
* CIL RE	TE	T.	ION I	RAT	ION	ALI	Z:	(If	ar	nl	icat	ale)							
							_ ,	,		F				EQUAT!		[]	

REMARKS:

															SA DAT BASELIN NI		[x]	
SUBSYSTI MDAC ID: ITEM:				MM 21 GA		CTU	JAT	red	נטמ	rs	(4)								
LEAD AND	ALY	ST	:	DU	FFY,	. I	:UI	(NH	, s <i>i</i>	\I]	ΣD	I								
ASSESSMI	ENT	:																		
		F	ICAL: LIGH: W/FUI	r	•		RI A	EDUI	NDAI		<i>t</i> 3	SCREI	ENS	c C			CI	L	ſ	
NASA IOA	[[3	/1R /1R]		[P P]	[I	9]	[P]]]	*
COMPARE	[/]		[]		•]	[N]		[]	
RECOMME	NDA'	TI	ons:		(If	d :	ifi	fer	ent	fı	ro	m NAS	SA))						
	[/]		[]	1	•]	[(AI	[)D/	'DE] ELI	ETE :
* CIL RI	ete)	NT:	ION 1	RAI	'ION?	ΔLI	€:	(I:	f a <u>r</u>	p]	li	.cable			EQUATI		[]	

REMARKS:

ASSESSME ASSESSME NASA FME	NT]	ID:	12/0: MMU- 2.6.	219A					BASE		[•	
SUBSYSTE MDAC ID:			MMU 219 GAS	ACTUA '	TED	NUTS	(4)						
LEAD ANA	LYST	r:	DUFF	Y, HU	YNH,	, SAIII	ΟI						
ASSESSME	NT:												
	I	rical FLIGH DW/FU	r	R A		NDANCY B	SCR	EENS C	1		CIL		
		•											
NASA IOA	[3	3 /2R 3 /1R]	[P]	[P [P]	[[P]		[]	*
COMPARE	[/N]	[]	[]	[N]		[]	
RECOMMEN	DAT]	cons:	(I	f dif	fere	ent fro	om N	ASA)					
	[3	3 /1R]	[P]	[P]	[P]	(AI	[DD/DI		TE)
* CIL RE	TENI	rion i	RATIO	NALE:	(Ii	f appli	cab	le)					
DEWI DVC.									DEQUA		[]	
REMARKS: FAIL OPE AND THER						SULT IN	TH	E SAM	E EF	FEDCI	' AS	2.	6.2

ASSESSME	SSESSMENT DATE: 12/05/86 SSESSMENT ID: MMU-220 ASA FMEA #: 2.6.1 UBSYSTEM: MMU									r	NASA DAT BASELIN NE	ΙE	[x		
SUBSYSTEM MDAC ID:	м:		MMU 220 GAS A	CTU	ΆΊ	ED 1	NUTS	s ((4)						
LEAD ANA	LYSI	r:	DUFFY	, н	UY	NH,	SA	III	Ι						
ASSESSME	NT:														
		TICAL FLIGH			RE	DUN	DAN	CY	SCRE	ENS			CIL		
	_	DW/FU			A			В		ı	C				
NASA IOA	[2	2 /2 2 /2]	[P P]	[P P]	[]		(X]	*
COMPARE	ί	/]	[]	[]	[]		[]	
RECOMMEN	DAT:	ions:	(If	di	L f :	fere	nt	fr	om NA	SA)					
	[/]	[]	[]	[1	(A	[DD/I)EL	ETE)
* CIL RE	TEN'	TION	RATION	ALI	Ε:	(If	ap	pl	icabl		ADEQUAT IADEQUAT]	
REMARKS:	}														

ASSESSM ASSESSM NASA FM	ENT	ľ		12/05 MMU-2									asa Bas	EL		[x]	
SUBSYST MDAC ID ITEM:				MMU 221 FILTE	R														
LEAD AN	ALY	ST	:	DUFFY	,	HU	YNH,	SA	II	DI									
ASSESSM	ENT	:																	
	CR		ICAL:			R	EDUN	DAN	CY	SCR	EENS	;					ΓL		
			W/FUI			A			В			С				ľ	rem		
NASA IOA	[3	/ /2R]	[P]	[P]	[P]			[]	*
COMPARE	ſ	N	/N]	[N]	[N]	[N]			[]	
RECOMME	NDA'	TIC	ONS:	(If	d :	if:	fere	nt :	fro	om N	ASA)								
	[3	/2R]	[P]	[P]	[P]		(AI	[\D/] LE:	ΓE)
* CIL RI	ETEI	NT]	ON R	ATION	ALI	Ξ:	(If	app	oli	.cab			EQU			<u>[</u>]	
REMARKS:													_			L		j	
LEAK. I	rss	F]	LTER	LEAK	H	\S	NOT	BEI	EN	ASSI	ESSE	D	BY	A	NAS	SA.	FMI	EA.	•

ASSESSME ASSESSME NASA FME	ent	I		12/05 MMU-2	•				N	NASA I BASEI		[
SUBSYSTE MDAC ID:				MMU 222 FILTI	ER									
LEAD ANA	\LY:	ST	:	DUFF	, HU	YNH,	SAII	DI						
ASSESSME	ENT	:												
	CR		ICAL LIGH	ITY T	R	EDUN	DANC	z sc	REENS			CII		
	1		W/FU		A	•	F	3	C	2				
NASA IOA	[[3	/ /2R]	[[P]	[[I	,] ,]	[[E	?]		[}	.] *	
COMPARE	[N	/N]	[N]	[1	1]	[]	4]		[]	ıj	
RECOMMEN	IDA!	ri	ons:	(II	f dif	fere	nt fi	om	NASA)					
	[3	/2R	3	[P	1	[]	7]	[]	?]			A] DELET	E)
* CIL-RE	ete)	NT:	ION :	RATION	NALE:	(If	app]	ica		ADEQUA ADEQUA	ATE	<u>[</u>	j	
REMARKS: FRACTURE FMEA.		F	SS F	ILTER	FRAC	TURE	HAS	NOT				_	_	SA

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:		NASA DA' BASELII N	
SUBSYSTEM: MDAC ID: ITEM:	MMU 223 GAN HEATERS		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICA: FLIG		DANCY SCREENS	CIL ITEM
HDW/F		ВС	
NASA [2 /2 IOA [3 /3] []]]	[] [] [P]	[X] * []
COMPARE [N /N] [N]	[N] [N]	[N]
RECOMMENDATIONS	: (If differe	nt from NASA)	
[3 /2]	R] [P]	[P] [P]	[D] (ADD/DELETE)
* CIL RETENTION	RATIONALE: (If	applicable) ADEQUATI INADEQUAT	
REMARKS: OPEN. THE ASTRO	•	SPECIAL TOOL STOWED (

ASSESSM ASSESSM NASA FM		: 12/05 MMU-2 4.2.1	24		NASA DAT BASELIN NE	
SUBSYST MDAC ID ITEM:		MMU 224 HEATE	R FOR FSS	S RECHARG	E SYSTEM PNE	UMATIC FILTER
LEAD AN	ALYST:	DUFFY	, HUYNH,	SAIIDI		
ASSESSM	ENT:					
	CRITICA FLIG		REDUNI	DANCY SCR	EENS	CIL ITEM
	HDW/F		A	В	С	TIEM
NASA IOA	[2 /2 [3 /3]	[] [P]	[] [P]	[] [P]	[X] * []
COMPARE	[N /N]	[N]	[N]	[и]	[N]
RECOMME	NDATIONS	: (If	differen	nt from N	ASA)	
	[3 /2]	Rj	[P]	[F]	[P]	[] ADD/DELETE)
* CIL R	ETENTION	RATION	ALE: (If	applicab	le) ADEQUATE INADEQUATE	
REMARKS	:					

WITH THE FSS HEATER FAILED OFF, THE FILTER WILL BECOME EMBRITTLED AND FRACTURE. DEBRIS MAY CAUSE OTHER MALFUNCTIONS DOWNSTREAM. A SIMILAR FAILURE IN THE ALTERNATE SYSTEM WILL CAUSE MISSION TERMINATION.

ASSESS ASSESS NASA F	MENT	ľ	D:	MMU-22		5							ASA DA BASELI N		[]	
SUBSYS MDAC I ITEM:		}		MMU 225 TOGGLE	e 1	VA I	LVE I	HEA!	rei	RS								
LEAD A	NALY	(ST	:	DUFFY,	. 1	U	ZNH,	SA	III	DI								
ASSESS	MENT	: :																
	CF		ICAL: LIGH	ITY		RI	EDUNI	OAN	CY	SCRE	ENS	3				L		
				NC		A			В			С			T.1	ľEN	1	
NAS IO	A [A [2	/2 /2R]	[P]	[P]	[P]]	X]	*
COMPAR	E (N	/N]	[N]	[N]	[N]		[N]	
RECOMM	ENDA	TI	ons:	(If	d:	ifí	fere	nt i	fro	om NAS	SA))						
	[3	/2R].	[P]	[P]	[P]	(AE				TE)
* CIL REMARK OPEN C	s:			RATIONA			•	apı	pli	icable	•	IA IAI	DEQUAT DEQUAT	E E	[]	

ASSESSME ASSESSME NASA FME	NT	I	D:	•										LINE NEW	[]	
SUBSYSTE MDAC ID: ITEM:				MM 22 PR		UE (GAUG	SE HE	EAT	ERS	.							
LEAD ANA	LY	ST	:	מם:	FFY,	HU	YNH,	SAI	II)I								
ASSESSME	NT	:																
		F	LIG	LITY HT UNC		R:		IDANG	EY B	SCR	EEN	s C				EL CEN	1	
NASA IOA	[2	/2 /3]	[P]]	P]	[P]		[X]	*
COMPARE	[N	/N]	[N]	[N]	[N]		[N]	
RECOMMEN	IDA'	TI	ons	:	(If d	lif	fere	ent i	fro	om N	IASA)						
	[3	/3]	ĺ]	[]	[]	(A		D /DI		ETE)
* CIL RE	TE.	NT	ION	RAT	IONAI	E:	(If	f app) 1:	icab			DEQU.		[]	
DEMADEC .																		

FAIL OPEN, SHORT CIRCUIT

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-227	NASA DATA BASELINE NEW	
MDAC ID:	MMU 227 QD HEATERS		
LEAD ANALYST:	DUFFY, HUYNH, S.	AIIDI	
ASSESSMENT:			
CRITICALI FLIGHT	ITY REDUNDA F	NCY SCREENS	CIL ITEM
HDW/FUN	-	В С	7 1 11 11 1
NASA [2 /2 IOA [3 /2R] []]]	[] [] [P] [P]	[X] *
COMPARE [N /N] [N]	[и] [и]	[N]
RECOMMENDATIONS:	(If different	from NASA)	
[3 /2R] [P]		[D] DD/DELETE)
* CIL RETENTION F	RATIONALE: (If a		
		ADEQUATE INADEQUATE	[]
REMARKS: FAIL OFF, OPEN CI OR FAIL CAUSING T SIDES IS LOSS OF	THE LOSS OF ONE	RCUIT. FSS QD MAY B RECHARGE SIDE. LOSS	E INOPERABLI

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-228 NASA FMEA #: 4.4.2								NASA DA BASELI N		
SUBSYSTE MDAC ID: ITEM:			MMU 228 HEAT	ER TH	ermo	STATS				
LEAD ANA	LYST	:	DUFF	Y, HU	YNH,	SAII	DI			
ASSESSME	ENT:									
	F	LIGH'	T			DANCY B	SCI	REENS C	CII ITE	
	HDI	W/FU	NC	A		Б		C		
NASA IOA	[3	/2R /2R]	[P]	[P [P]	[] [P]	[] *]
COMPARE	[/]	[]	[]	[N]	[3
RECOMMEN	(DATI	ons:	(I	f dif	fere	nt fr	om 1	NÀSA)		
	[2	/2]	[1	[]	[]	[A [ADD/I	A] DELETE)
* CIL RE		ION :	RATIO	NALE:	(If	appl:	ical	ole) ADEQUAT INADEQUAT]
REMARKS:	3									

FAIL OPEN. MISSION IS TERMINATED WHEN FLIGHT CRITICAL COMPONENT FAILS. MMU WILL NOT FLY WITHOUT A REDUNDANT SYSTEM AVAILABLE.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-229 4.4.1	NASA DAT BASELIN NE	
SUBSYSTEM: MDAC ID: ITEM:	MMU 229 HEATER THERMO	STATS	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICAL		DANCY SCREENS	CIL
FLIGH HDW/FU		В С	ITEM
NASA [3 /2R IOA [3 /3] [P]] [P]	[F] [] [P]	[X] *
COMPARE [/N] []	[N] [N]	[N]
RECOMMENDATIONS:	(If differen	nt from NASA)	
[2 /2] []		[] ADD/DELETE)
* CIL RETENTION I	RATIONALE: (If	applicable) ADEQUATE INADEQUATE	
	SSION IS TERMI	NATE WHEN FLIGHT CRIT	ICAL COMPONENT

FAILS. MMU WILL NOT FLY WITHOUT A REDUNDANT SYSTEM AVAILABLE.

NASA DATA:

ASSESSME ASSESSME NASA FME	NT	II) :	MMU	U-230 5.1										SA DA' BASELI N	NE]	
SUBSYSTE MDAC ID: ITEM:				MMU 230 TOG)	7	/AI	VE	TE	EME	٠.	SEN	SORS	5					
LEAD ANA	LYS	ST:	}	DUF	Ϋ́Υ,	ŀ	IUY	/NH	, S	SA]	II	Ι							
ASSESSME	NT:	:																	
	CR		CAL LIGH	ITY			RE	EDU	NDA	/N(CY	SCR	EENS	5			CIL	1	
	I			NC			A				В			С				_	
NASA IOA	[3 3	/3 /3]] [P]		[P]	[P]		[]	*
COMPARE	[/]		[N]		[N]	[N]		[1	
RECOMMEN	IDA'	ric	ons:	((If	d:	ifi	fer	ent	t :	fro	om N	ASA)					
	נ		/]		[]		[]	[]	(AI	[[D/DC] ELF	ETE)
* CIL RE	e te i	NT:	ION	RAT	CONA	L	E:	()	[f a	apj	pl:	icab		Al NAI	DEQUAT DEQUAT	E E	[]	
REMARKS: LOSS OF IS NOT M SCREENS.	SI (IS	GN. SI	AL. ON E	THI SSE1	E FS NTIA	SS	SI •	UPI TI	PLY HIS	T(F)	OG(AI	GLE LURE	VAL	VE	TEMPE	RA!	rure	SI	ENSOR [RE

ASSESSMI ASSESSMI NASA FMI		12/05/86 MMU-231			NASA DATA BASELINE NEW	•]
SUBSYSTI MDAC ID: ITEM:		MMU 231 TOGGLE VA	LVE TEMP.	SENSORS	3		
LEAD AND	ALYST:	DUFFY, HU	YNH, SAII	DI			
ASSESSMI	ent:						
	CRITICAL: FLIGHT HDW/FUI	r	EDUNDANCY B	SCREENS	c	CIL	ſ
NASA IOA	[/]] [] [P] [] [P] [P]	[] *
COMPARE	[N /N] [N] [n] [и ј	[3
RECOMMEN	DATIONS:	(If dif	ferent fro	om NASA)			
	[3 /3] [] [) (] (Al	[DD/DE] :Lete
* CIL RE		RATIONALE:	(If appli		ADEQUATE ADEQUATE	[]

FAIL HIGH

ASSESSMEN ASSESSMEN NASA FMEA	T II		12/ MMU									DATA ELINE NEW			
SUBSYSTEM MDAC ID: ITEM:			MMU 232 TOG		VA	LVE	TEMP	. s:	ENSOR:	s					
LEAD ANAI	YST	:	DUF	FY,	HU	YNH	, SAI	IDI							
ASSESSMEN	IT:														
c		ICAL LIGH			R	EDU	NDANC'	Y S	CREEN	S			CII		
		W/FU			A			В		С					
NASA IOA	[3	/ /3]		[[P]	[P]	[[P]		[]	*
COMPARE	[N	/N]		(N]	[]	N]	[N]		[]	
RECOMMEN	DATI	ons:	([If	dif	fer	ent f	rom	NASA)					
	[3	/3]		[]	[]	(]	(A] DELE	TE)
* CIL RET	TENT	ION	RATI	ONA	LE:	(I	f app	lic				UATE UATE]	
REMARKS: FAIL LOW															

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-233		1	NASA DATA: BASELINE NEW		
SUBSYSTEM: MDAC ID: ITEM:	MMU 233 ORBITER P	POWER CONN	ECTOR			
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI			
ASSESSMENT:						
CRITICAL FLIGH		EDUNDANCY	SCREENS		CIL ITEM	
HDW/FU		B			TIEM	
NASA [/ IOA [3 /3] [] [P] [p] [F	,]	[]	*
COMPARE [N /N] [N) [N) [N]	[]	
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)			
[/] [] [] . [[] D/DELE	TE)
* CIL RETENTION 1	RATIONALE:	(If appl	A	DEQUATE DEQUATE	[]	
REMARKS: THIS ITEM AND FA: MMU-184.	ILURE MODE	ARE VOID		IS COVER	. ,	H ITEM

ASSESSME ASSESSME NASA FME	TN	II		•	12/05/86 NASA DATA: MMU-234 BASELINE [] NEW [X]										
SUBSYSTE MDAC ID:				MMU 234 EXTE	RNAL	POWE	ER LIN	E/CO	NNECTO	OR					
LEAD ANA	LY	ST	:	DUFF	Y, H	JYNH,	SAII	DI							
ASSESSME	ENT	:													
	CR				I	REDUN	NDANCY	SCR	EENS			CIL			
	1		LIGH W/FU	NC	2	4	E	3	С			111	••		
NASA IOA	[3	/]	[[]	·]	[])	[[P]		[[]	*	
COMPARE	[N	/N	1	[]	1]	[]	[]	[N]		[]		
RECOMMEN	NDA'	TI	ons:	()	f di	ffer	ent fi	om N	IASA)						
	[/]	[]	[]	[]	(A	[.DD/D			
* CIL RI	ETE	NT:	ION	RATIO	NALE	: (I:	f appl	licak	ole) A INA	DEQU <i>I</i> DEQU <i>I</i>	ATE ATE	[]		
REMARKS OPEN CII VOIDED.	: RCU	ΙT	. 7	THIS I	OA I	s sai	ME AS	MMU-	-184,	AND N	IAY	THER	EF	ORE :	BE

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 NASA DATA: MMU-235 BASELINE [] 2.4.1 NEW [X]							
MDAC ID:	MMU 235 ORBITER ADAPTOR BEAM	MOUNTS (6)						
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI	•						
ASSESSMENT:								
CRITICALI FLIGHT	r	ITEM						
HDW/FUN	NC A B	С						
NASA [1 /1 IOA [3 /1R] [] []] [P] [P]	[] [X] * [P]						
COMPARE [N /N] [N] [N]	[и] [и]						
RECOMMENDATIONS:	(If different from	NASA)						
[/] [] []	[] [] (ADD/DELETE)						
* CIL RETENTION F	RATIONALE: (If application	•						
		ADEQUATE [] INADEQUATE []						
ARE NOT WITHIN TH	HE SPECIFICATION OF 22	THESE FAILURES SINCE THEY						

UNLIKELY.

