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

WORKING PAPER NO. 1.0-WP-VA88003-11

INDEPENDENT ORBITER ASSESSMENT ASSESMENT OF THE MANNED MANEUVERING UNIT

12 FEBRUARY 1988

This Working Paper is Submitted to NASA under Task Order No. VA88003, Contract NAS 9-17650

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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 <u>NSTS 22206</u>, <u>Instructions</u> 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.

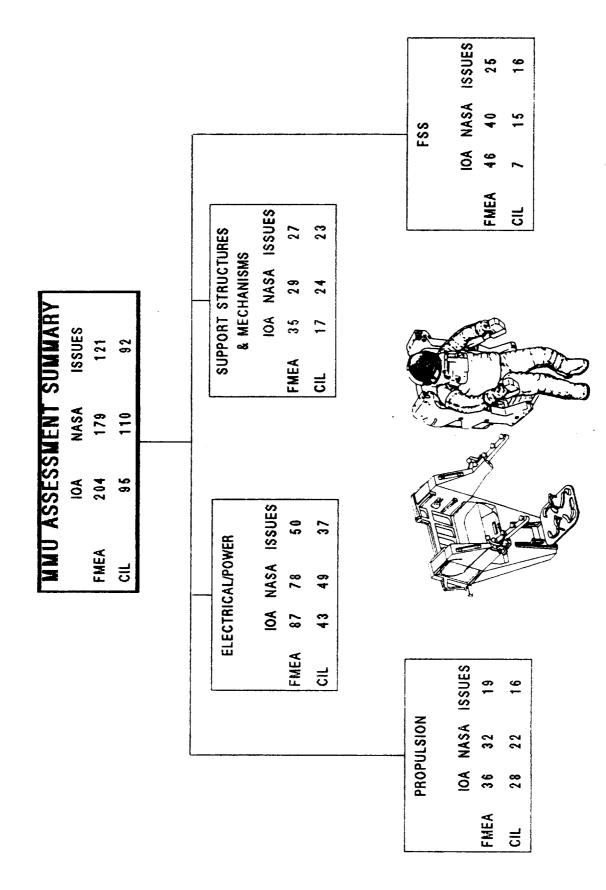


Figure 1 - MMU FMEA/CIL ASSESSMENT

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 FMEA/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 <u>NSTS 22206</u>. 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.

- Propulsion Subsystem 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. Figure 4 is a schematic of the propulsion subsystem.
- <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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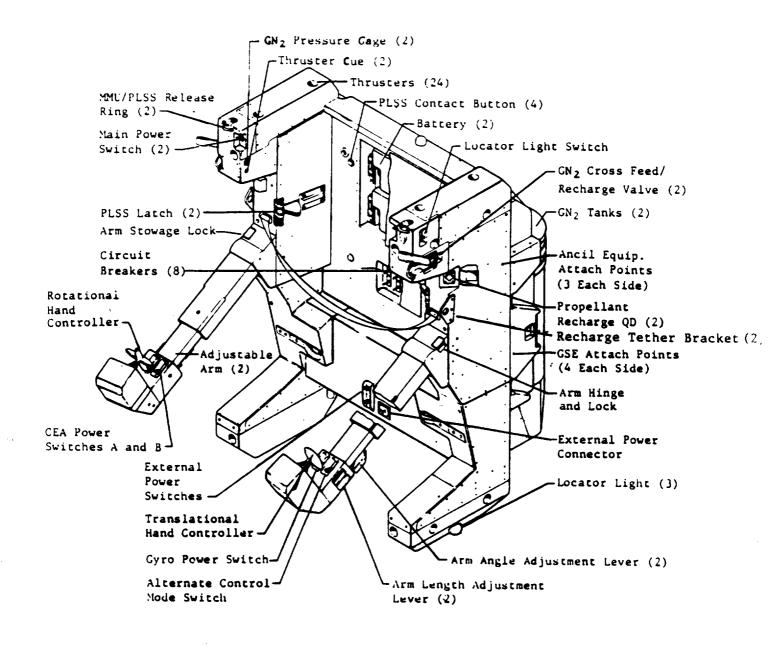


Figure 2 - MANNED MANEUVERING UNIT (MMU)