	12/05/86 MMU-237		NASA DATA: BASELINE [] NEW [X]					
	MMU 237 BACKBEAM SHOCK	MOUNTS (4)						
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI						
ASSESSMENT:								
CRITICAL: FLIGHT		ANCY SCREEN	S	CIL ITEM				
HDW/FUI		В	С					
NASA [/ IOA [3 /2R] []]]	[] [[P]	p]	[] *				
COMPARE [N /N] [N]	[и]	иј	[]				
RECOMMENDATIONS:	(If different	t from NASA	')	·				
[/] []	[]	[] (A)	[] DD/DELET	E)			
* CIL RETENTION	RATIONALE: (If	applicable)	ADEQUATE	r 1				
		1	ADEQUATE NADEQUATE	ii				
REMARKS: THE RECOMMENDATION ARE NOT WITHIN TO	ON IS NOT TO COM	NSIDER THES	E FAILURES	SINCE T	HEY S			

PART OF STRUCTURE, AND ITS FAILURE MODE AND CAUSE RELATIONSHIP ARE VERY UNLIKELY. THIS FAILURE MODE MAY BE WITHDRAWN.

ASSESSME ASSESSME NASA FME	NT ID:	12/05/8 MMU-238			NASA DATA: BASELINE [] NEW [X]						
SUBSYSTE MDAC ID:		MMU 238 FOOT RE	STRA	INT ADJ	UST						
LEAD ANA	LYST:	DUFFY,	HUYN	H, SAII	DI						
ASSESSME	NT:										
	CRITICAL FLIGH HDW/FU	r	RED A	UNDANCY B	SCREE	NS C		CIL			
NASA IOA	[/]] [P]	[[P]	[[P]	[] *]		
COMPARE	[N /N] [и ј	[и]	[N]	[]		
RECOMMEN	DATIONS:	(If d	iffe	rent fr	om NAS	A)					
	[3 /3] [P]	[P	1	(P	-	[[ELETE)		
* CIL RE	TENTION 1	RATIONAL	E: (If appl	•	AD	EQUATE EQUATE	[]		
REMARKS:					•			L	J.		

ASSESSME NASA FME	NT I	ID:	MMU-2	239			NASA DATA: BASELINE [] NEW [X]						
SUBSYSTE MDAC ID: ITEM:			MMU 239 FOOT	REST	RAIN	ILDA TI	JST						
LEAD ANA	LYS	r:	DUFFY	, HU	YNH,	SAII)I						
ASSESSME	NT:												
	1	FLIGH				IDANCY	SCR				IL TEM		
	HI	DW/FU	NC	A		В		С					
NASA IOA	[:	3 /3 3 /3]	[[P]	[[P]	[[P]	[[]	*	
COMPARE	[/]	[N	1	[N]	[N]	[]		
RECOMMEN	IDAT:	ions:	(I	f dif	fere	ent fr	om N	ASA)					
	[/]	[]	[]	[]] /DELI	ETE)	
* CIL RE	TEN	TION	RATIO	NALE:	(Ii	f appl	icab		DEQUAT DEQUAT	E []		
REMARKS: JAM LOCK													

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	MMU-240		SA DATA: ASELINE [] NEW [X]								
	MMU 240 MMU LATCH										
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI									
ASSESSMENT:											
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM											
HDW/F	INC A	в с									
NASA [3 /2] IOA [3 /3	R] [P] [P]	[P] [P] [] *								
COMPARE [/N] []	[] [и									
RECOMMENDATIONS	(If differe	nt from NASA)									
[/] []	[] [] [] (ADD/DELETE)								
* CIL RETENTION	RATIONALE: (If										
		AD INAD	EQUATE [] EQUATE []								
OF MISSION, IF	INADEQUATE [] MARKS: MOPEN. LOSS OF FUNCTION (TO LATCH MMU TO FSS) COULD BE LOSS MISSION, IF THE UNIT CANNOT BE RECHARGED. HOWEVER PRIOR TO ENTRY, THE MMU CAN BE STRAPPED DOWN IN THE MIDDECK. IOA AGREES										

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		MU-241 BASELINE [
	MMU 241 MMU LATCH							
LEAD ANALYST:	DUFFY, HU	YNH, S	AIII	OI				
ASSESSMENT:								
CRITICAL FLIGH		EDUNDA	NCY	SCREEN	S		CIL	ſ
HDW/FU			В		С		1111	•
NASA [3 /2R IOA [3 /3] [P]	[P] [p]		[] *
COMPARE [/N] []	[] [и ј		[]
RECOMMENDATIONS:	(If dif	ferent	fro	om NASA	.)			
[/	וֹ נ]	ָר נ) (1	(AI	[DD/DE] ELETE)
* CIL RETENTION	RATIONALE:	(If a	ppl	·	ADEQ	UATE]
	MISSION I FAILED LAT FMEA.			red if	REDUN		LANYA	

ASSESSMI ASSESSMI NASA FMI		12/05/86 MMU-242	5		NASA DAT BASELIN NE	E []	
SUBSYSTI MDAC ID: ITEM:		MMU 242 MUSHROOM	4 KNOB	S (8)				
LEAD AND	ALYST:	DUFFY, H	HUYNH,	SAIID	I			
ASSESSMI	ent:							
	CRITICAL:	r			SCREENS		CIL	
	HDW/FU	NC	A	В		С		
NASA IOA	[3 /3] [P]	[[P] [P]	[] *
COMPARE	[N /N] [и]	[N) [N]	ſ]
RECOMMEN	NDATIONS:	(If di	ffere	nt fro	m NASA)	•		
	[3 /3	ז נ	P]	[P	j ([ADD/D] ELETE
* CIL RI	ETENTION 1	RATIONALE	E: (If	appli	·	ADEQUATE NADEQUATE	-]

REMARKS:

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	: 12/05/8 MMU-24:			NASA DATA: BASELINE [] NEW [X]						
SUBSYSTEM: MDAC ID: ITEM:	MMU 243 THERMAI	L BLANKI	ets							
LEAD ANALYST:	DUFFY,	HUYNH,	SAIIDI							
ASSESSMENT:										
CRITICA FLIG		REDUNI	DANCY SCRE	ENS	CIL					
HDW/F		A	В	С						
NASA [/ IOA [3 /2]] R]	[] [P]	[] [P]	[] [P]	[] *				
COMPARE [N /N]	[и]	[N]	[N]	[]				
RECOMMENDATIONS	: (If o	differe	nt from NA	SA)						
[3 /2	R]	[P]	[P]	[P]	[D\ D D] ELETE				
* CIL RETENTION	RATIONA	LE: (If	applicabl	e) ADEQUATE INADEQUATE]				
REMARKS: FSS THERMAL BLA RESULT IN LOSS MISSION.				SITIVE COMPO	NENT					

NASA FMEA #:					′05/8€ J−244	5								DATA: LINE NEW	[_	
SUBSYSTEMDAC ID				MMU 244 TET		REE:	L R	ESTI	RA]	נאז	•						
LEAD AN	ALY	ST	:	DUF	FY, F	IUY	NH,	SA	III	ΟI							
ASSESSM	ENT	:															
	CR		ICA LIG			RE	DUN	DANG	CY	sc	REENS	3			CII		
]	HD	W/F	UNC		A			В			С					
NASA IOA	[3	/ /3]	[[P]	[P]	[[P]		[]	*
COMPARE	[N	/N]	[N]	[N]	Ε	N]		[]	
RECOMME	NDA'	TI	ons	: (If di	ff	ere	nt 1	fro	m	NASA))					
	[/	3	[]	[]	[]	(AI	[DD/I) DELI	ETE)
* CIL RI		NT:	ION	RATI	ONALE	E:	(If	app) 1i	ica	·			ATE ATE	[]	
FRACTURI TO THE	Ξ.		HIS	MALF	UNCTI	ON	IS	VOI	DE	ED	SINC	3	THE	ITEM	IS.	CON	NECTED

ASSESSMEN'	SSESSMENT DATE: 12/05/86 SSESSMENT ID: MMU-245 ASA FMEA #:									•		SA D ASEL]
SUBSYSTEM MDAC ID: ITEM:	:		MMU 245 TETHER	R R	ŒĒ	L RE	esti	RAI	NT						
LEAD ANAL	YST:		DUFFY,	H	UY	NH,	SA	[II	I						
ASSESSMEN	T:														
С			TY		RE	DUNI	OAN	CY	SCR	EENS	}			CII	
	_	IGH' FUI			A			В			С				
NASA IOA	[3	/ /3]	[P]]	P]	[P]		[] *]
	[N]				[N]		[]
RECOMMEND	ATIC	ns:	(If	d :	ifí	ere	nt	fr	om N	ASA)	١				
•	[/]	[]	[]	[]	(A	[DD/1] DELETE)
* CIL RET	ENT	ON	RATION	AL	E:	(If	ap	pl	icab			EQUA]
REMARKS: THIS MALE	UNC	rion	IS VO	ID	ED	SIN	CE	TH	E II	EM :	IS	CONI	NECT	ED '	TO THE

EMU.

ASSESSM ASSESSM NASA FM	ID:		-1001X .1	3			1	NASA DA BASELI N]		
SUBSYST MDAC ID ITEM:			MMU 100 GN2										
LEAD AN	ALYS	ST:	DUF	FY, HU	YNH	, SAII	DI						
ASSESSM	ENT:	:											
	CRI	ITICA: FLIG		R	EDU	NDANCY	SCI	REENS		C]	L LEM	•	
	F	HDW/F	UNC	A		В		(2	1.	. ism		
NASA IOA		1 /1 1 /1]]	[]	[]	[[]	[X X]	*
COMPARE	[/]	ί]	[]	[]	C]	
RECOMMEN	radi	CIONS	; (If dif	fere	ent fr	om N	IASA)					
	[/]	[]	[]	C]	[(ADD/	DE:] LE'	TE)
* CIL RE REMARKS: IOA IS I	:						icab	A	DEQUATE	_]	

ASSESSME	ASSESSMENT DATE: ASSESSMENT ID: MMU- NASA FMEA #: 1.5. SUBSYSTEM: MMU										SA DATA SELINE NEW	[]	
SUBSYSTEM MDAC ID: ITEM:	M:		MMU 1031 TOGG	LE V	ALV	ES									
LEAD ANA	LYSI	r:	DUFF	Y, H	IUYN	H, SA	III	Ι							
ASSESSME	NT:														
(RED	UNDAN	CY	SCR	REENS	;		CI	L EM	a.	
	FLIGHT HDW/FUNC				A		В			С		11	. Lif	1	
NASA IOA	[2	2 /1R 2 /1R]]	P] P]	[P P]	[P]		[X X]	*
COMPARE	[/]	Į]	[]	[N]]	[]	
RECOMMEN	DATI	cons:	(I	f di	ffe	rent :	fro	om N	IASA)						
	C	/]	[]	[]	[•] (<i>P</i>		DI		ETE)
* CIL RE					·			icab			EQUATE EQUATE]	
IOA IS I	N AC	GREEM	ENT W	ITH	THE	FMEA	•								

ASSESSMI	SESSMENT DATE: SESSMENT ID: MMU-1051X SA FMEA #: 1.4.3 BSYSTEM: MMU AC ID: 1051													SA DAT SELIN NE]	x]		
SUBSYSTI MDAC ID: ITEM:				10		ri(ON	VAL	VE											
LEAD AN	ALYS	ST	:	DŪ	JFFY,	, F	U	YNH,	SA	II	DI									
ASSESSMI	ENT:	:																		
		F	ICAL LIGH N/FU	r	Ţ.		RI A	EDUN	DAN	CY B		CREEN		С				L PEM	ſ	
NASA IOA	[2 2	/1R /1R]		[P P]	[P P]	[[P]			[X X]	*
COMPARE	[/]		(3	(]	([:	N]			[]	
RECOMME	NDAT	ri(ons:		(If	đi	ifi	fere	nt	fr	om	NAS?	4)							
	(/]		[]	(·]	(]		(AD	[D/	DE] ELI	ETE
* CIL RI		NT:	ION 1	RAT	TION	LI	Ξ:	(If	aŗ	pl	ica	•			QUATE]]	

IOA IS IN AGREEMENT WITH THE FMEA.

ASSESSME ASSESSME NASA FME	NT	II):			1X								DAT. ELIN NE	E				
SUBSYSTE MDAC ID: ITEM:				MMU 1141 THRU	STE	R I	rri <i>a</i>	ΔD											
LEAD ANA	LYS	ST	:	DUFF	Υ,	HUY	, HNY	, SA	II.	DI									
ASSESSME	ENT	:																	
	CR		ICALI LIGHT	TY T		RI	EDUN	IDA N	CY	sc	REENS	3				CI IT		<u>I</u>	
	1			1C		A			В			С							
NASA IOA	[[2 2	/1R /1R]]]	P P]	[P P]	[P]			[X X]	*
COMPARE	[/	1	[]	[]	[N	1			[]	
RECOMMEN	NDA'	rI	ons:	(I	f d	if	fer	ent	fr	om 1	nasa))							
	[/]	[]	(]	[]	([)D/			ETE)
* CIL RI	ETE:	NT	ION I	RATIO	NAI	E:	(I:	f ar	pl	ica		A IAN	DEQ DEQ	UATE UATE		[]	
REMARKS		AG	REEM	ENT W	ITH	T	HE :	FME <i>l</i>	۱.										

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA BASELINE NEW	
MDAC ID:	MMU 1191 REGULATOR			
LEAD ANALYST:	DUFFY, HUYNH	, SAIIDI		
ASSESSMENT:				
CRITICAL: FLIGHT	ITY REDU	NDANCY SCREE	NS	CIL ITEM
HDW/FUI	NC A	В	С	
NASA [3 /2R IOA [2 /1R] [P]] [P]	[P] [P]	[] [P]	[] * [x]
COMPARE [N /N] []	[]	[N]	[и]
RECOMMENDATIONS:	(If differ	ent from NAS	A)	
[2 /1R] [P]	[P]		[A] DD/DELETE)
* CIL RETENTION F	RATIONALE: (I	f applicable		
DEWI DVG			ADEQUATE INADEQUATE	[]
REMARKS: HIGH PRESSURE DOW LOSS OF GN2 OR LO PERSON STRANDED.	INSTREAM WILL DSS OF SIDE.	FORCE THE V	ENT VALVE OF	PEN. THUS

ASSESSMEI ASSESSMEI NASA FME	NT I	D:		2113	C						SA DAT BASELIN NI				
SUBSYSTEM MDAC ID:			MMU 1211 GN2 RE	EGUI	LATO	R									
LEAD ANA	LYST	':	DUFFY,	н	JYNH	, SA	III	ΟI							
ASSESSME	NT:														
		ICAL	ITY	I	REDU	NDAN	CY	SCI	REENS	;		C	IL		
			NC	7	A		В			С		•		. •	
NASA IOA	[1	/1 /1R]	[]	?]	[P]	[P]	[X]	*
COMPARE	[N	/N]	[]	1]	[N]	[N]	[]	
RECOMMEN	DATI	ONS:	(If	di	ffer	ent :	fro	om 1	NASA)						
·	[2	/1R]	[]	?]	ſ	P]	ĺ	P])/D		ETE)
* CIL RE	TENT	'ION	RATIONA	ALE:	: (I	f ap	pl:	ical		3.5	NEO/13 EI			,	
									IN	AL IAI	DEQUATI DEQUATI	s (]	
REMARKS: THE FMEA CRITICAL CAUSE LOS STOP THE	ITY SS 0	INAP:	PROPRIA FE IMMI	ATE1	LY.	THE	L	oss	OF F	EC	ULATO	R DC	ES	NO	TC

ASSESSME	ASSESSMENT DATE: ASSESSMENT ID: MMU-1212X NASA FMEA #: 1.2.5 SUBSYSTEM: MMU														DATA ELINI NEV		x]	
SUBSYSTE MDAC ID:				12	12	EGI	UL	ATOR											
LEAD ANA	LY	ST	:	DU	FFY,	, 1	HU:	YNH,	SA	II	DI								
ASSESSME	TN	:																	
	CR:		ICAL LIGH				RI	EDUN	DAN	CY	SCF	REEN	S				IL PEN	1	
]	HDI	W/FU	NC			A			В			С						
NASA IOA			/1R /1R]]	P P]]	P P]	[[P]		[X X]	*
COMPARE	[/]		[]	[]	[N]		[]	
RECOMMEN	DA:	ΓI	ons:		(If	d :	if	fere	nt	fr	om N	IASA	.)						
	(/]		[]	[]	[1	(2	[ADD,	/DI		ete:
* CIL RE										_	icab	-			JATE JATE]	
IOA IS I	N.	AG)	KEEM)	LNT	WI	ĽH	TI	HE F	MEA	•									

	NT DATE: NT ID: A #:		51X		NASA DAT BASELIN NE	XA: UE [] UW [X]
SUBSYSTE MDAC ID: ITEM:		MMU 1251 QUICK D	OISCONNI	ECT		
LEAD ANA	LYST:	DUFFY,	HUYNH,	SAIIDI		
ASSESSME	NT:					
	CRITICAL FLIGH		REDUNI	DANCY SCR	EENS	CIL ITEM
	HDW/FU		A	В	С	
NASA IOA	[1 /1 [3 /2R] [P]	[] [P]	[[X] * []
COMPARE	[N /N] [и ј	[N]	[N]	[N]
RECOMMEN	DATIONS:	(If d	liffere	nt from N	ASA)	
	[3 /2R] [P]	[P]		[D] ADD/DELETE)
* CIL RE	TENTION :	RATIONAL	E: (If	applicab	le) ADEQUATE INADEQUATE	: []
REMARKS:	DID 1100	COVATA				ON OR TO SELL

THE FMEA DID NOT CONSIDER THE FACT THAT THE COUPLER ON QD IS SELF SEALING WHICH STOPS LEAKAGE UNDER SUCH A CIRCUMSTANCE. ALSO, RECHARGE ACTIVITY IS ACCOMPLISHED DURING POST-OPS NOT PREP AS INDICATED BY THE FMEA.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1252X 1.3.4		NASA DATA BASELINE NEW	
	MMU 1252 QUICK DISCONN	ECT		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI		
ASSESSMENT:				
CRITICAL! FLIGHT		DANCY SCREI	ens	CIL ITEM
HDW/FU		В	С	IIDM
NASA [3 /2R IOA [3 /2R] [P]] [P]	[P] [P]	[] [P]	[] *
COMPARE [/] []	[]	[N]	[]
RECOMMENDATIONS:	(If differe	nt from NAS	SA)	
[/] []	[]		[] DD/DELETE)
* CIL RETENTION H	RATIONALE: (If	applicable	ADEQUATE INADEQUATE	
REMARKS: IOA IS IN AGREEME DURING POST-OPS.	ENT WITH THE F	MEA, EXCEPT	~	. ,

ASSESSME ASSESSME NASA FME	NT I	D:							SA DA BASELI N	NE					
SUBSYSTE MDAC ID: ITEM:	M:		MMU 1253 QUICK	DIS	CONNE	CT									
LEAD ANA	LYST	:	DUFFY	, HU	YNH,	SAI	II	I							
ASSESSME	NT:														
		ICAL: LIGH'	ITY r	R	EDUNI	ANC	Y:	SCRE	ENS	3			CIL	1	
	_		NC	A			В			С				-	
NASA IOA	[3 [3	/2R /2R]	[P]]	P P]	[P]		[]	*
COMPARE	[/]	[]	[]	[N]		[]	
RECOMMEN	IDATI	ons:	(If	dif	fere	nt f	r	om NA	SA))					
	[/]	[]	. [1	[]	(AI	[DD/DI		ETE)
* CIL RE	ETENT	'ION	RATION	ALE:	(If	app) 1:	icabl		IA IAN	DEQUA'	TE TE	[]	
REMARKS:		REEM	ENT WI	тн т	HE FI	MEA.									

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				NASA DATA BASELINI NEV	
SUBSYSTEM: MDAC ID: ITEM:	MMU 1281 BATTERY				
LEAD ANALYST:	DUFFY, HU	YNH, SA	IIDI		
ASSESSMENT:					
CRITICAL: FLIGHT		EDUNDAN	CY SCRE	ENS	CIL
HDW/FUN	ic a		В	С	
NASA [2 /2 IOA [3 /2R] [] [P] [P]	[] [P]	[X] *
COMPARE [N /N] [N] [N]	[N]	[N]
RECOMMENDATIONS:	(If dif	ferent i	from NA	SA)	
[3 /2R] [P] [P]	[P] (A	[D] .DD/DELETE
* CIL RETENTION F	ATIONALE:	(If app	plicable	≥)	
REMARKS:				ADEQUATE INADEQUATE	[]
FMEA DOES NOT REC ANOTHER ONE STORE	OGNIZE REI	PLACING TER.	THE AFI	FECTED BATTE	RY WITH

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		_ ·	BASELINE NEW	[x]]
SUBSYSTEM: MDAC ID: ITEM:	MMU 1681 GYRO POWER SUPP	LY			
LEAD ANALYST:	DUFFY, HUYNH, S.	AIIDI			
ASSESSMENT:					
CRITICAL: FLIGHT		NCY SCREENS		CIL ITEM	
HDW/FUI		В			
NASA [3 /3 IOA [3 /2R]	[] *	
COMPARE [/N] [N]	[N] [N]	[]
RECOMMENDATIONS:	(If different	from NASA)			
[3 /2R] [P]	[P] [F		[DD/DE] LETE)
* CIL RETENTION	RATIONALE: (If a	A	DEQUATE	[]
REMARKS: LOSS OF GYRO RESI CAPABILITY NEEDE RHC CONTROL IS A	D FOR CERTAIN MI	SSIONS LIKE	SOLAR MAX	X. M	ANUAL HE LOSS

ASSESSMENT ASSESSMENT NASA FMEA #							ASA DATA BASELINE NEW] 2]			
SUBSYSTEM: MDAC ID: ITEM:		MMU 1701 TRANSLA	TIC	NAL H	IAND	CONTI	ROI	LLI	ER				
LEAD ANALYS	T:	DUFFY,	HUY	NH, S	AIII)I							
ASSESSMENT:													
	TICALI FLIGHT DW/FUN		RE A	DUNDA	NCY B	SCREE	ens	s C			IL PEN	1	
NASA [IOA [2 /2 3 /1R] [P P]	[P]	[P]	[X]	*
COMPARE [N /N] []	[]	[N]	[N]	
RECOMMENDAT	ions:	(If d	iff	erent	fro	om NAS	SA)	ŀ					
[:	3 /1R] [P]	[P]	[P		-	D / DE	-	ETE)
* CIL RETENT							IN	IAI	DEQUATE DEQUATE	[]	
IOA CONSIDE	ro int	WYED K	EDU	NUANT	TO	LACH	0.1	HŁ	iK.				

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-1702X NASA FMEA #: 3.2.4													LINE	[
SUBSYSTEM MDAC ID:	M:			MMU 1702 TRANSI	LA!	ric	ONAI	L HA	ND	CON	TROI	LL	ER					
LEAD ANA	LYS	ST	:	DUFFY	, 1	HUY	/NH,	SA	II	DI								
ASSESSME	NT:	:																
•	CR:		ICAL	ITY r		RI	EDUN	IDAN(CY	SCR	EENS	3			C:	IL PEN		
	1	HD	W/FUI	NC		A			В			С						
NASA IOA	[2	/2 /1R]]	P P]] [P P]]	P]		[[X]	*
COMPARE	[N	/N]	[]	[]	[N]		[N]	
RECOMMEN	DA!	ΓI	ons:	(If	d :	if	fere	ent	fr	om N	IASA))						
	[3	/1R]	[P]	[P]	[P]	(A		D /DI		ETE)
* CIL RE	ΓE	NT	ION 1	RATION	AL	E:	(Ii	f ap	pl.	icab		IA IAI	DEQU.	ATE ATE	[]	
REMARKS:	ID:	ER	S TH	E AXES	R	EDI	UNDA	TNA	то	EAC	CH O	CHI	ER.					

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-1703X NASA FMEA #: 3.2.5 SUBSYSTEM: MMU														DATA ELINI NEI		x]	
SUBSYSTI MDAC ID: ITEM:				MMU 1703 TRAN	SLA!	ri	ONAI	L H	ANI	o coi	NTRO	LL	ER					
LEAD ANA	LY	ST	:	DUFF	Y, 1	HU	HNY,	, S.	AI	DI								
ASSESSME	ENT	:																
CRITICALITY RED FLIGHT HDW/FUNC A								NDA			REEN					IL PEI		
		HD	W/FUI	NC		A			I	3		С						
NASA IOA	[2 3	/2 /1R]]	P P]		[] []) }]	[P]		[X]	*
COMPARE	[N	/N]	[3		[]	[N]		[N)	
RECOMMEN	IDA'	ΓI	ons:	(I	f d	if	fere	ent	fı	om 1	NASA)						
	[3	/1R]	[P]		[I)	[P)		[ADD,		•	ETE)
* CIL RE							·		-		I	NAI	DEQ	UATE UATE	[]	
IOA CONS	ID	ER	S THI	E AXE	S RI	EDU	JNDA	TNA	TC	EAC	CH O	TH	ER.					

ASSESSMENT DA ASSESSMENT II NASA FMEA #:	MU-170					BASELINE NEW				
SUBSYSTEM: MDAC ID: ITEM:	1	1MU L704 TRANSLA	TIC	NAL H	łand	CONTR	OLL	ÆR		
LEAD ANALYST	: E	OUFFY,	HUY	NH, S	SAIII	DI				
ASSESSMENT:										
	CALIT	ГY	RE	DUND	ANCY	SCREE	NS		CIL	M.
- -	V/FUNC	C	A		В		C	:		
NASA [2 IOA [2	/1R] /1R]] [P]	[P [P]	[[P	·]	[X] *
COMPARE [/]) []	[1	[N	[]	[]
RECOMMENDATIO	ons:	(If d	liff	erent	t fr	om NAS	A)			
[/]] {	•	1	[]	[] (A	[DD/D] ELETE)
* CIL RETENT:	ION RA	ATIONAI	Œ:	(If a	appl	icable	A	ADEQUATE ADEQUATE	[]
FAILS OFF IN	ALL T	THREE A	XIS	s. s	EE A	NALYSI	SW	ORKSHEET	•	

ASSESSMENT DATE: 3/16/87 ASSESSMENT ID: MMU-1721X NASA FMEA #: 3.1.3 SUBSYSTEM: MMU												DATA ELINE NEV] 3	x]					
SUBSYSTE MDAC ID: ITEM:	M:			17	721	[0]	NA]	L H	AND	(201	NTR	OLLE	R						
LEAD ANA	LY	ST	:	DŪ	JFFY,	,	HU	YNH	, s	A:	[]	ΟI								
ASSESSME	NT	:																		
	CR		ICAL LIGH		Z.		RI	EDU	NDA	NO	CY	sc	REEN	S				I L FEI		
]	HD	W/FU	NC			A				В			С						
NASA IOA	[2	/2 /1R]		[P]] [P]	[P]		[X]	*
COMPARE	[N	/N]		[N	3		[N]	[N]		[N]	
RECOMMEN	DA!	ri(ONS:		(If	d :	if	fer	ent	1	iro	m	NASA)						
	[3	/1R]		[P]		[P]	[P]	(A	•	D DI	•	ETE)
* CIL RE	TEI	NT:	ION 1	RAI	IONA	L	Ε:	(I:	f a	ÞĒ	oli	.ca	•		-	UATE UATE]	
FAIL OFF	01	NE	AXIS	3.	SEE	2	ANZ	ALYS	SIS	V	ЮF	KS	HEET	1	721	•				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1722X		BASELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 1722 ROTATIONAL HAM	ND CONTROLLER	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICAL		DANCY SCREENS	CIL ITEM
FLIGH HDW/FU		в с	11111
NASA [2 /2 IOA [3 /1R	[] [P]	[] [[P] [P] [X] *] []
COMPARE [N /N] [N]	[N] [N] [N]
RECOMMENDATIONS:	(If differe	nt from NASA)	. •
[3 /1F	[P]	[P] [P	<pre>[D] (ADD/DELETE)</pre>
* CIL RETENTION	RATIONALE: (If	A	DEQUATE [] DEQUATE []
REMARKS: LOSS OF ROTATION	IN ONE AXIS.	THE PILOT CAN	ROTATE AND TRANSLATE

IN OTHER AXES. LOSS OF ALL FUNCTIONS WILL LEAVE THE PILOT

STRANDED IF UNABLE TO SIGHT THE ORBITER.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1723X		N	BASELINE NEW		
	MMU 1723 ROTATIONAL	L HAND COI	NTROLLER			
LEAD ANALYST:	DUFFY, HUY	YNH, SAIII	oi .			
ASSESSMENT:						
CRITICAL: FLIGH	ITY RI	EDUNDANCY	SCREENS		CIL	
HDW/FU	NC A	В	C	:		
NASA [2 /2 IOA [3 /1R] [P] [P] [P] [P] [P]	[X) *
COMPARE [N /N] [] [] [N	1	[N]
RECOMMENDATIONS:	(If diff	ferent fro	om NASA)			
[3 /1R] [P] [P] [P		[D [D/D] ELETE
* CIL RETENTION I			A INA	DEQUATE DEQUATE	[]
FAIL OFF (1-3 AXI	ES), SEE AI	LSO MMU-17	'21A.			

ASSESSMEN' ASSESSMEN' NASA FMEA	T ID:	MMU-17						ASA DAT BASELIN NE]	
SUBSYSTEM MDAC ID: ITEM:	:	MMU 1724 ROTATI	ONAI	. HAN	D COI	ITROLL	ER					
LEAD ANAL	YST:	DUFFY,	, HUY	NH,	SAIII)I						
ASSESSMEN	T:											
C	RITICAL FLIGH		RI	EDUNE	ANCY	SCREE	ns			CIL		
	HDW/FU		A		В		С					
NASA IOA	[2 /1F [1 /1	R]	[P]	[P]	[]		X X] ;	*
COMPARE			[]		ĺИ	1	[1		[]	
RECOMMEND	ATIONS:	(If	dif	ferer	nt fr	om NAS	A)					
	[1 /1	3	[]	[1	[]	(ADI	[D/D] ELE'	TE)
* CIL RET	PENTION	RATION	ALE:	(If	appl	icable	A	DEQUATI	E E	[]	
SEE ANALY	SIS WOI	RKSHEET	172	2.								

ASSESSMI ASSESSMI NASA FMI	ENT D ENT I EA #:	ATE: D:	3/16/ MMU-1 3.2.8	'87 .731X				1	NASA BASE		[
SUBSYSTEMDAC ID:			MMU 1731 TRANS	LATI	ONAL	, HAND	CON	TROLI	LER					
LEAD ANA	ALYST	:	DUFFY	, HU	YNH,	SAII	DI							
ASSESSME	ENT:													
		ICAL LIGH	ITY	R	EDUN	DANCY	SCR	EENS			CI			
			NC	A		В		C	:		IT	CEM	I	
NASA IOA	[1	/1 /1]	[]	[]	[]		[X X]	*
COMPARE	[/]	[]	[]	[]		[]	
RECOMMEN	IDATI(ons:	(If	dif	fere	nt fro	om N	ASA)						
	[/]	[]	[]	•	}		[DD/			ETE
* CIL RE		ION 1	RATION	ALE:	(If	appli	icab	À	DEQUA	ATE ATE	[]	
REMARKS: MECHANIC BOTH ISO NORMAL P	ALLY VAL	VES A	ARE CL	OSED	. T	HE HAN	IDLE	CANN	OT BI	E RET	rur	NE	D	TO

ASSESSMEN	SSESSMENT DATE: 3/19/87 SSESSMENT ID: MMU-1861X ASA FMEA #: 4.3.2 UBSYSTEM: MMU														DAT ELIN NE	_]	
SUBSYSTEM MDAC ID: ITEM:	1 :			18		Œ	RMC	STA	TS	(2	SET	rs)							
LEAD ANAI	LYS	T:		DU:	FFY,	F	ΙUΊ	NH,	SA	II	DI								
ASSESSMEN	T:																		
C		TIC:					RI	EDUN	IDAN	ICY	SCI	REENS	3			CI:		[
		DW/					A			В			С						
NASA IOA	[:	2 / 2 /	1R 1R]]	P P]	[]	P P]] [P]		[]	X X]	*
COMPARE	[/]		[]	[•]	ĺ	N]		(3	
RECOMMENI	DAT	ION	s:		(If	d :	if	fere	ent	fr	om 1	NASA)						
	[/]		[]	ĺ	•]	[]	([D/		-	ETE)
* CIL RE	ren	TIO	N I	RAT	ION	λL	Ε:	(If	f ar	pl	ical				UATE UATE	[]	
REMARKS: FAILS CLA	OSE													~		-		-	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	4/14/87 MMU-1862X 4.3.1	•		ASA DATA: BASELINE NEW	[[X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 1862 MMU THERM	IOSTATS				
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI .			
ASSESSMENT:						
CRITICAL FLIGH HDW/FU	T	EDUNDANCY	SCREENS		CIL	ſ
NASA [2 /1R IOA [2 /1R) [F] [P]	X]] *
COMPARE [/] [] [N] [N]	[]
RECOMMENDATIONS:	(If dif	ferent from	om NASA)			
1] [) (] [[D/DE] CLETE
* CIL RETENTION :	RATIONALE:	(If appl	A	DEQUATE DEQUATE	[]

FAILS OPEN

ASSESSME	ENT DATE: ENT ID: EA #:	MMU-189				NASA D BASEL	ATA: INE [] NEW [X]
SUBSYSTE MDAC ID: ITEM:	!		LE AD	JUST			
LEAD ANA	LYST:	DUFFY,	ничин	, SAII	DI		
ASSESSME	ENT:						
	CRITICAL:		REDU	NDANCY	SCR	EENS	CIL ITEM
	HDW/FU		A	В		С	IIIM
NASA IOA	[1 /1 [3 /2R] [p]	[[P]	[] [P]	[X] * []
COMPARE	[N /N] [N]	[N]	[N]	[N]
RECOMMEN	NDATIONS:	(If d	iffer	ent fr	om N	ASA)	
	[3 /2R] [P]	[P]	[P]	[D] (ADD/DELETE)
* CIL RE	TENTION 1	RATIONAL	E: (I	f appl	icab		TE [] TE []
REMARKS: IF THE A SINCE IT	ARM JAMS	IN THE W SHORTEN	ORK P ED BE	OSITIO FORE I	N, T T IS	HE PILOT C PLACED IN	AN FLY BACK THAT POSITION.

ASSESSME	ENT DATE: ENT ID: EA #:	MMU-1892	C		NASA DATA BASELINE NEW	
SUBSYSTE MDAC ID:	:	MMU 1892 ARM ANGLE	: ADJUS	S T		
LEAD ANA	ALYST:	DUFFY, HU	YNH, S	AIIDI		
ASSESSME	ENT:					
	CRITICAL:		EDUNDA	NCY SCRE	ens	CIL ITEM
	HDW/FU	NC A		В	С	
NASA IOA	[2 /1R [3 /2R] [F)	[P] [P]	[] [P]	[X] * []
COMPARE	[N /N] []	[]	[N]	[N]
RECOMMEN	DATIONS:	(If dif	ferent	from NAS	SA)	
	[3 /2R] [F	']	[P]		[D] DD/DELETE)
		RATIONALE:	(If a	pplicable	e) ADEQUATE INADEQUATE	[]
	RM JAMS				E PILOT CAN : PLACED IN TH	

ASSESSMENT DATE: 3/19/87 ASSESSMENT ID: MMU-1893X NASA FMEA #: 2.1.3									-	BASELIN NE			
SUBSYSTI MDAC ID: ITEM:		MMU 1893 ARM	3 ANGLE	ADJ	TUST								
LEAD ANA	ALY	ST	:	DUF	FY, HUY	/NH,	SAII	DI					
ASSESSMI	ENT	:											
	CR		ICAL LIGH	ITY	RI	EDUN	IDANCY	SCR	EENS		CIL		
	1	-			A		В		C			••	
NASA IOA	[1 3	/1 /3]	[]	[]	[]	[]	*
COMPARE	[N	/N]	[]	[]	[]	[]	
RECOMME	NDA'	TI:	ons:	(:	If dif	fere	ent fr	om N	IASA)				
	[3	/3	3	[)	[]	[]	1] 1\dd A)		TE)
* CIL R	ETE:	NT	ION	RATI	ONALE:	(II	f appl	icak	F	ADEQUATI	E []	
REMARKS IF THE OPERATE	ARM	F E	AILS MMU	TO FROM	LOCK B	ACK ORK	TO FI	IGHT	POSI SINCI	TION, T	THE PI	LOT T B	CAN E

SHORTENED BEFORE IT IS PLACED IN THE WORK POSITION.

ASSESSMENT DATE: 3/19/87 ASSESSMENT ID: MMU-1894X NASA FMEA #: 2.1.4											1	NASA D BASEL		[]	
SUBSYSTI MDAC ID: ITEM:				MMU 1894 ARM A													
LEAD ANA	LY	ST	:	DUFFY	, I	HU	ζNΗ,	SA	II	DI							
ASSESSMI	ENT	:															
	CR		ICAL LIGH	ITY T		RI	EDUN	IDAN	CY	SCF	REENS				L PEM	ſ	
]	HD	W/FU	NC		A			В	в с						_	
NASA IOA	[2 3	/1R /3]	[P]]	P]	[[]		[x] *	k
COMPARE	C	N	/N]	[N]	[N]	ſ]		[N]	
RECOMMEN	IDA'	TI	ons:	(If	di	Ĺfí	ere	nt	fro	om N	IASA)						
	[3	/3]	[]	[]	[]	(AI		D 'DE] LEI	re)
* CIL RE		NT:	ION :	RATION	ALI	E:	(If	ap	pli	icab	1	ADEQUA' ADEQUA']	
REMARKS:		F	AILS	TO LO	CK	BA	CK	то	FL]	IGHT	POS	ITION,	THE	E F	ΊΙ	OT	CAI
OPERATE	TH	E 1	UMM:	FROM T	ΗE	WC	RK	POS	IT)	CON	SINC	THE'	ARM	MU	SI	' BE	2

SHORTENED BEFORE IT IS PLACED IN THE WORK POSITION.

ASSESSMENT DATE: 3/19/87 ASSESSMENT ID: MMU-1895X NASA FMEA #: 2.1.5										_	ASA DATA BASELINE NEW		-	
SUBSYSTEM: MMU MDAC ID: 1895 ITEM: ARM ANGLE ADJUST LEAD ANALYST: DUFFY, HUYNH, SAIIDI														
LEAD ANA	LYST	:	DUFFY,	H	UY	NH,	SA:	III	OI					
ASSESSME	NT:													
			ITY r		RE	EDUND	AN	CY	SCR	EENS		CIL		
FLIGHT HDW/FUNC A B C														
NASA IOA	[3	/2R /3]	[P]	[P]	[]	[[] *]	
COMPARE	[/N]	[N]	[N]	[]	[]	
RECOMMEN	DATI	ons:	(If	di	.f1	feren	t :	fro	om Na	ASA)				
	[3	/3	1	[]	[]	ſ		[DD/D] ELETE)
* CIL RE	TENT	ION I	RATIONA	LE	::	(If	apj	pli	lcab:	•		_		
											DEQUATE DEQUATE]	
REMARKS: IF THE A OPERATE SHORTENE	RM F THE	MMU I	FROM TH	ΙE	WC	ORK P	os:	IT	ON S	SINCE	THE ARM			ΑN

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1896X	.		NASA DATA: BASELINE NEW							
SUBSYSTEM: MDAC ID: ITEM:		: ADJUST									
LEAD ANALYST:	DUFFY, HU	YNH, SA	IDI								
ASSESSMENT:											
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM											
HDW/FU	NC A		В	С							
NASA [1 /1 IOA [3 /2R] [] [P] [F] [P]	[X] *						
COMPARE [N /N] [N] [и][N]	[]						
RECOMMENDATIONS:	(If dif	ferent f	from NASA	.)							
[3 /2R] [P) [F] [[] DD/DELETE)						
* CIL RETENTION I	RATIONALE:	(If app	•	ADEQUATE NADEQUATE							
REMARKS: THE FAILURE IS, 'ALSO SECURED WITH											

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1897X BASELINE []									
MDAC ID:	MMU 1897 ARM ANGLE	ADJUST								
LEAD ANALYST:	DUFFY, HUY	NH, SAII	DI							
ASSESSMENT:										
CRITICALI FLIGHT	TY RI	EDUNDANCY	SCREENS	CIL ITEM						
HDW/FUN	=	В	С	2221						
NASA [3 /2R IOA [3 /2R] [P] [P] [P] []] [P]	[] *						
COMPARE [/] [] [] [N]	[]						
RECOMMENDATIONS:	(If diff	ferent fr	om NASA)							
\]] [] [] []	[] (ADD/DELETE)						
* CIL RETENTION H	RATIONALE:	(If appl	ADEQ	UATE [] UATE []						
REMARKS: IF THE ARM JAMS I SINCE IT MUST BE	IN THE WORI	K POSITIO BEFORE I	N, THE PILOT T IS PLACED	CAN FLY BACK IN THAT POSITION.						

ASSESSMENT DA ASSESSMENT II NASA FMEA #:	ATE: 3/19/ D: MMU-1 2.1.1	/87 1898X 11		NASA DA BASELI N									
SUBSYSTEM: MDAC ID: ITEM:	MMU 1898 ARM A	ANGLE ADJ	UST										
LEAD ANALYST:	DUFF	, HUYNH,	SAIIDI										
ASSESSMENT:													
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM													
HDW	/FUNC	A	В	С									
NASA [3 IOA [3	/3] /2R]	[] [P]	[] [P]	[] [P]	[] *]							
COMPARE [/N]	[N]	[N]	[N]	[]							
RECOMMENDATIO	ons: (I	differe	nt from N	ASA)									
[3	/2R]	[P]	[P]		[(ADD/D] ELETE)							
* CIL RETENTI	ON RATION	NALE: (If	applicab	le) ADEQUAT INADEQUAT	•]							
	~												

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		ζ		BASELINE NEW	
MDAC ID:	MMU 1899 ARM ANGLE	E ADJUST	•		
LEAD ANALYST:	DUFFY, H	JYNH, SA	IIDI		
ASSESSMENT:					
CRITICAL FLIGH		REDUNDAN	CY SCRE	ENS	CIL ITEM
HDW/FU		A	В	С	
NASA [/ IOA [2 /1R] [1] [P]	[] [P]	[x] *
COMPARE [N /N] [1	4] [[N]	[N]	[и]
RECOMMENDATIONS:	(If di	fferent	from NA	SA)	
[2 /1R	.] []	P] [[P]	[P] (2	[A] ADD/DELETE)
* CIL RETENTION	RATIONALE	: (If ap	pplicabl	e) ADEQUATE INADEQUATE	[]
REMARKS: FAILS FROM WORK	TO LAUNCH	POSITIO	ON.		

ASSESSMENT ID: I					3/24/87 MMU-1981X 2.3.1							NASA DATA: BASELINE [] NEW [X]					
SUBSYSTE MDAC ID:				MMU 198 MMU		TE	RY :	LATC	HE:	s							
LEAD ANA	LY	ST	:	DUF	FY,	HU'	YNH	, SA	II	DI							
ASSESSME	ASSESSMENT:																
CRITICAL FLIGH HDW/FU				T						sc	REEN	s c		CIL ITEM			
			·						_			Ĭ					
NASA IOA	[1 3	/1 /2R]	[P]]	F]	[[P]	[X]	*
COMPARE	(N	/N]	[N]	[N]	[N]	ι]	
RECOMMEN	IDA'	TI	ons:	(If d	if	fer	ent	fro	o m	NASA)					
	(3	/2R]	ſ	P]	[F]	. [P	•	[(ADD,	/DI] ELI	ETE :
* CIL RE	TE	NT:	ION I	RATI	ONALI	Ξ:	(I 1	f ap	pl:	ica			DEQUATI]	

REMARKS:

ASSESSME ASSESSME NASA FME	ENT	ID:	MMU-2						ASA DA' BASELII N	-	x]		
SUBSYSTE MDAC ID: ITEM:			MMU 2111 FSS P	RESS	URE	GAUGE	s						
LEAD ANA	LYS'	T:	DUFFY	, HU	YNH,	SAII	DI						
ASSESSME	ENT:												
		TICAL FLIGH DW/FU	T	R: A		DANCY B		EENS C			CIL ITEM		
W1 G1		•				_	_	_	_	г	7		
NASA IOA	[3 /3]	[P]	[P]	[P	.]	[]		
COMPARE	[/]	[N]	[N	1	[N]	[]		
RECOMMEN	IDAT	ions:	(If	dif	fere	nt fr	om Na	ASA)					
	[/]	[]	[]	[[(ADD,] /DEL	ETE	
* CIL RI		TION	RATION	ALE:	(If	appl	icab	A	DEQUAT DEQUAT]		
REMARKS:	;												

ASSESSMENT ASSESSMENT NASA FMEA	r ID:	MMU-2		K			N	NASA DAS BASELII N					
SUBSYSTEM: MDAC ID: ITEM:		MMU 2141 FSS S	UPPI	LY VA	LVE								
LEAD ANALY	YST:	DUFFY	, н	JYNH,	SAI	IDI							
ASSESSMENT:													
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM													
	HDW/FC	INC	7	A]	В	C	:					
NASA IOA	[3 /2F [/NA	R]	[[]	[]	P]]]	[[] *			
COMPARE	[и /и]	[]	[]	v]	[]	[1			
RECOMMENDA	ATIONS:	(If	di	ffere	nt f	com 1	NASA)						
I	[/	1	[]	(]	[1	[(ADD/D] ELETE)			
* CIL RETI	ENTION	RATION	ALE	(If	app:	licak	Ä	DEQUATI]			
DEMARKS.							INA	DEQUATI	Ε []			
IOA RECOMMIS THE FSS	REMARKS: IOA RECOMMENDS DELETING THIS FAILURE MODE, SINCE THE ITEM STUDIED IS THE FSS SUPPLY VALVE AND THE FAILURE MODE IS FOR THE SUPPLY VALVE CIRCUIT BREAKER. THIS IS NOT CONSISTENT - IT ASSUMES A FAILURE IN ANOTHER SUBSYSTEM. MMU SUPPLY VALVE CB IS STUDIED												

UNDER ARPCS-230 TO BE 3/2R (P,P,P).

ASSESSMENT ASSESSMENT NASA FMEA	ID:												
SUBSYSTEM: MDAC ID: ITEM:		MMU 2142 FSS SUI	PPLY V	VALVE									
LEAD ANALY	ST:	DUFFY,	HUYNI	H, SAI	IDI								
ASSESSMENT	:												
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM													
		ic	A B										
NASA [IOA [3 /2R 3 /2R]	[P] [P]	[P] P]	[[P]	[] *]				
COMPARE [/]	[]	[]	[N]	[]				
RECOMMENDA	TIONS:	(If o	diffe	rent f	rom l	NASA)							
[/]	[]	C]	[] (A	[DD/DE					
* CIL RETE	NTION I	RATIONA	LE: (If app	lical	A	DEQUATE DEQUATE]				
REMARKS: IOA IS IN IS DONE DU				FMEA,	BUT	RECOGI	NIZES TH	AT RE	CHARGING				

ASSESSMENT DATE: ASSESSMENT ID: MMU-2143X NASA FMEA #: 1.13.3														DATA LINE NEW	[]	
SUBSYSTE MDAC ID: ITEM:				MMU 2143 FSS S	SUPI	PL:	Y VA	LVE										
LEAD ANA	LEAD ANALYST: DUFFY, HUYNH, S.																	
ASSESSME	NT	:																
	CR:		ICAL LIGH	ITY T		RI	EDUN	IDANC	Y	SCR	EEN:	S				IL PEN		
]		W/FU	_		A			В			С			1.	LEP	7	
NASA IOA	[3 2	/2R /2]	[P P]]	P P]	[P]		[x]	*
COMPARE	[N	/N]	[]	[]	[N]		[N]	
RECOMMEN	DA'	ric	ons:	(If	đ	if	fere	ent f	r	om N	IASA))						
	[2	/2]	[]	Į.]	[]		[DD/			ETE
* CIL RE	TEI	NT:	ION 1	RATION	IALE	Ξ:	(If	app	13	icab				ATE ATE	[]	
REMARKS:	rD1	F 1	.Fak	ACF OC	יריזיני	00	מענים	ጥ උአ	NT N	TOT					•	117	J 777	T T7T

EAKAGE OCCURS THAT CANNOT BE STOPPED BY THE VALVE ITSELF, THEN GN2 FROM ORBITER AND MMU WILL ESCAPE OUTSIDE. RECHARGE CAPABILITY WILL BE LOST FOR THAT MMU. ONLY ONE MMU REMAINING TO ACCOMPLISH THE MISSION, AND THAT IS REAL TIME CALL DEPENDENT UPON THE CIRCUMSTANCE.

ASSESSMENT DATE: ASSESSMENT ID: MMU-2144X NASA FMEA #: 1.13.4											DATA ELINE NEW	[]					
SUBSYST MDAC ID ITEM:				MM 21 FS		PI	PLY	. V.	ALV:	E									
LEAD AN	ALYS	ST	:	DU	FFY,	ŀ	IU Y	NH	, S	AI:	II	ΟI							
ASSESSM	ENT:	:																	
	CR		CAL LIGH				RI	EDU:	NDA:	NC.	Y	SCR	EENS			CI	L EM	ſ	
	1	HDV	/FU	NC			A]	В			С					
NASA IOA]	3 3	/3 /3]		[P]		[]	P]	[]		[]	*
COMPARE	C		/]		[N]		[]	N]	[]		[]	
RECOMME	NDA'	ric	ons:		(If	đ:	ifí	fer	ent	f	r	om N	ASA)						
	[/]		[]		[]	[]	(A	[DD/	/DE	-	ETE)
* CIL R		NT:	ION	RAT	IONA	\L l	E:	(I	fa	pp	1:	icab			JATE JATE	[]	
REMARKS IOA IS	-	AGI	REEM	ENT	WIT	Н	TI	ΗE	FME	A.									

ASSESSMEN' ASSESSMEN' NASA FMEA	MMU-218:	ıx	NASA DATA: BASELINE [] NEW [X]							
SUBSYSTEM MDAC ID: ITEM:		MMU 2181 FLEX HOS	SE							
LEAD ANAL	YST:	DUFFY, I	HUYNH,	SAIIDI						
ASSESSMEN	r:									
CI	RITICALI FLIGHT		REDUND	ANCY SCRE	ens	CIL ITEM				
	HDW/FUN	ic	A	В	С					
NASA IOA	[3 /2R [3 /2R] [P] P]	[P] [P]	[] [P]	[] *				
COMPARE	[/] []	[]	[N]	[]				
RECOMMEND	ATIONS:	(If di	fferen	t from NAS	SA)					
1	[/] []	[]		[] OD/DELETE)				
* CIL RET	ENTION R	RATIONALI	E: (If	applicable	e) ADEQUATE INADEQUATE	[]				
REMARKS: IOA IS IN UNDERSTOOM					THAT RECHAI					

NASA DATA:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-2391X		NASA DATA: BASELINE [] NEW [X]							
MDAC ID:	MMU 2391 FOOT RESTRA	INT								
LEAD ANALYST:	ST: DUFFY, HUYNH, SAIIDI									
ASSESSMENT:										
CRITICAL FLIGH		UNDANCY SCREEN	S	CIL ITEM						
HDW/FU		В	С							
NASA [1 /1 IOA [3 /2R] []]	[] [[P] [P]	[X] * []						
COMPARE [N /N] [N]	[и]	N]	[N]						
RECOMMENDATIONS:	(If diffe	erent from NASA	.)							
[3 /2R] [P]	[P] [P] (AI	[D] OD/DELETE)						
* CIL RETENTION	RATIONALE: (ADEQUATE NADEQUATE	[]						
REMARKS: CRITICALITY FOR UNTIL MODIFICATI	IOA IS PRELI ON TO THE RE	MINARY. FINAL	ANALYSIS							

ASSESSMENT DATE: ASSESSMENT ID: MMU-2392X NASA FMEA #: 2.2.3								ŀ		DATA ELINE NEW		x]		
SUBSYSTI MDAC ID ITEM:				MM 239 FS		RES	TRAINT							
LEAD AND	ALY	ST	:	DUI	FFY, HU	YNH	, SAII	DI						
ASSESSMI	ENT	:												
	CR		ICAI LIGH		R	EDU	NDANCY	SCF	REENS			CII	_	
	1	HDW/FUNC			A	A		В		С		111	bri	
NASA IOA	[[3 3	/3 /3]	[]	[]	[]		[]	*
COMPARE	[/	1	[]	[]	[]		[]	
RECOMMEN	IDA'	ric	ons:	. ((If dif	fer	ent fr	om N	IASA)					
	[/]	[]	[]	[]	(A)	[DD/I] DELF	ETE)
* CIL RE REMARKS: IOA IS I								icab	A		JATE JATE	[]	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/23/87 MMU-4000X	NASA DATA: BASELINE [] NEW [X]								
MDAC ID:	MMU 4000 ARM STRAP									
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI								
ASSESSMENT:										
CRITICALI FLIGHT HDW/FUN	ר	ANCY SCREE B	ens C	CIL ITEM						
NASA [/ IOA [3 /3] []] [P]	[] [P]	[] [P]	[] *						
COMPARE [N /N] [N]	[N]	[N]	[]						
RECOMMENDATIONS:	(If different	t from NAS	5A)							
[3 /3] []	[]	[] (Al	[] DD/DELETE)						
* CIL RETENTION I	RATIONALE: (If	applicable	ADEQUATE	[]						

REMARKS:

ASSESSMENT DATE: 3/23/87 ASSESSMENT ID: MMU-4001X NASA FMEA #: 5.1.1						ELINI		x]						
SUBSYSTE MDAC ID:				MMU 4001 ARM S	TRAP	s									
LEAD ANA	LY	ST	:	DUFFY	, HU	YNH,	SAII	DI							
ASSESSME	NT	:													
	CR:			ITY	R	EDUND	ANCY	SCRI	EENS				L		
	1		LIGH W/FU	NC	A		E	3	(С		17	PEN	1	
NASA IOA	[1	/1 /3]	[]	[]	[]		[X] *	k
COMPARE	[N	/N	1	[]	[]	[]		[N]	
RECOMMEN	DA!	ri	ons:	(If	dif	feren	t fr	om N	ASA)						
	[3	/3]	[]	[]	(]	(2	_	D DE] ELEI	TE)
* CIL RE	TEI	NT:	ION	RATION	ALE:	(If	appl	icab				_		_	
7511 PT-										ADEQU ADEQU		[]	
REMARKS: TWO LATC PROJECTI							то	FAIL	FOR	THE	ARM	то	BE	COM	ME A

ASSESSME ASSESSME NASA FME	ENT	I	D:	MMU-46 5.2.1	002	2 X							ASA D BASEI	INE]
SUBSYSTE MDAC ID:				MMU 4002 MMU B	ATT	ГEІ	RY R	ЕСН	AR	GE	CABL	E				
LEAD ANA	LY:	ST	:	DUFFY	, I	HUY	(NH,	SA	II	DI						
ASSESSME	ENT	:														
		F	ICAL: LIGH!			RI A	EDUN	DAN	CY B		REEN	s c			CIL	
	•		.,			••			_							
NASA IOA	_		/1 /2R		[P]]]	P]]	P]		(X] *
COMPARE	[N	/N]	[N]	[N]	[N]		[N	3
RECOMMEN	IDA'	ΓI	ons:	(If	d :	if	fere	nt	fr	om	NASA)				
	[3	/2R]	[P]	[P)	[P]	(AI	[D] ELETE)
* CIL RI		NT:	ION 1	RATION	ΑL	E:	(If	ap	pl	ica	•		DEQU <i>I</i> DEQU <i>I</i>		_]
THE FMEA	C							Y C	F	BAT	TERY	E	XPLOS	SION	FOR	WHICH

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	MMU-4003X 5.2.1		NASA DATA: BASELINE [] NEW [X]							
SUBSYSTEM: MDAC ID: ITEM:	MMU 4003 MMU BATTE	RY RECHAR	GE CABLE							
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI							
ASSESSMENT:										
CRITICA FLIG	LITY R HT	EDUNDANCY	SCREENS		CIL ITEM					
HDW/F	UNC A	В	(
NASA [1 /1 IOA [3 /2	R] [P] [] [P] [1	·]	[X] *					
COMPARE [N /N] [и] [N] [1	1]	[N]					
RECOMMENDATIONS	: (If dif	ferent fr	om NASA)							
[3 /2	R] [P] [P] []	-	[D] DD/DELETE					
* CIL RETENTION	RATIONALE:	(If appl	1	ADEQUATE ADEQUATE	[]					
REMARKS: SEE MMU-4002 RE	MARKS.									

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			BASELINE NEW	[] [X]
	MMU 4004 TRUNNION PIN AT	TACHMENT DI	EVICE	
LEAD ANALYST:	DUFFY, HUYNH, S	AIIDI		
ASSESSMENT:				
CRITICALI FLIGHT HDW/FU		NCY SCREENS	s C	CIL ITEM
•		r 1 (1	[X] *
IOA [3 /2R] []] [P]	[4]	Pj	[X] * []
COMPARE [N /N] [N]	[и][N]	[N]
RECOMMENDATIONS:	(If different	from NASA)	
[3 /2R] [P]	[P] [P] (AI	[D] DD/DELETE)
* CIL RETENTION 1	RATIONALE: (If a		ADEQUATE NADEQUATE	[]
REMARKS: THE FMEA ASSUMES RESCUE (LIFE SAVI CONTINGENCY SCEN	ING) OPERATION.	THIS ALRE	ADY ASSUMES	EDED FOR

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4005X 5.5.1		NASA DATA: BASELINE [] NEW [X]					
MDAC ID:	MMU 4005 BATTERY TRANSF	ER BAG						
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI						
ASSESSMENT:								
CRITICALI FLIGHT		ANCY SCREI	ens	CIL				
	IC A	В	С	ITEM				
NASA [2 /2 IOA [3 /2R] [P]] [P]	[P] [F]	[] [P]	[X] *				
COMPARE [N /N] []	[и]	[N]	[N]				
RECOMMENDATIONS:	(If differen	t from NAS	5 A)					
[3 /2R] [P]	[P]		[D] DD/DELETE)				
* CIL RETENTION F	RATIONALE: (If	applicable	e) ADEQUATE INADEQUATE					
REMARKS: ADDITIONAL BATTER A TETHER ATTACHED	RIES EXIST TO R	EPLACE THE	E LOST ONE, A					

ASSESSMEN ASSESSMEN NASA FME	NT ID:	MMU-4006 5.6.1	x				DATA: ELINE NEW	
SUBSYSTEM MDAC ID:		MMU 4006 BATTERY	TETHER	STR	ΑP			
LEAD ANA	LYST:	DUFFY, H	UYNH, S	AIL)I			
ASSESSME	NT:							
·	CRITICAL: FLIGH	[TY	REDUNDA	NCY	SCREE	ns		CIL ITEM
		1C	A	В		С		110
NASA IOA	[2 /2 [3 /2R] [P] P]	[P]	[] [P]		[X] * []
COMPARE	[N /N] []	[]	[N]		[и]
RECOMMEN	DATIONS:	(If di	.fferent	fr	om NAS	SA)		
	[3 /2R] [P]	[P]	[P]	(AI	[D] DD/DELETE)
	TENTION 1	RATIONALE	: (If a	ppl	icable		QUATE QUATE	[]
REMARKS: IOA CONSTHE FAIL	IDERED B	ACK-UP BA R CAN BE	TTERIES	TO ED W	REPLA ITH AN	CE THE	LOST	ONE. ALSO OTHER MMU).

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4007X 5.7.1		NASA DATA BASELINE NEW	[]
SUBSYSTEM: MDAC ID: ITEM:	MMU 4007 CONTINGENCY T	OOL		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI		
ASSESSMENT:				
CRITICAL: FLIGH		DANCY SCREEN	s	CIL ITEM
HDW/FU	NC A	В	С	
NASA [2 /2 IOA [2 /2] []]]	[] [[P]	P]	[X] * [X]
COMPARE [/] [N]	[и]	N]	[]
RECOMMENDATIONS:	(If differe	nt from NASA)	
[/] []	[] [[] DD/DELETE
* CIL RETENTION I REMARKS: IOA IS IN AGREEMI		I	ADEQUATE NADEQUATE	[]

ASSESSME	ASSESSMENT DATE: ASSESSMENT ID: MMU-4008X WASA FMEA #: 5.7.2											DATA ELINE NEW)]				
SUBSYSTE MDAC ID: ITEM:	M:			MM 40 CO		IGI	ENC	CY '	TOOL										
LEAD ANA	LYS	ST:	:	DU	FFY,	I	:UI	NH	, SA	III	DI								
ASSESSME	NT:	;																	
	CRI		ICAL LIGH		•		RI	EDU:	NDAN	ICY	SCI	REENS	S			CI	L		
	F		/FU	-			A			В			С						
NASA IOA	[3 3	/2R /2R]		[P P]	[]	P]	[P]]]	*
COMPARE	[/]		[]	(]	[N]		[]	
RECOMMEN	'DA'	ric	ons:		(If	d:	if:	fer	ent	fr	om 1	NASA)						
	נ		/]		[]	(•]	[]	(1	[ADD/	/DE		TE)
* CIL RE											ical				UATE UATE]	
TOW TO T	'TA 5	701	CCCM	T-114 T	. WI.	. 11	T 1	ندد	LITTE										

ASSESSM	ASSESSMENT DATE: ASSESSMENT ID: MMU-4009X VASA FMEA #: 5.8.1									ASA DA BASEL:	INE] K]				
SUBSYSTI MDAC ID ITEM:				MMU 4009 5/16"	T	HI:	N WA	LL	so	CKET	r						
LEAD AND	ALY:	ST	:	DUFFY	, 1	HU	YNH,	S	\II	DI							
ASSESSMI	ENT	:															
	CR:		ICAL: LIGH:	ITY I		R	EDUN	IDAN	icy	SCI	REENS	3			CII		
	I	HD	/FUI	NC		A			В			С					
NASA IOA	[[3 3	/2R /2R]	[P P]	[P]	[P]		[]	*
COMPARE	[/]	[]	(•]	[N]		[]	
RECOMMEN	IDAT	ric	ons:	(If	d :	if:	fere	nt	fr	om N	IASA)						
•	[/]	[]	[•]	[]	(Al	[DD/E] ELE:	ΓE)
* CIL RE	ETEI	T	ON I	RATION	ALI	€:	(If	ap	pl:	icab	•		EQUAT		[r]	
REMARKS:		AGF	REEME	ENT WI	TH	TI	ie f	MEA	١.						L	1	

ASSESSME	SSESSMENT DATE: SSESSMENT ID: MMU-4010X ASA FMEA #: 5.8.2										DAT ELIN NE	ΙE	_	x]					
SUBSYSTE MDAC ID:				MM 40:	10	TI	HI	ı WA	LL :	soc	CKET	r								
LEAD ANA	LYS	ST	:	DU:	FFY,	·	ĮU.	ZNH,	SA	III	ΟI									
ASSESSME	ENT	:																		
	CR		ICAL:				RI	EDUN	ID AN	CY	SCI	REENS	5				CI IT	L EM		
	I		W/FUI				A			В			С							
NASA IOA	[[3	/2R /2R]		[P P]	[[P P]	[[P]			[] *	r
COMPARE	[/]		[3	[]	(N]			[]	
RECOMMEN	IDA:	ric	ons:		(If	d:	ifi	fere	ent	fr	om 1	NASA)							
	[/]		[]	C]	(]	(AL	[)D/	DE:] LEI	ľE)
* CIL RE		NT:	ION 1	RAT:	IONA	LI	Ξ:	(If	ap	pl:	ical	•			UATE UATE		[]	
REMARKS:		AG	REEMI	ENT	WIT	CH.	TH	HE F	MEA											

ASSESSMI NASA FMI	·							1	VASA DA BASELI N		x]
LEAD ANA	ALYS	ST:	DUFF	Y, HU	YNH,	SAII	DI				
ASSESSMI	ENT:	•									
		TICAL FLIGH	T	R A		IDANCY				CI	IL TEM
		HDW/FU		A		В		C	i		
NASA IOA	[3 /3 3 /3]	[]	[]	[]	[] *
COMPARE	[/]	[]	[]	[]	[1
RECOMMEN	radı	CIONS:	(I	f dif	fere	nt fr	om N	IASA)			
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* CIL RE		TION	RATIO	NALE:	(If	appl	icab	P	DEQUAT]

IOA IS IN AGREEMENT WITH THE FMEA.

ASSESSM ASSESSM NASA FM	IENT	II	D:		MU-4012X .10.1					NASA DATA: BASELINE [] NEW [X]						
SUBSYST MDAC II ITEM:				MMU 401 THE	L2	'EI	۹ د	UE	LIGHT	EXT	render					
LEAD AN	IALY	ST	:	DUI	FFY,	F	{UI	MN	, SAII	DI						
ASSESSI	ŒNT	:														
	CR		ICAL LIGH	TTY.			RI	E DU I	NDANCY	SCI	REENS			CI IT	L EM	
]	HDI	W/FU	NC			A		В		С					
NASA IOA	A [3 3	/3 /3]		[P]]]	[]		[]	*
COMPARE	E [/]		[N]	[]	[]		[]	
RECOMMI	ENDA'	TI	ons:		(If	d :	if	fer	ent fr	om 1	NASA)					
	[/]		[]	[]	[]	(A	[DD/	DEI	ETE)
* CIL I		NT:	ION	RAT:	IONA	L	E:	(I	f appl	ical	A		JATE JATE]	
REMARKS IOA IS		AG:	REEM	ENT	WIT	ľН	TI	ΗE	FMEA.							

ASSESSMENT I ASSESSMENT I NASA FMEA #:	D: M	MU-4013X .11.1			N	IASA DA BASELI N] K]
SUBSYSTEM: MDAC ID: ITEM:		MU 013 AMERA BR	ACKET					
LEAD ANALYST	: DU	JFFY, HU	YNH, SAI	IDI				
ASSESSMENT:								
	CICALITY FLIGHT	r R	EDUNDANC	Y SCR	EENS		CII	
HE	W/FUNC	A		В	C	:		
NASA [3 IOA [3	3 /3]] [] []	[]	[[] *
COMPARE [/]	[] [)	[]	[]
RECOMMENDATI	ONS:	(If dif:	ferent f	rom N	ASA)			
[/]	Γ] []	[]	[(ADD/I] DELETE
* CIL RETENT REMARKS: IOA IS IN AG				licab	A	DEQUAT:	•]

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-401	4 X		NASA DAT BASELIN NE	
	MMU 4014 SUNSHIE	LD			
LEAD ANALYST:	DUFFY,	HUYNH, S	AIIDI		
ASSESSMENT:					
CRITICAL FLIGH		REDUNDA	NCY SCRE	ENS	CIL ITEM
	NC	A	В	С	11111
NASA [2 /1R IOA [/NA	[]	P]	[P] []	[]	[X] * []
COMPARE [N /N] [и ј	[N]	[]	[N]
RECOMMENDATIONS:	(If d	ifferent	from NA	SA)	
[/] [1	[]	() ([] ADD/DELETE)
* CIL RETENTION	RATIONAL	E: (If a	pplicabl		
				ADEQUATE INADEQUATE	[]
REMARKS: THIS FAILURE MODE COMPONENT IS CON AND THEREFORE NO REALISTIC, 3) THE VIBRATION AND SH AND THE FSS ISOL	SIDERED T CONSID ONLY PO OCK. HO	IN THE S ERED, 2) SSIBILIT WEVER TH	SAME FASH THE CAUS TY FOR FA	ION AS THE E OF FAILUR ILURE MAY B	ORBITER SKIN, E IS NOT E THROUGH

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4015X 4.2.2			NASA DATA BASELINE NEW	-
	MMU 4015 HEATERS				
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI		
ASSESSMENT:					
CRITICAL: FLIGH		EDUNDANCY	SCREENS	3	CIL
HDW/FU		В		С	ITEM
NASA [2/2 IOA [/NA] [P] []	[X] *
COMPARE [N /N] [N] [N] []	[N]
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)		
] [] [] [[] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl	icable)	ADEQUATE	r 1
REMARKS:			IN	ADEQUATE	į
IOA RECOMMENDS DI CREDIBLE.	ELETING TH	IS FAILUR	E MODE S	SINCE IT I	S NOT

APPENDIX D

CRITICAL ITEMS

APPENDIX D POTENTIAL CRITICAL ITEMS

NASA FMEA	MDAC-ID		FAILURE MODE
1.1.2	100	GN2 TANK	LEAK
1.5.3	102	GN2 TANK TOGGLE VALVE	FAIL OPEN
1.5.2	103	TOGGLE VALVE	FAIL CLOSED
1.4.1	104	ISOLATION VALVE	FAIL OPEN
1.4.2	105	ISOLATION VALVE	FAIL CLOSE
1.7.3	106	GN2 LINES (ISOL VLV - REG	LEAK
1.7.4	106	GN2 LINES (REG-THRUSTERS)	LEAK
1.7.1	106	GN2 LINES (XFEED VLV - XF	LEAK
1.7.2	106	GN2 LINES (TANK-ISOL VLV)	LEAK
	110	THRUSTER MANIFOLD	LEAK
	111	THRUSTER MANIFOLD	CONSTRICTION
1.6.2	112	THRUSTER	FAIL OPEN
1.6.4	113	THRUSTER	FAIL CLOSED
1.6.3	114	THRUSTER	LEAK
1.2.4	116	GN2 REGULATOR	FAIL CLOSED
1.2.3	117	GN2 REGULATOR	FAIL OPEN
1.2.6	119	GN2 REGULATOR	FAIL LOW
1.2.2	120	GN2 RELIEF VALVE	FAIL OPEN
	121	GN2 RELIEF VALVE	FAIL CLOSED
1.8.1	122	PRESSURE GAGE	LEAK
	127	GN2 TEST PORT	LEAK
3.11.1	128	BATTERY	NO OUTPUT-LOW OUTPUT
	129	INT/EXT POWER SWITCH	FAIL OPEN
3.14.3	130	TOGGLE VALVE TOGGLE VALVE ISOLATION VALVE ISOLATION VALVE GN2 LINES (ISOL VLV - REG GN2 LINES (REG-THRUSTERS) GN2 LINES (XFEED VLV - XF GN2 LINES (TANK-ISOL VLV) THRUSTER MANIFOLD THRUSTER MANIFOLD THRUSTER THRUSTER GN2 REGULATOR GN2 REGULATOR GN2 REGULATOR GN2 REGULATOR GN2 RELIEF VALVE GN2 RELIEF VALVE PRESSURE GAGE GN2 TEST PORT BATTERY INT/EXT POWER SWITCH INT/EXT POWER SWITCH	FAIL TO INTERNAL POSITION
3.14.4	130	INI/EXI POWER SWITCH	FAIL TO INTERNAL POSITION
3.14.1	131	INT/EXT POWER SWITCH	FAIL TO EXTERNAL
	• • • •		POSITION
	132	TERMINAL BOARD	SHORT
	133	TERMINAL BOARD	FAIL OPEN
3.13.1	134	TERMINAL BOARD TERMINAL BOARD MAIN POWER SWITCH MAIN POWER SWITCH MAIN POWER SWITCH LTS/HTP.cb	FAIL OFF
3.13.2	134	MAIN POWER SWITCH	FAIL OFF
3.13.4	135	MAIN POWER SWITCH	FAIL ON
3.3.1	130	DID/ HIK.CD	TAIL OPEN
3.8.1	138	CEA CIRCUIT BREAKER	FAIL OPEN
3.7.1	142	VDA cb	FAIL OPEN
3.12.5	152	CEA POWER SWITCH	FAIL ON IN ISO.
3.12.6	152	CEA POWER SWITCH	FAIL ON IN ISO.
3.12.1	154	CEA POWER SWITCH	FAIL OFF
3.12.2	154	CEA POWER SWITCH	FAIL OFF
2 2 1	158 150	CEA	FAIL ON 1-12 CH.
3.3.1 3.3.3	159 160	CEA CEA	FAIL OFF 1-12 CH. NOISY OUTPUT

NASA FMEA	MDAC-ID	ITEM	FAILURE MODE
3.3.3	161	CEA	LOGIC FAILURE
	162	ISOLATION VALVE TIMER ISOLATION VALVE TIMER	FAIL OFF
	163	ISOLATION VALVE TIMER	TOO SHORT
	164	ISOLATION VALVE TIMER	FAILS ON
3.3.2	166	VALVE DRIVER AMPLIFIER VALVE DRIVER AMPLIFIER	FAIL OFF
	167	VALVE DRIVER AMPLIFIER	FAIL ON
3.2.1	169	THC	FAIL ON 1-3 AXES
3.2.2	169	THC	FAIL ON 1-3 AXES
3.1.1	171	THC THC RHC RHC THC ISOLATE SWITCH	FAIL ON (1-3 AXES)
3.1.2	171	RHC	FAIL ON (1-3 AXES)
3.2.7	173	THC ISOLATE SWITCH	FAIL ON
3.2.9	174	THC ISOLATE SWITCH	FAIL OFF
3.2.10	174	THC ISOLATE SWITCH	FAIL OFF
3.3.1	182	CEA PWR SPLY	FAIL HIGH OR LOW
3.4.1	183	WIRE HARNESS	SHORT OR OPEN CIRCUIT
3.5.1	184	EXTERNAL POWER CONNECTOR	FAIL OPEN
4.1.1	185	HEATERS	FAIL OFF
4.2.1	185	HEATERS	FAIL OFF
2.1.9	190	ARM LENGTH ADJUST	FAIL UNLATCHED
	191	ARM LENGTH ADJUST	FAIL LATCHED SHORT
2.1.7	192	ARM LENGTH ADJUST	FAIL LATCHED LONG
2.1.8	192	ARM LENGTH ADJUST	FAIL LATCHED LONG
3.6.1	194	EXTERNAL POWER CONNECTOR	FAIL CONNECTED
3.6.2	195	EXTERNAL POWER CONNECTOR	FAIL DISCONNECTED
2.5.1	196	THC ISOLATE SWITCH THC ISOLATE SWITCH THC ISOLATE SWITCH CEA PWR SPLY WIRE HARNESS EXTERNAL POWER CONNECTOR HEATERS HEATERS ARM LENGTH ADJUST ARM LENGTH ADJUST ARM LENGTH ADJUST ARM LENGTH ADJUST EXTERNAL POWER CONNECTOR EXTERNAL POWER CONNECTOR PLSS LATCHES PLSS LATCHES MMU BATTERY LATCHES BACKUP ARM LATCH	FAIL OPEN
2.5.3	196	PLSS LATCHES	FAIL OPEN
2.3.2	199	MMU BATTERY LATCHES	FAIL LATCHED
	200	BACKUP ARM LATCH BACKUP ARM LATCH BATTERY THERMAL COVER	FAIL LATCHED
	201	BACKUP ARM LATCH	FAIL UNLATCHED
4.6.1	203	BATTERY THERMAL COVER	FAIL OPEN
5.4.1	206	BACKUP PLSS LATCHES (LAP BACKUP PLSS LATCHES	FAIL OPEN
	207	BACKUP PLSS LATCHES	FAIL CLOSED
2.6.1	220	GAS ACTUATED NUTS (4)	FAIL CLOSED
_		FILTER	FRACTURE
4.2.1	224	HEATER FOR FSS RECHARGE S	FAIL OPEN
4.4.2	228	HEATER THERMOSTATS	FAIL OPEN
4.4.1	229	HEATER THERMOSTATS	FAIL CLOSED
1.1.1	1001	GN2 TANK	RUPTURE
1.5.1	1031	TOGGLE VALVES	EXTERNAL LEAKAGE
1.4.3	1051	ISOLATION VALVE	EXTERNAL LEAKAGE
1.6.1	1141	THRUSTER TRIAD	SHORT IN SOLENOID
3.2.6	1704	THC	FAILS OFF
1.2.6	1191	REGULATOR	OUT OF TOLERANCE
1.2.1	1211	GN2 REGULATOR	PISTON JAMMED
1.2.5	1212	GN2 REGULATOR	EXTERNAL LEAKAGE
3.1.6	1724	RHC	FAIL OFF THREE AXES
3.2.8	1731	THC	MECHANICALLY JAMS
4.3.2	1861	CEA THERMOSTATS (2 SETS)	FAILED CLOSED

NASA FMEA	MDAC-ID	ITEM	FAILURE MODE
4.3.1	1862	MMU THERMOSTATS	FAILS OFF
2.1.6	1896	ARM ANGLE ADJUST	INADVERTENTLY UNLOCKS
	1899	ARM ANGLE ADJUST	FAILS FROM WORK
2.3.1	1981	MMU BATTERY LATCHES	LATCH FAILS OPEN
1.13.3	2143	FSS SUPPLY VALVE	EXTERNAL LEAKAGE
5.7.1	4007	CONTINGENCY TOOL	FAILS TO RELEASE FLEX

APPENDIX E DETAILED ANALYSIS

This appendix contains the IOA analysis worksheets supplementing previous results reported in STSEOS Working Paper 1.0-WP-VA86001-09, Analysis of the Manned Maneuvering Unit, (21 November 1986). Prior results were obtained independently and documented before starting the FMEA/CIL assessment activity. Supplemental analysis was performed to address failure modes not previously considered by the IOA. Each sheet identifies the hardware item being analyzed, parent assembly and function performed. For each failure mode possible causes are identified, and hardware and functional criticality for each mission phase are determined as described in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986. Failure mode effects are described at the bottom of each sheet and worst case criticality is identified at the top.

LEGEND FOR IOA ANALYSIS WORKSHEETS

Hardware Criticalities:

- 1 = Loss of life or vehicle
- 2 = Loss of mission or next failure of any redundant item
 (like or unlike) could cause loss of life/vehicle
- 3 = All others

Functional Criticalities:

- 1R = Redundant hardware items (like or unlike) all of which,
 if failed, could cause loss of life or vehicle.
- 2R = Redundant hardware items (like or unlike) all of which,
 if failed, could cause loss of mission.

Redundancy Screen A:

- 1 = Is Checked Out PreFlight
- 2 = Is Capable of Check Out Preflight
- 3 = Not Capable of Check Out PreFlight
- NA = Not Applicable

Redundancy Screens B and C:

- P = Passed Screen
- F = Failed Screen
- NA = Not Applicable

DATE: HIGHEST CRITICALITY HDW/FUNC SUBSYSTEM: MMU MDAC ID: 1001 FLIGHT: 1/1 ITEM: GN2 TANK FAILURE MODE: RUPTURE LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI BREAKDOWN HIERARCHY: 1) MMU 2) PROPULSION SYSTEM 3) 4) 5) 6) 7) 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 1/1 OPS: 1/1 POST-OPS: 1/1

REDUNDANCY SCREENS: A [] B [] C []

LOCATION: PART NUMBER:

CAUSES: FATIGUE, MATERIAL FAILURE

EFFECTS/RATIONALE:

POSSIBLE LOSS OF CREW/VEHICLE FROM SHARPNEL AND/OR IMPULSIVE

DELTA V.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1031 FLIGHT: 2/1R

ITEM: TOGGLE VALVES FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) PROPULSION SYSTEM
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 2/2 OPS: 2/1R

POST-OPS: 2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: SIDE A OR B

PART NUMBER:

CAUSES: SEAL (O-RING) FAILURE, SEAT GALLED

EFFECTS/RATIONALE:

LOSS OF GN2 ON THE SIDE WITH LEAK. POSSIBLE LOSS OF CREWPERSON BY STRANDING IF OTHER SIDE ALSO FAILS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1051 FLIGHT: 2/1R

ITEM: ISOLATION VALVE FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) PROPULSION SYSTEM
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 2/2 OPS: 2/1R

POST-OPS: 2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: SIDE A OR B

PART NUMBER:

CAUSES: SEAL (O-RING) FAILURE/DAMAGE, SEAT GALLED

EFFECTS/RATIONALE:

LOSS OF GN2 FROM THE SIDE WITH LEAKING VALVE. POSSIBLE LOSS OF CREWMEMBER BY STRANDING IF OTHER GN2 SIDE FAILS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1141 FLIGHT: 2/1R

ITEM: THRUSTER TRIAD FAILURE MODE: SHORT IN SOLENOID

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) PROPULSION SYSTEM
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 2/2
OPS: 2/1R
POST-OPS: 2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: SIDE A OR B

PART NUMBER:

CAUSES: CONTAMINATION, CHAFFING FROM VIBRATION, INSULATION

FAILURE

EFFECTS/RATIONALE:

LOSS OF SIDE DUE TO CIRCUIT BREAKER TRIPPING OR EXCESSIVE BATTERY DRAIN. POSSIBLE STRANDING OF THE CREW PERSON IF OTHER SIDE ALSO FAILS DURING EVA OPS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU MDAC ID: 1191

FLIGHT: 2/1R

ITEM:

REGULATOR

FAILURE MODE: OUT OF TOLERANCE (HIGH)

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) PROPULSION SUBSYSTEM
- 3) A OR B SIDE
- 4) REGULATOR
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

2/2

OPS:

2/1R

POST-OPS:

2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

A OR B SIDE

PART NUMBER:

CAUSES: CONTAMINATION, SPRING FAILURE, INCORRECT CALIBRATION

EFFECTS/RATIONALE:

IF DOWNSTREAM PRESSURE SUFFICIENTLY HIGH, RELIEF VALVE OPENS, LOSS OF SIDE RESULTS. AT PRESSURES BELOW RELIEF OPENING, NO SIGNIFICANT IMPACT. LOSS OF BOTH SIDES STRANDS CREWMEMBER.

HIGHEST CRITICALITY HDW/FUNC DATE:

SUBSYSTEM: MMU

2/1R FLIGHT: MDAC ID: 1211

ITEM:

GN2 REGULATOR FAILURE MODE: PISTON JAMMED

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- PROPULSION SYSTEM 2)
- 3)
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC 3/3 PRE-OPS:

2/1R OPS: POST-OPS: 3/3

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: PART NUMBER:

CAUSES: CONTAMINATION, CORROSION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

A POSIBILITY EXISTS TO HAVE THE PISTON JAMMED IN SUCH A MANNER WHICH MAY FAIL THE REGULATOR IN OPEN AND THE VENT PORT IN CLOSED POSITION. IN THIS CASE, THE HIGH PRESSURE DOWNSTREAM MAY DAMAGE THE THRUSTERS MANIFOLD AND LOOSE ATTITUDE CONTROL. THE AFFECTED SIDE MUST BE ISOLATED THROUGH ISOLATION VALVE, CANCEL MMU ACTIVITY AND RETURN TO ORBITER.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1212 FLIGHT: 2/1R

ITEM: GN2 REGULATOR FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 2/2 OPS: 2/1R

POST-OPS: 2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

SIDE A OR B LOCATION:

PART NUMBER:

CAUSES:

EFFECTS/RATIONALE:

LOSS OF SIDE REQUIRING IT BE ISOLATED. POSSIBLE LOSS OF

CREWPERSON STRANDING IF OTHER SIDE FAILS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1251 FLIGHT: 3/2R

ITEM: QUICK DISCONNECT

FAILURE MODE: PREMATURE OPERATION

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) PROPULSION
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/3
OPS: /NA
POST-OPS: 3/2R

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:
PART NUMBER:

CAUSES: SHOCK, VIBRATION, PART FAILURE

EFFECTS/RATIONALE:

THE QD COMING OFF PREMATURELY DURING RECHARGE POSES NO IMMEDIATE PROBLEM SINCE IT HAS SELF-SEALING CAPABILITY. NO RECHARGE CAPABILITY AT WORST CASE WILL CANCEL MMU ACTIVITY THUS LOSS OF MISSION.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1252 FLIGHT: 3/2R

ITEM: QUICK DISCONNECT FAILURE MODE: INABILITY TO MATE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) PROPULSION
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: /NA OPS: /NA

POST-OPS: 3/2R

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: PART NUMBER:

CAUSES: CORROSION, CONTAMINATION, PIECE PART FAILURE

EFFECTS/RATIONALE:

LOSS OF RECHARGE CAPABILITY FROM ONE PORT. TOTAL LOSS OF RECHARGE CAPABILITY WILL CANCEL SUBSEQUENT MMU ACTIVITY THUS MISSION LOSS WITH MULTIPLE MMU OPS.

HIGHEST CRITICALITY HDW/FUNC DATE:

SUBSYSTEM: MMU

3/2R FLIGHT: MDAC ID: 1253

QUICK DISCONNECT ITEM: FAILURE MODE: INABILITY TO DEMATE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) PROPULSION
- 3)
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/3 /NA

OPS: POST-OPS:

3/2R

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: CORROSION, CONTAMINATION, PIECE PART FAILURE

EFFECTS/RATIONALE:

THE HOSE MUST BE CUT BY EMERGENCY TOOL TO REMOVE FLEX HOSE FROM QD. THIS WILL HOWEVER NEGATE RECHARGE CAPABILITY FOR SUBSEQUENT MMU OPS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1281 FLIGHT: 3/2R

ITEM: BATTERY

FAILURE MODE: INABILITY TO MATE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/2R OPS: /NA

POST-OPS: 3/2R

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: MECHANICAL (PIN BENT), CORROSION/CONTAMINATION

EFFECTS/RATIONALE:

THE AFFECTED BATTERY NEEDS TO BE CHANGED WITH A GOOD ONE FROM ORBITER AND RESUME MMU ACTIVITIES. IF NO BATTERY EXISTS, THEN MMU ACTIVITY CANNOT BE ACCOMPLISHED - MISSION LOSS.

HIGHEST CRITICALITY HDW/FUNC DATE:

SUBSYSTEM: MMU

FLIGHT: 3/2R MDAC ID: 1681

GYRO POWER SUPPLY ITEM: FAILURE MODE: UNCOMMANDED OUTPUT

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- ELECTRICAL SUBSYSTEM 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

3/3 PRE-OPS: 3/2R OPS: POST-OPS: 3/3

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: PART NUMBER:

CAUSES: SHORT

EFFECTS/RATIONALE:

UNCOMMANDED RATES PROVIDED TO MMU PROPULSION. REQUIRES REMOVAL OF POWER TO POWER SUPPLY AND LOSS OF AAH. SOME MISSION (LIKE SOLAR MAX) MAY REQUIRE AAH AND ALT CONTROL SWITCH TO SUCCESSFULLY ACCOMPLISH THE MISSION GOAL. LOSS OF AUTO CONTROL, WILL LEAVE MANUAL ATTITUDE CONTROL THROUGH RHC.

DATE: 3/13/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1701 FLIGHT: 3/1R

ITEM: TRANSLATIONAL HAND CONTROLLER

FAILURE MODE: FAILS OFF ELECTRICALLY IN ONE AXIS (+, -, OR + AND

-)

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) THC SYSTEM
- 3)
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 2/2 OPS: 3/1R

POST-OPS: 2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: PART NUMBER:

CAUSES: LOOSE MAGNET/CONNECTOR, MECHANICAL JAMMING, CONTAMINATION, PIECE PART FAILURE

EFFECTS/RATIONALE:

CANNOT TRANSLATE IN ONE AXIS, IN ONE DIRECTION OR BOTH. THE PILOT CAN ROTATE AND TRANSLATE ON OTHER AXES. LOSS OF ALL FUNCTIONS WILL LEAVE THE PILOT STRANDED.

DATE:

3/13/87

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

1702 MDAC ID:

FLIGHT:

3/1R

ITEM:

TRANSLATIONAL HAND CONTROLLER

FAILURE MODE: FAILS OFF MECHANICALLY IN ONE AXIS (+, -, OR + AND

-)

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) THC SYSTEM
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

2/2

OPS:

3/1R

POST-OPS:

2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: LOSSE MAGNET/CONNECTOR, MECHANICAL JAMMING,

CONTAMINATION, PIECE PART FAILURE

EFFECTS/RATIONALE:

CANNOT TRANSLATE IN ONE AXIS, IN ONE DIRECTION OR BOTH. THE PILOT CAN ROTATE AND TRANSLATE ON OTHER AXES. LOSS OF ALL FUNCTIONS WILL LEAVE THE PILOT STRANDED.

DATE: 3/13/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1703 FLIGHT: 3/1R

ITEM: TRANSLATIONAL HAND CONTROLLER

FAILURE MODE: FAILS OFF IN ONE AXIS (+, -, OR + AND -) -DETACHED

MAGNET

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) THC SYSTEM
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 2/2

OPS: 3/1R POST-OPS: 2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: PART NUMBER:

CAUSES: LOOSE MAGNET/CONNECTOR, MECHANICAL JAMMING,

CONTAMINATION, PIECE PART FAILURE

EFFECTS/RATIONALE:

CANNOT TRANSLATE IN ONE AXIS, IN ONE DIRECTION OR BOTH. THE PILOT CAN ROTATE AND TRANSLATE ON OTHER AXES. LOSS OF ALL FUNCTIONS WILL LEAVE THE PILOT STRANDED.

DATE:

3/16/87

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1704

FLIGHT: 2/1R

ITEM:

TRANSLATIONAL HAND CONTROLLER

FAILURE MODE: FAILS OFF IN ALL THREE AXIS

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) THC SYSTEM
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

2/2

OPS:

2/1R

POST-OPS:

2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: LOOSE MAGNET/CONNECTOR, MECHANICAL JAMMING, PIECE PART

FAILURE

EFFECTS/RATIONALE:

THC FAILS ON ALL THREE AXES, PILOT CANNOT TRANSLATE. THIS FAILURE CAN BE WORKED AROUND USING THE SATELLITE STABILIZATION FUNCTION AND THE ROTATIONAL HAND CONTROLLER YAW COMMANDS WHICH WILL RESULT IN TRANSLATION ALONG THE Y AXIS. WE CONSIDER THIS AN UNLIKE REDUNDANT SYSTEM FOR TRANSLATION. LOSS OF ALL FUNCTIONS WILL RESULT IN POSSIBLE LOSS OF PILOT/VEHICLE.

DATE:

3/16/87

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1721

FLIGHT:

3/1R

ITEM:

ROTATIONAL HAND CONTROLLER

FAILURE MODE: FAILS OFF ELECTRICALLY ONE AXIS

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- RHC SYSTEM 2)

3)

4)

5)

6)

7)

8)

9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

2/2

OPS: POST-OPS: 3/1R 2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: LOOSE MAGNET/CONNECTOR, MECHANICAL JAMMING,

CONTAMINATION, PIECE PART FAILURE.

EFFECTS/RATIONALE:

LOSS OF ROTATION IN ONE AXIS. THE PILOT CAN ROTATE AND TRANSLATE IN OTHER AXES. LOSS OF ALL FUNCTIONS WILL LEAVE THE PILOT STRANDED IF UNABLE TO SIGHT THE ORBITER.

DATE:

9/19/86

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

FLIGHT: 3/1R

ITEM:

ROTATIONAL HAND CONTROLLER

FAILURE MODE: FAIL OFF MECHANICALLY IN ONE AXIS

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- RHC SYSTEM 2)

MDAC ID: 1722

- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

2/2

OPS:

3/1R 2/2

POST-OPS:

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: PART NUMBER:

CAUSES: LOOSE MAGNET/CONNECTOR, MECHANICAL JAMMING CONTAMINATION, PIECE PART FAILURE

EFFECTS/RATIONALE:

LOSS OF ROTATION IN ONE AXIS. THE PILOT CAN ROTATE AND TRANSLATE IN OTHER AXES. LOSS OF ALL FUNCTIONS WILL LEAVE THE PILOT STRANDED IF UNABLE TO SIGHT ORBITER.

DATE: 9/19/86 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1723 FLIGHT: 3/1R

ITEM: ROTATIONAL HAND CONTROLLER

FAILURE MODE: FAIL OFF (1-3 AXES) - DETACHED MAGNET

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) RHC SYSTEM
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 2/2 OPS: 3/1R

POST-OPS: 2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: LOOSE MAGNET/CONNECTOR, MECHANICAL JAMMING

EFFECTS/RATIONALE:

LOSS OF ROTATION IN ONE AXIS. THE PILOT CAN ROTATE AND TRANSLATE IN OTHER AXES. LOSS OF ALL FUNCTIONS WILL LEAVE THE PILOT STRANDED IF UNABLE TO SIGHT ORBITER.

HIGHEST CRITICALITY HDW/FUNC 3/16/87 DATE: SUBSYSTEM: MMU

MDAC ID: 1724

FLIGHT:

1/1

ITEM:

ROTATIONAL HAND CONTROLLER

FAILURE MODE: FAIL OFF THREE AXES

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- RHC SYSTEM 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 2/2 1/1 OPS: 2/2 POST-OPS:

REDUNDANCY SCREENS: A [] B [] C []

LOCATION: PART NUMBER:

CAUSES: LOOSE MAGNET/CONNECTOR, MECHANICAL JAMMING, CONTAMINATION, PIECE PART FAILURE

EFFECTS/RATIONALE: NO ROTATIONAL CONTROL. THE PILOT IS STRANDED IF UNABLE TO SIGHT THE ORBITER. THIS CRITICALITY CAN BE DOWNGRADED TO A 2/1R IF IT PROVES FEASIBLE FOR THE PILOT TO PUT A HAND ON ONE OF THE PROPULSIVE NOZZLES WHILE FIRING TRANSLATION TO FORCE A ROTATIONAL MOTION.

DATE: 3/16/87 HIGHEST CRITICALITY HDW/FUNC SUBSYSTEM: MMU

MDAC ID: 1731 FLIGHT: 1/1

ITEM: TRANSLATIONAL HAND CONTROLLER FAILURE MODE: MECHANICALLY JAMS IN ISO MODE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) THC SYSTEM
- 3)
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 2/2 OPS: 1/1

POST-OPS: 2/2

REDUNDANCY SCREENS: A [] B [] C []

LOCATION: PART NUMBER:

CAUSES: MECHANICAL JAM, CONTAMINATION, PIECE PART FAILURE

EFFECTS/RATIONALE:

ISOLATION VALVES ARE CLOSED. LOSS OF ALL PROPULSIVE CAPABILITY. PILOT IS STRANDED.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1861 FLIGHT: 2/1R

ITEM: CEA THERMOSTATS (2 SETS)

FAILURE MODE: FAILED CLOSED (HEATERS ON CONTINUOUSLY)

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) CEA
- 3)
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

2/2 2/1R

OPS: POST-OPS:

2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES:

EFFECTS/RATIONALE:

THIS FAILURE WILL MAINTAIN THE CONTROL ELECTRONIC ASSEMBLY HEATERS ON CONTINUOUSLY. LOSS OF ESSENTIAL EQUIPMENT IN THE CEASUCH AS THE VALVE DRIVE AMPLIFIERS WILL FOLLOW, FORCING THE SHUTDOWN OF ONE SIDE. FUNCTION FAILURE MAY LEAVE PILOT STRANDED.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1862 FLIGHT: 2/1R

ITEM:

MMU THERMOSTATS

FAILURE MODE: FAILS OFF

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) CEA
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: OPS: /NA 2/1R

POST-OPS: /NA

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: ELECTRICAL OPEN

EFFECTS/RATIONALE:

HEATER WITH THE FAILED THERMOSTAT WILL NOT OPERATE. POSSIBLE COMPONENT FAILURE IF TEMPERATURE EXCEEDS LOWER LIMITS. IF FLIGHT CRITICAL COMPONENT, POSSIBLE STRANDING/LOSS OF CREWMEMBER IF OTHER SIDE ALSO FAILS.

HIGHEST CRITICALITY HDW/FUNC DATE:

SUBSYSTEM: MMU

FLIGHT: 3/2R MDAC ID: 1891

ARM ANGLE ADJUST ITEM:

FAILURE MODE: UNABLE TO MOVE FROM WORK TO FLIGHT POSITION-LEFT

ARM

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- MECHANICAL 2)
- 3) ARM ASSEMBLY
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC 3/2R PRE-OPS: 3/2R OPS: 3/3 POST-OPS:

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

LEFT OR RIGHT MMU ARM

PART NUMBER:

CAUSES: PIECE PART FAILURE, VIBRATION, SHOCK, JAMMING

EFFECTS/RATIONALE:

IF FAILURE OCCURS PRE-OPS, LATCH BOLTS CAN BE REMOVED AND ARM PLACED IN FLIGHT POSITION WITH PIP PINS. HOWEVER, THIS CORRECTIVE ACTION FREEZES THE ARM IN FLIGHT POSITION AND MAY PREVENT COMPLETION OF THE MISSION. DURING THE OPS PHASE THIS FAILURE MAY PREVENT COMPLETION OF THE MISSION. POST-OPS THE ARM CAN BE LEFT IN THE FLIGHT POSITION AND CAN BE SECURED FOR LANDING WITH PIP PINS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1892 FLIGHT: 3/2R

ITEM: ARM ANGLE ADJUST

FAILURE MODE: UNABLE TO MOVE SYSTEM WORK TO FLIGHT-RIGHT ARM

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) MECHANICAL
- 3) ARM ASSEMBLY
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/2R OPS: 3/2R POST-OPS: 3/3

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: LEFT OR RIGHT MMU ARM

PART NUMBER:

CAUSES: PIECE PART FAILURE, VIBRATION, SHOCK, JAMMING

EFFECTS/RATIONALE:

IF FAILURE OCCURS PRE-OPS, LATCH BOLTS CAN BE REMOVED AND ARM PLACED IN FLIGHT POSITION WITH PIP PINS. HOWEVER, THIS CORRECTIVE ACTION FREEZES THE ARM IN FLIGHT POSITION AND MAY PREVENT COMPLETION OF THE MISSION. DURING THE OPS PHASE THIS FAILURE MAY PREVENT COMPLETION OF THE MISSION. POST-OPS THE ARM CAN BE LEFT IN THE FLIGHT POSITION AND CAN BE SECURED FOR LANDING WITH PIP PINS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID:

1893

FLIGHT:

3/3

ITEM:

ARM ANGLE ADJUST

FAILURE MODE: LEFT ARM FAILS TO LOCK, INADVERTENTLY UNLOCKS, ANY

SINGLE POSITION

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) MECHANICAL
- 3) ARM ASSEMBLY
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 3/3 OPS: 3/3 POST-OPS: 3/3

REDUNDANCY SCREENS: A [] B [] C []

LOCATION:

LEFT MMU ARM

PART NUMBER:

CAUSES: PIECE PART FAILURE, VIBRATION, SHOCK

EFFECTS/RATIONALE:

IF FAILURE OCCURS PRE-OPS, CREW INCONVENIENCE, ARM MAY HAVE TO BE PINNED IN POSITION. IF FAILURE OCCURS DURING OPERATIONS (I.E., AFTER SATELLITE SERVICING) AND ARM FAILS TO LOCK BACK IN FLIGHT POSITION, NO IMPACT. CREW INCONVENIENCE TO TRAVEL WITH UNLOCKED ARM. POST-OPS, WHILE PREPPING TO RETURN, THE ARM CAN BE STRAPPED OR LOCKED IN A DIFFERENT POSITION.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU MDAC ID: 1894 FLIGHT: 3/3

ITEM: ARM ANGLE ADJUST

FAILURE MODE: RIGHT ARM FAILS TO LOCK, INADVERTENTLY UNLOCKS.

ANY SINGLE POSITION

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) MECHANICAL
- 3) ARM ASSEMBLY
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 3/3 OPS: 3/3 POST-OPS: 3/3

REDUNDANCY SCREENS: A [] B [] C []

RIGHT MMU ARM LOCATION:

PART NUMBER:

CAUSES: PIECE PART FAILURE, VIBRATION, SHOCK

EFFECTS/RATIONALE:

IF FAILURE OCCURS PRE-OPS, CREW INCONVENIENCE, ARM MAY HAVE TO BE PINNED IN POSITION. IF FAILURE OCCURS DURING OPERATIONS (I.E., AFTER SATELLITE SERVICING) AND ARM FAILS TO LOCK BACK IN FLIGHT POSITION, NO IMPACT. CREW INCONVENIENCE TO TRAVEL WITH UNLOCKED ARM. POST-OPS, WHILE PREPPING TO RETURN, THE ARM CAN BE STRAPPED OR LOCKED IN A DIFFERENT POSITION.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1895 FLIGHT: 3/3

ITEM: ARM ANGLE ADJUST

FAILURE MODE: FAILS TO LOCK, INADVERTENTLY UNLOCKS, ANY SINGLE

POSITION

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) MECHANICAL
- 3) ARM ASSEMBLY
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 3/3 OPS: 3/3

POST-OPS: 3/3

REDUNDANCY SCREENS: A [] B [] C []

LOCATION: LEFT OR RIGHT MMU ARM

PART NUMBER:

CAUSES: PIECE PART FAILURE, VIBRATION, SHOCK

EFFECTS/RATIONALE:

IF FAILURE OCCURS PRE-OPS, CREW INCONVENIENCE, ARM MAY HAVE TO BE PINNED IN POSITION. IF FAILURE OCCURS DURING OPERATIONS (I.E., AFTER SATELLITE SERVICING) AND ARM FAILS TO LOCK BACK IN FLIGHT POSITION, NO IMPACT. CREW INCONVENIENCE TO TRAVEL WITH UNLOCKED ARM. POST-OPS, WHILE PREPPING TO RETURN, THE ARM CAN BE STRAPPED OR LOCKED IN A DIFFERENT POSITION.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1896

FLIGHT:

3/2R

ITEM:

ARM ANGLE ADJUST

FAILURE MODE: INADVERTENTLY UNLOCKS (LAUNCH, LANDING), FAILS TO

STAY IN LAUNCH POSITION

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) MECHANICAL
- ARM ASSEMBLY 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/2R /*

OPS:

POST-OPS: 3/2R

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: LEFT OR RIGHT MMU ARM

PART NUMBER:

CAUSES: PIECE PART FAILURE, VIBRATION, SHOCK

EFFECTS/RATIONALE:

*SEE MDAC ID-1891

THE ARMS HAVE LOCKS PLUS STRAPS TO KEEP THEM IN POSITION DURING LAUNCH OR LANDING. SHOULD ALL REDUNDANCIES FAIL, THIS MMU MISSION MAY BE LOST DUE TO AN INOPERABLE ARM.

HIGHEST CRITICALITY HDW/FUNC DATE:

SUBSYSTEM: MMU

3/2R FLIGHT: MDAC ID: 1897

ARM ANGLE ADJUST ITEM:

FAILURE MODE: UNABLE TO MOVE FROM LAUNCH TO WORK/FLIGHT

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) MECHANICAL
- 3) ARM ASSEMBLY
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 3/2R 3/2R

OPS: POST-OPS: 3/3

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: LEFT OR RIGHT MMU ARM

PART NUMBER:

CAUSES: PIECE PART FAILURE, VIBRATION, SHOCK, JAMMING

EFFECTS/RATIONALE:

IF FAILURE OCCURS PRE-OPS, LATCH BOLTS CAN BE REMOVED AND ARM PLACED IN FLIGHT POSITION WITH PIP PINS. HOWEVER, THIS CORRECTIVE ACTION FREEZES THE ARM IN FLIGHT POSITION AND MAY PREVENT COMPLETION OF THE MISSION. DURING THE OPS PHASE THIS FAILURE MAY

PREVENT COMPLETION OF THE MISSION. POST-OPS THE ARM CAN BE LEFT IN THE FLIGHT POSITION AND CAN BE SECURED FOR LANDING WITH PIP PINS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1898 FLIGHT: 3/2R

ITEM: ARM ANGLE ADJUST

FAILURE MODE: UNABLE TO RELEASE ARM FROM FLIGHT TO LAUNCH/WORK

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) MECHANICAL
- 3) ARM ASSEMBLY
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 3/2R OPS: 3/2R

POST-OPS: 3/3

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: LEFT OR RIGHT MMU ARM

PART NUMBER:

CAUSES: PIECE PART FAILURE, VIBRATION, SHOCK, JAMMING

EFFECTS/RATIONALE:

IF FAILURE OCCURS PRE-OPS, LATCH BOLTS CAN BE REMOVED AND ARM PLACED IN FLIGHT POSITION WITH PIP PINS. HOWEVER, THIS CORRECTIVE ACTION FREEZES THE ARM IN FLIGHT POSITION AND MAY PREVENT COMPLETION OF THE MISSION. DURING THE OPS PHASE THIS FAILURE MAY

PREVENT COMPLETION OF THE MISSION. POST-OPS THE ARM CAN BE LEFT IN THE FLIGHT POSITION AND CAN BE SECURED FOR LANDING WITH PIP PINS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1899 FLIGHT: 2/1R

ITEM:

ARM ANGLE ADJUST

FAILURE MODE: FAILS FROM WORK TO LAUNCH POSITION

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) MECHANICAL
- 3) ARM ASSEMBLY
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 2/2 OPS: 2/1R

POST-OPS: 3/3

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: PIECE PART FAILURE, VIBRATION, SHOCK

EFFECTS/RATIONALE:

PRE-OPS, PILOT WILL NOT PROCEED WITH THE MISSION IF PROBLEM CANNOT BE CORRECTED. DURING OPERATIONS, THE HARDWARE CRITICALITY IS BASED ON THE PILOTS ABILITY TO TETHER HIMSELF TO THE MMU, DOFF TO CORRECT THE ARM POSITION BACK TO FLIGHT AND DONNING IT FOR THE FLIGHT BACK. FAILURE TO CORRECT THIS CONDITION AND DONN THE MMU AGAIN MAY RESULT IN CREWMAN BEING STRANDED AWAY FROM THE ORBITER.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 1981 FLIGHT: 3/2R

ITEM: MMU BATTERY LATCHES

FAILURE MODE: LATCH FAILS OPEN-LAUNCH AND LANDING

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) BATTERY
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/2R

OPS: /*

POST-OPS: 3/2R

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION:

PART NUMBER:

CAUSES:

EFFECTS/RATIONALE:

*SEE ANALYSIS MDAC ID-198.

DURING LIFTOFF, IF THE LATCH FAILS OPEN, THE VELCRO THERMAL COVER WILL HOLD THE LATCH FROM TRAVELING. THIS WILL KEEP THE BATTERY IN PLACE. THE MOMENT ARM BETWEEN THE BATTERY PIN AND THE LATCH HINGE POINT IS SMALL COMPARED TO THE MOMENT ARM BETWEEN THE END OF THE LATCH (AGAINST THE VELCRO COVER) AND THE SAME LATCH HINGE POINT. SHOULD THE SYSTEM FAIL, THE BATTERY MAY BECOME UNHINGED, CAUSING LOSS OF BATTERY AND HINGES, THUS LOSS OF MISSION.

HIGHEST CRITICALITY HDW/FUNC DATE:

SUBSYSTEM: MMU

FLIGHT: 3/3 MDAC ID: 2111

FSS PRESSURE GAUGES ITEM: FAILURE MODE: ERRONEOUS-HIGH OR LOW

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

1)

2)

3)

4)

5) 6)

7)

8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/3 /NA

OPS: POST-OPS:

3/3

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

FSS

PART NUMBER:

CAUSES: CONTAMINATION, MECHANISM BINDS

EFFECTS/RATIONALE:

NO EFFECT DUE TO NO IMPACT ON THE SYSTEMS (MMU OR FSS).

DATE: SUBSYSTEM:				HIGHEST				•
MDAC ID:	2141				FL	IGHT:		/NA
ITEM: FAILURE MODI			ALVE					
LEAD ANALYS	r: DUFFY,	HUYNH,	SAIIDI	su	BSYS	LEAD:	M.J.	SAIIDI
BREAKDOWN HT 1) 2) 3) 4) 5) 6) 7) 8)	IERARCHY:							
		PT TCU	CRITICA	LITIES HDW/1	ETIMO			
		PRE	-OPS:	/I				
		0.00	: T-OPS:	,				
REDUNDANCY S	SCREENS:	A []	в []	,	c []	
LOCATION: PART NUMBER	:							
CAUSES:								
EFFECTS/RATT THIS FAILURI WILL AFFECT	E MODE WAS							WHICH
REFERENCES:								

HIGHEST CRITICALITY HDW/FUNC DATE:

SUBSYSTEM: MMU MDAC ID: 2142

FLIGHT:

3/2R

ITEM:

FSS SUPPLY VALVE

FAILURE MODE: FAILS CLOSED

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- FSS 2)
- 3) PROPULSION
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/3

OPS:

/NA

POST-OPS:

3/2R

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: CONTAMINATION, CORROSION, MECHANICAL FAILURE

EFFECTS/RATIONALE:

THE FAILURE WILL HAVE NO EFFECT UNTIL RECHARGE IS ATTEMPTED AFTER THE FIRST MMU-OPS. LOSS OF RECHARGE CAPABILITY WILL CANCEL SUBSEQUENT MMU-OPS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 2143 FLIGHT: 2/2

ITEM: FSS SUPPLY VALVE FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) FSS
- 3) PROPULSION
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/3

OPS:

/NA

POST-OPS:

2/2

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: SHOCK, VIBRATION

EFFECTS/RATIONALE:

A SEVERE EXTERNAL LEAKAGE (IF NOT ABLE TO BE ISOLATED BY THE VALVE-DOWNSTREAM SIDE) WILL PREVENT THE MMU FROM BEING RECHARGED - GAS (GN2) WILL ESCAPE FROM ORBITER AND MMU TANKS. THUS MMU-OPS WILL BE LOST AFTER THE FIRST MMU ACTIVITY. ONLY ONE MMU REMAINING.

HIGHEST CRITICALITY HDW/FUNC DATE: SUBSYSTEM: MMU FLIGHT: 3/3 MDAC ID: 2144 FSS SUPPLY VALVE ITEM: FAILURE MODE: FAILED OPEN LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI BREAKDOWN HIERARCHY: 1') MMU 2) FSS 3) PROPULSION 4) 5) 6)

CRITICALITIES

FLIGHT PHASE HDW/FUNC PRE-OPS: 3/3 OPS: /NA POST-OPS: 3/3

REDUNDANCY SCREENS: A [] B [] C []

LOCATION:
PART NUMBER:

7) 8) 9)

CAUSES: VIBRATION, CORROSION, SHOCK, CONTAMINATION

EFFECTS/RATIONALE:

NO IMMEDIATE EFFECT IS RECOGNIZED, SINCE THE ORBITER MMU SUPPLY VALVES AND MMU CROSSFED VALVES MAY BE USED TO ISOLATE THE LINE.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 2181 FLIGHT: 3/2R

ITEM: FLEX HOSE

FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1)
- 2)
- 3)
- 4)
- 5) 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/3

OPS:

/NA 3/2R

POST-OPS:

/ 2R

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: MATERIAL FAILURE DUE TO THERMAL CYCLING OR STRESSED IN EXCESS OF ALLOWABLE BEND RADIUS.

EFFECTS/RATIONALE:

LOSS OF GN2 TO SPACE. PROBABLE INEFFICIENT AND UNACCEPTABLE CHANGE TO MMU. MISSION IMPACT IF REDUNDANT FSS CHARGE CAPABILITY ALSO FAILED.

DATE:

3/27/87

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 2391

FLIGHT:

3/2R

ITEM:

FOOT RESTRAINT

FAILURE MODE: BOOT JAMS IN FOOT RESTRAINT

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) FSS
- MECHANICAL 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/2R /NA

OPS: POST-OPS:

3/2R

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES:

EFFECTS/RATIONALE:

FOOT RESTRAINT IS BEING MODIFIED SUCH THAT THE HEEL CLIP CAN COME OFF IF THE FOOT JAMS INSIDE. FINAL ANALYSIS SHOULD BE RESERVED UNTIL MODIFICATION IS AVAILABLE TO IOA.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 2392 FLIGHT: 3/3

ITEM: FSS FOOT RESTRAINT

FAILURE MODE: INABILITY TO CAPTURE BOOT

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

1) FSS

2) FOOT RESTRAINT

3)

4)

5)

6)

7)

8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/3 OPS: 3/3

POST-OPS: 3/3

REDUNDANCY SCREENS: A [] B [] C []

LOCATION: FSS, RIGHT OR LEFT RESTRAINT

PART NUMBER:

CAUSES: WEAR, DAMAGE TO BOOT OR FOOT RESTRAINT

EFFECTS/RATIONALE:

IF BOTH RESTRAINTS FAIL, GREATER EFFORT IN HOLDING POSITION.

DATE: 9/23/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 4000 FLIGHT: 3/3

ITEM: ARM STRAP

FAILURE MODE: FAILS LATCHED

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) ARM ASSEMBLY
- 3)
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/3
OPS: 3/3
POST-OPS: 3/3

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: PART NUMBER:

CAUSES: PIECE PART FAILURE, JAMMING

EFFECTS/RATIONALE:

STRAP CAN BE FORCEFULLY UNLATCHED OR IT CAN BE CUT. THE PRIMARY LATCH CAN BEAR ENTRY LOADS, OR ARM CAN BE PINNED IN THE FLIGHT POSITION.

DATE: SUBSYSTEM:	3/23/87 MMU	7		HIGHES	ST CRIT	'ICALI'	ry Hi	W/FUNC
MDAC ID:					FI	LIGHT:		3/3
ITEM: FAILURE MODE			HED					
LEAD ANALYST	: DUFFY,	HUYNH,	SAIIDI	S	SUBSYS	LEAD:	M.J.	SAIIDI
BREAKDOWN HI 1) MMU 2) ARM ASS 3) 4) 5) 6) 7) 8)								
			CRITICA	LITIES				
		PRE- OPS:	PHASE -OPS: : -OPS:	HDV	N/FUNC 3/3 /* 3/3			
REDUNDANCY S	CREENS:	A []	в[]	1	c []	
LOCATION: PART NUMBER:								
CAUSES:								
EFFECTS/RATI *SEE MDAC-20 THIS PRIMARY	1.	LDS THE	E ARM IN	PLACE.				
REFERENCES:								

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 4002 FLIGHT: 3/2R

ITEM: MMU BATTERY RECHARGE CABLE

FAILURE MODE: FAILURE TO PROVIDE A RECHARGE INTERFACE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) FSS
- 3)
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/2R OPS: /NA

POST-OPS: 3/2R

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: ORBITER AIRLOCK

PART NUMBER:

CAUSES: MECHANICAL FAILURE, ELECTRICAL OPEN

EFFECTS/RATIONALE:

LOSS OF INTERFACE PREVENTS RECHARGE OF BATTERY AND RESULTS IN A MISSION IMPACT IF OTHER BATTERIES AND RECHARGING FUNCTIONS ARE FAILED.

DATE:

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 4003

FLIGHT:

3/2R

ITEM:

MMU BATTERY RECHARGE CABLE

FAILURE MODE: FAILURE TO PROVIDE A RECHARGE INTERFACE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- MMU 1)
- 2) FSS
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/2R

OPS: POST-OPS:

3/3 3/3

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

ORBITER AIRLOCK

PART NUMBER:

CAUSES: SHORT DUE TO CONTAMINATION, FRAYED CONNECTOR

EFFECTS/RATIONALE:

EXCESSIVE CURRENT DRAW FROM ORBITER WHICH WILL LIKELY RESULT IN

AIRLOCK RPC AUTOMATICALLY OPENING.

HIGHEST CRITICALITY HDW/FUNC DATE:

SUBSYSTEM: MMU MDAC ID: 4004

FLIGHT:

3/2R

ITEM:

TRUNNION PIN ATTACHMENT DEVICE

FAILURE MODE: FAILS TO PROVIDE ATTACHMENT

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) FSS
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/2R

OPS:

3/2R

POST-OPS:

3/3

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PART NUMBER:

CAUSES: MATERIAL FAILURE, MISALIGNMENT (BENT)

EFFECTS/RATIONALE:

INABILITY TO ATTACH MISSION SPECIFIC AUXILLARY HARDWARE. MISSION

IMPACT IF REMAINING DEVICE ALSO FAILS.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 4005 FLIGHT: 3/2R

ITEM:

BATTERY TRANSFER BAG

FAILURE MODE: FAILS OPEN

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

1) MMU

2) STRUCTURE AND MECHANISM

3)

4)

5)

6)

7)

8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/2R

OPS:

/NA

POST-OPS:

/NA

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: ANCILLARY EQUIPMENT

PART NUMBER:

CAUSES: MATERIAL FAILURE

EFFECTS/RATIONALE:

POSSIBLE LOSS OF BATTERY IF OPENING SUFFICIENT ENOUGH TO LOSE

ENTIRE BATTERY.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 4006 FLIGHT: 3/2R

ITEM: BATTERY TETHER STRAP
FAILURE MODE: FAILS TO RETAIN BATTERY

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

1) MMU

2) STRUCTURE AND MECHANISM

3)

4)

5)

6)

7) 8)

9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/2R OPS: /NA

POST-OPS: /NA

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: PART NUMBER:

CAUSES: MATERIAL FAILURE, BRACKET FRACTURES, SNAP

FRACTURES/RELEASES

EFFECTS/RATIONALE:

BATTERY LOST TO SPACE. MISSION IMPACT IF OTHER TETHER ALSO NON-

FUNCTIONAL.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 4007 FLIGHT: 2/2

ITEM:

CONTINGENCY TOOL

FAILURE MODE: FAILS TO RELEASE FLEX HOSE FROM QD

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

1) MMU

2) FSS

3)

4)

5)

6)

7)

8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

2/2

OPS:

/NA

POST-OPS:

/NA

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

ANCILLARY EQUIPMENT

PART NUMBER:

CAUSES: BINDING, MATERIAL FAILURE

EFFECTS/RATIONALE:

INABILITY TO REMOVE/SEPARATE FLEX HOSE FROM QD. MMU RETAINED IN

FSS AND UNAVAILABLE FOR MISSION.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 4008 FLIGHT: 3/2R

ITEM: CONTINGENCY TOOL

FAILURE MODE: FAILS TO RELEASE ARM ANGLE MECHANISM

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) FSS
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/2R OPS: /NA

POST-OPS: /NA

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: ANCILLARY EQUIPMENT

PART NUMBER:

CAUSES: BINDING, MATERIAL FAILURE

EFFECTS/RATIONALE:

INABILITY TO RELEASE ARM WOULD RESULT IN MISSION IMPACT IF POWER

TOOL HAS ALSO FAILED.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 4009 FLIGHT: 3/2R

ITEM: 5/16" THIN WALL SOCKET

FAILURE MODE: FAILS TO INTERFACE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) FSS
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/2R OPS: /NA

POST-OPS: 3/2R

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: ANCILLARY EQUIPMENT

PART NUMBER:

CAUSES: MATERIAL FAILURE, SOCKET STRIPPED OR BENT

EFFECTS/RATIONALE:

INABILITY TO EMPLOY SOCKET ON LAUNCH BOLTS OR ARM CONTINGENCY BOLTS. IF CONTINGENCY TOOL ALSO FAILED MISSION IMPACT RESULTS FROM INABILITY TO RELEASE MMU.

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 4010 FLIGHT: 3/2R

ITEM: 5/16" THIN WALL SOCKET

FAILURE MODE: FAILS TO INTERFACE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

- 1) MMU
- 2) FSS
- 3)
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/2R OPS: /

POST-OPS: 3/2R

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: ANCILLARY EQUIPMENT

PART NUMBER:

CAUSES: MATERIAL FAILURE, SOCKET STRIPPED OR BENT

EFFECTS/RATIONALE:

INABILITY TO EMPLOY SOCKET ON LAUNCH BOLTS OR ARM CONTINGENCY BOLTS. IF CONTINGENCY TOOL ALSO FAILED MISSION IMPACT RESULTS FROM INABILITY TO RELEASE MMU.

HIGHEST CRITICALITY HDW/FUNC DATE: SUBSYSTEM: MMU MDAC ID: 4011 FLIGHT: 3/3 SUBWAY STRAPS ITEM: FAILURE MODE: SEPARATES FROM DONNING STATION LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI BREAKDOWN HIERARCHY: 1) MMU 2) FSS 3) 4) 5) 6) 7) 8) 9) CRITICALITIES FLIGHT PHASE HDW/FUNC PRE-OPS: 3/3 /NA OPS: POST-OPS: 3/3 REDUNDANCY SCREENS: A [] B [] C [] LOCATION: PART NUMBER: CAUSES: MATERIAL FAILURE EFFECTS/RATIONALE: NO EFFECTS DUE TO STRAPS BEING NON-CRITICAL IN DONNING OR DOFFING PROCESSES. REFERENCES:

DATE: HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: MMU

MDAC ID: 4012 FLIGHT: 3/3

ITEM: THRUSTER CUE LIGHT EXTENDER

FAILURE MODE: DOES NOT OPERATE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

1) MMU

2) STRUCTURE AND MECHANISM

3)

4)

5)

6)

7)

9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS: 3/3 OPS: 3/3

POST-OPS: 3/3

REDUNDANCY SCREENS: A [2] B [] C []

LOCATION: ANCILLARY EQUIPMENT

PART NUMBER:

CAUSES: FRACTURED, MATERIAL FAILURE, SEPARATED FROM MMU

EFFECTS/RATIONALE:

CREW INCONVENIENCE, OTHERWISE NO MAJOR IMPACT.

DATE: HIGHEST CRITICALITY HDW/FUNC SUBSYSTEM: MMU

MDAC ID: 4013 FLIGHT: 3/3

ITEM: CAMERA BRACKET
FAILURE MODE: FAILS TO INTERFACE

LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI

BREAKDOWN HIERARCHY:

1) MMU

2) STRUCTURE AND MECHANISM

3)

4)

5)

6)

7) 8)

9)

CRITICALITIES

FLIGHT PHASE HDW/FUNC

PRE-OPS:

3/3

OPS:

/NA

POST-OPS:

/NA

REDUNDANCY SCREENS: A [] B [] C []

LOCATION:

ANCILLARY EQUIPMENT

PART NUMBER:

CAUSES: MATERIAL FAILURE

EFFECTS/RATIONALE:

INABILITY TO ATTACH CAMERA. THE CAMERA IS NOT CONSIDERED A CRITICAL COMPONENT FOR MISSION SUCCESS, LIFE SUPPORT, OR VEHICLE OPERATION.

DATE: SUBSYSTEM: MM	ט		HIGHEST	CRITICALI	ry HDW/FUNC
MDAC ID: 40				FLIGHT:	/NA
ITEM: FAILURE MODE:			ECTION		
LEAD ANALYST:	DUFFY, HUY	NH, SAIIDI	SUB	SYS LEAD:	M.J. SAIIDI
BREAKDOWN HIER 1) MMU 2) STRUCTURES 3) 4) 5) 6) 7) 8) 9)		HANISM			
		CRITICA	LITIES		
-	FI	LIGHT PHASE PRE-OPS: OPS: POST-OPS:		A A	
REDUNDANCY SCR	EENS: A	[]]	3 []	c []
LOCATION: PART NUMBER:					
CAUSES: MATER	IAL FAILUF	RE			
EFFECTS/RATION THE COMPONENT SKIN AND THERE	IS CONSIDE				E ORBITER

DATE: HIGHEST CRITICALITY HDW/FUNC SUBSYSTEM: MMU MDAC ID: 4015 FLIGHT: /NA ITEM: HEATERS FAILURE MODE: FAILS ON LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI **BREAKDOWN HIERARCHY:** 1) MMU 2) ELECTRICAL SYSTEM 3) 4) 5) 6) 7) 8) 9) CRITICALITIES FLIGHT PHASE HDW/FUNC PRE-OPS: /NA OPS: /NA POST-OPS: /NA REDUNDANCY SCREENS: A [] B [] C [] LOCATION: PART NUMBER: CAUSES: SHORT CIRCUIT EFFECTS/RATIONALE: THE CAUSE FOR FAILURE IS NOT CREDIBLE. REFERENCES:

APPENDIX F

NASA FMEA TO IOA WORKSHEET CROSS REFERENCE/RECOMMENDATIONS

This section provides a cross reference between the NASA FMEA and corresponding IOA analysis worksheet(s) included in Appendix E. The Appendix F identifies: NASA FMEA Number, IOA Assessment Number, NASA criticality and redundancy screen data, and IOA recommendations.

Appendix F Legend

Code Definition

- 1 IOA recommends changing the second failure mode described in the effects field.
- 2 IOA recommends deleting the IOA failure mode.

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APPENDIX F

NASA FMEA TO 10A WORKSHEET CROSS REFERENCE / RECOMMENDATIONS

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2,1,4	; MMU-1894X	1				1		1			1		
2,1,5	1 MMU-1895X	- 1				:		i , r	r	~			
2.1.5	: MMU-1896X					- 1		1 5	F	•	. A.		
	# 1	•	!	1		1	1	i					

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IDE		NASA II IDA RECOMMENDATI				TENDATIONS *	ATIONS *		
NASA PYEA NI MBER		 CRIT 	! SCREENS	::: ::: CR:T :: 43/5	SERRENS :	OTHER (SEE LEBENA CADE)	1888		
2.1.7		11 1/1		11 2/2			i k		
2.1.8) P P	11 2/2			X		
2.1.9		2/2		11 /					
2.2.1		1/1	:	11 3/2R	IPPP!		1 X		
2.2.2		11 3/3	i	11 /					
2.2.3		1 3/3	i	11 /	1				
2.3.1		1/1	1	11 3/2R	: P		1 X		
2.3.2		1 2/2	1						
2,4,1		1 1/1					. ¥		
2.5.1		1 2/1R	P P	11 /					
2.5.2		1 2/18	1 P 8	11 3/2R			: X		
1.5.3	i Anulitem i	1 2/2	1 P P	11 2/18	IPPP:		γ		
1:1:1	150-220	1.12	0 0	11 /			1		
2.2.2	1 1110-215	JUF	2 2	H Z					
1.5.3	::MU-219A	1 3/2R	; p =	J 0/18			(
2.7.1	MMU-241	3/2R	I P P	11 /	i :				
2.7.2	MMU-240	3/2R	15 3	11 /					
3.1.1	1 MMU-171	1 1/1	18 8	11 /	1 1		•		
3.1.2	: MMU-171A	2/18	: P P	11 1/1	1		1 Х		
3,1,3	: MMU-1721X	1 2/2	!	11 3/1R	1 P P P :) X		
3.1.4	: MMU-1722X	1 2/2		11 3/1R	IPPP:		1 1		
3.1.5	1 MMU-1723X	1 2/2	! P P	!! 3/1R	1 P P P 1		: X		
3,1,6	1 MMU-1724X	1 2/1R	P P	11 1/1			a A		
3,1.7		3/3	1	11 3/2R	: P P P :		1 X		
3,1.3		3/3	1 P F	11 /	1 1				
3,10.1		1 2/2	1 P P	11 3/3	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Y Y		
J. 10.2		1 3/28	1 P P	11 /	1				
3.11.1	1 448-128	1 2/1R	p p	11 7	1		•		
7 7 7 7		2/2	1	:: 3/2R			1 g		
7 (0)		2/1R	. p = 3	11 2/2					
J. 12.2		2/1R		11 474					
3.12.3		2/18	p p	11 3/3	1 !		7		
3.12.4		1 2/1R		11 3/3	1 !		; X		
3,12,5		2/1R		11 2/2			Ŷ		
5,12.6		2/18		11 /	· · · · · · · · · · · · · · · · · · ·				
- 0:14:0 	. ***** * * * * * * * * * * * * * * * *			:			1 4		
				11 2/2			7		
25 - 45 -	1 5811 - 75	1 717	1		- 1 - 1		*		
3,13,3				11 11 11 11 11 11 11 11 11 11 11 11 11			. ,		
3.13.4				1 - 2 -			. A		
J, 14. 1		1 2/2	1 . 1	47 413					
3,14,2		1 2/2		11 3/3	1 1 1		; , ,		
3,14.3	+ ESST100	1 77 2		11 /	i .				
3.14.4		1 2/2		$\frac{11}{12}$ $\frac{1}{12}$			1		
7 /5 / J: L=1 L	1/271/2	. 41 ±5							
1:11:1	10474495	3/25							
1.15.1			1 5 5	11 3/2F			**		
3, 15, 4					P 9 P		. X		
3.15.3	MMU-179			11 3/2R			, , , , , , , , , , , , , , , , , , ,		
1.15.4	MMU-179A	1 3/3		11 3/2R			i X		
J.14.1				11 J/2R	1 P P P 1		1 1		
	,	!	1	11	1				

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IDE	NTIFIERS	11 1	IASA	! ! ! !	ICA RECOMM	ENDATIONS +	+		
NASA FMEA NUMBER	ASSESSMENT NUMBER		A B D	11 HW/F	SCREENS S		ISSUE		
:=====================================	:===;=================================	11 3/3	:========	====== /]		!		
3.17.1		11 3/3	1 P P	11 /	!		1		
3.17.2		11 3/3		11 /	1		1		
3.17.3	• • • • • • • • • • • • • • • • • • • •	11 3/3		11 /	: !		1		
4:11:4		11 3/3		11 /	1		1		
7 47 8	, .	11 3/3		11 /	!		t ·		
3.17.4	•	11 3/3		$\ddot{\Pi} = \dot{I}$			1		
7 (0 (11 3/3		11 7	;	•	•		
3.18.1		11 3/3	1 P P	11 /	1	• •	1		
3.19.1		11 1/1	, p p	11 /	!	•			
3.2.1	MMU-169	11 2/1 8	1 P P	11 1/1	1	:	· 1		
5,2,10	1 MMU-1744			11 1/1	1 P P P	•	: 7		
3.2.2	MMU-169A	11 2/18		1/1 1/1 3/18		•	1 1		
7.2.3	MMU-1701X	11 2/2					7		
3.0.2	: ::::::::::::::::::::::::::::::::::::	11 2/2		11 3/1E	4 7 7 7 4 p p p		Y		
5,2,5	1 MMU-1703X	11 2/2		11 3/1R		: •	- Λ 1		
3.2.6	1 MMU-1704X	11 2/18	I P P	11 /	;		1		
3.2.7	1 MMU-173	11 2/1R	P P	$\Pi = I$!				
3.2.8	! MMU-1731X	11 1/1	1	11 /	1	1			
3.2.9	: MMU-174	11 2/18	PP	11 1/1]	! !	X		
3.20.1	: MMU-157A	11 3/3	: P P	11 /	!	1	:		
3,21,1	1 MMU-155	11 - 3/2R	1 P P	11 /	† t	1	1		
3,3,1	! MMU-159	11 2/1R	1 P P	11 /	1	† !	•		
Q1014	MMU-182	11 2/1R	PP	H = f	1 t	1	1		
3,3,2	: MMU-166	11 2/18	1 P F	11 /	} •	! !	:		
3,3,3	1 MMU-160	11 2/2	: P P	11 2/1R	1 P P P	! !	ì X		
0:0:0	1 MMU-161	11 2/2	PP	11 2/1R	PPP	t) <u>X</u>		
3,3,4	MMU-157	11 3/3	P P	11 /	!	1	1		
	1 MMU-1681X	11 3/3	!	11 3/2R	1 P P P	I .	i X		
3,3,5	MMU-151	11 3/3	1 p p	11 3/2R	1 9 9 9	4 4	, X		
3.3.6	MMB-151A	11 3/3	1 P P	11 3/2R	1 P P P	1	: 4 A		
3.3.7		11 3/3		11 3/28		!	; Х		
3.3.8	MMU-198	11 3/3	1	11 3/28		!	1 X		
3.3.9	MMU-187		1 P P	11 /	1	!	1		
3.4.1	: MMU-183		1 F F		•	1	!		
3.5.1	MMU-184	11 2/2	: : n n		:	!			
3.6.1	: XMU-174	11 2/2	[P P	11 /	:	1	· ·		
3.4.2	1 195	11 2/2	I P P	11 /	•		1		
7 7 4 	1 1915-142	11 2/13				:	- 4 - 1 - 1		
7.7.2	1 MMU-143	11 2/1R		11 3/3			Ā		
3.8.1	: MMU-138	11 2/1R		11 /_			1 5		
3.3.2	1 MMU-139	11 2/18		11 3/3	i	!	1 1		
3.9.1	WWR-129	11 2/1R	I P P	11 /	1	1			
3.9.2	1 MMU-137	11 2/1R	P P	11 3/3	1	P. D. Company of the	X		
4, 1, 1	1 MMU-185	11 2/1R	1 P F	11 7	!	!	•		
4.2.1	MMU-185A	11 2/2	1 P F	11 2/18	P F P	P :	7		
· · · · · ·	: "M3-223	11 2/2	!	11 3/28	1000	•	* ¥		
	MMU-224	11 2/2	!	1: 3/2R	1 P F P	•	. X		
	1 MMU-225	11 2/2	!	11 3/2R		<u>.</u>	1 3		
	MMU-226	11 5/5		11 3/3	1	1 1	X		
	MMU-227	11 2/2	÷ 1	11 3/2R		! !	: X		
	: mmu=227 MMU=4015X	11 2/2	P	11 /		\$.	į X		
4.2.2	(BBBC**514X	4.1 4/4	4 4 1	11 /	-				

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II.	DENTIFIERS	!!		NAS	j	!!	!! IGA RECOMMENDATIONS *								
MASA FMEA NUMBER	! IDA : ASSESEMENT NUM	 	CRIT	! (CREENS	ii	CRIT HW/F	! SE	REE	:NS :0	: 18E	OTHE OKEBBL E		1 15	55UE
4,3.1	: MMU-1862X	11	2/1R		F		/	1						:	
4.3.2	MMU-1861X	11	2/1R	1	9 9	11	1	:			1			i	
4.4.1	MMU-229	11	3/28	1 1	۶	1.	2/2	<u> </u>			4			ļ. 1	ĭ
4,4,2	: MMU-228	1.1	3/2R	1 1	p p	11	2/2	ļ			1			!	X
4.5.1	: #MU-230	! !	3/3	<u> </u>		1 1	1	!			1				
4.6.1	1 MMU-202	11	2/1R	! [o p	1 1	3/2R	: P	Р	P	i.			:	χ
	: MMU-203	: :	2/1R	1	o p	1 1	2/2	1			1			!	X
	1 MMU-204	11	2/1R	1 5	9 0	1 1	3/3	1			b c				χ
	MMU-205	11	2/18	1.5	o p	: ! : !	3/3	:						į	Y
4.7.1	1 MMU-4014X	1.1	2/1R	; ;	P	1 1	1	!			† (1	y a
5.1.1	: MMU-4001X	1 1	1/1	1		1 1	3/3				F s			:	X
5 45 ±	1 MMU-4012X	* :	3/3	1		1 1	1	:			1			1	
5.11.1	MMU-4013X	1.1	3/3	÷		1 :	1	* !						!	
·	[[[-10]]] {		. / 4	1		1.1	3725	\$	c	7	1				17
	: MMU-4003X	1.1	1/1	:		1 : : 1	3/28	. 5	₽	P	1				1
5.3.1	MMU-4004X	1 1	1/1	ì		1.5	3/2R	1 0	P	5	1			!	X
5.1.1	1 MMU-206	1 1	2/1R	1.8	P	1 1	1	}			i i			1	
5.5.1	1 MMU-4005X	!!	2/2	1 5	P	† † ! 1	3/2R	P	Ρ	F	i			1	X
5.6.1	: MMU-4006X	1 1	2/2	1 F	ם כ	1.1	3/2R	l P	P	P	1			! !	χ
5.7.1	: MMU-4007X	1 1	2/2	ì		!!	1	i i			!			ŧ	
5.7.2	: MMU-4008X	1.1	3/2R	1 1	P	1 1	1	ŧ			!			ì	
5.8.1	: MMU-4009X	1 1	3/2R	1 5	p	11	1	! {			!			ŀ	
5,8,2	1 MMU-4010X	1 1	3/2R		p p	1 !	1	1			1				
5.9.1	: MMU-4011X	11	3/3	i		!!	1	1			1			:	

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