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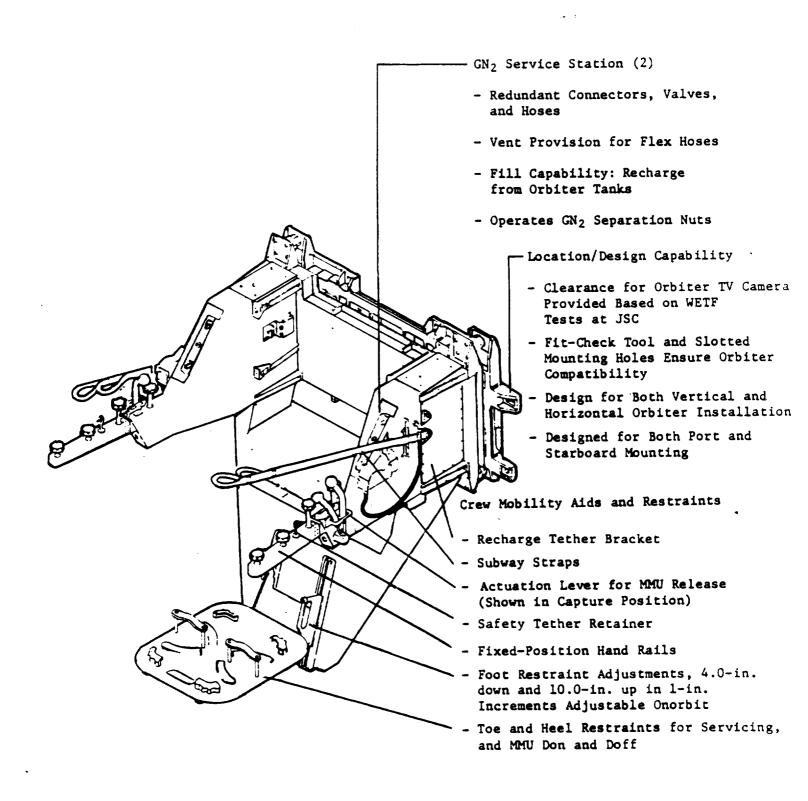
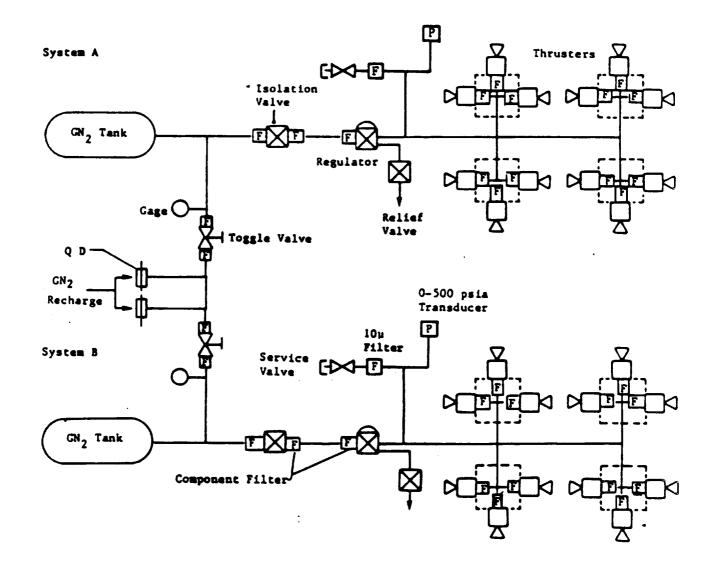


Figure 3 - FLIGHT SUPPORT STATION



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Figure 4 - PROPULSION SUBSYSTEM SCHEMATIC



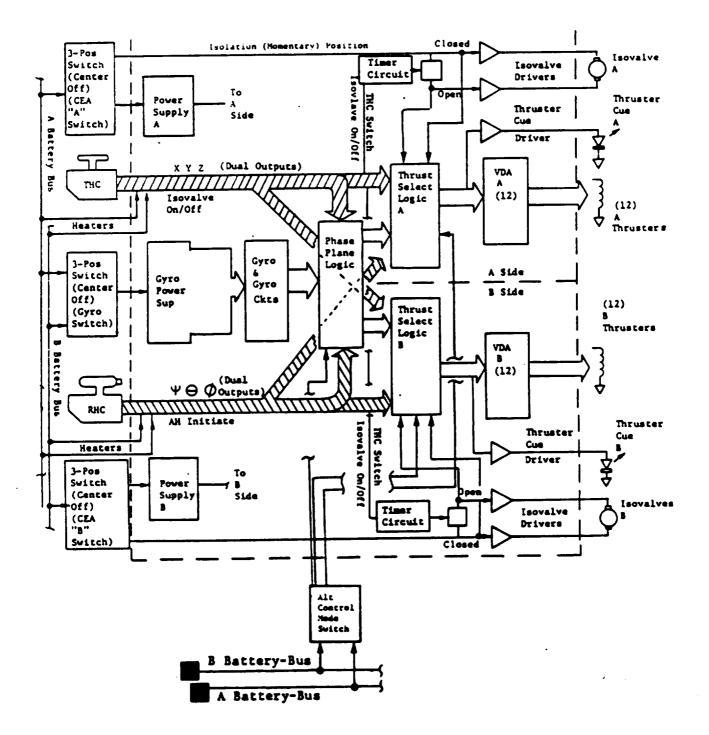


Figure 5 - ELECTRICAL/POWER SUBSYSTEM OVERVIEW

The CEA contains circuitry to operate the thruster valves of the propulsion system, and circuitry to respond to handcontroller 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. <u>Support Structures and Mechanisms</u> - 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. <u>Flight Support Station (FSS)</u> - 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.

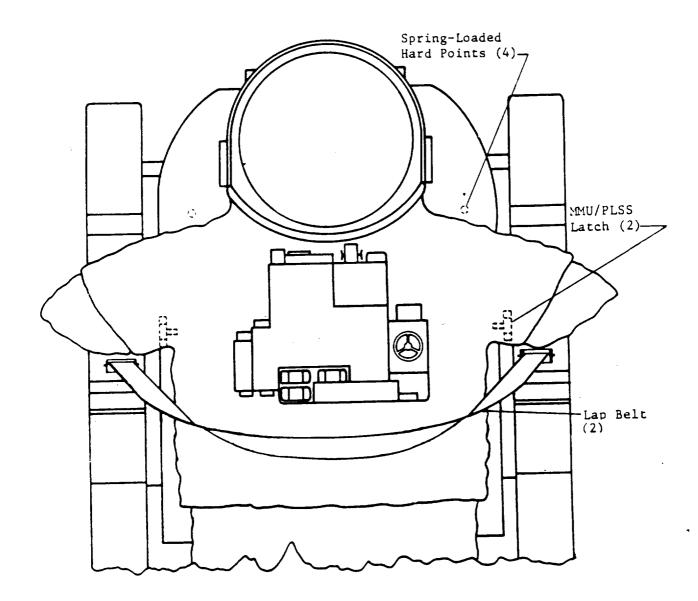


Figure 6 - MMU-EMU INTERFACES

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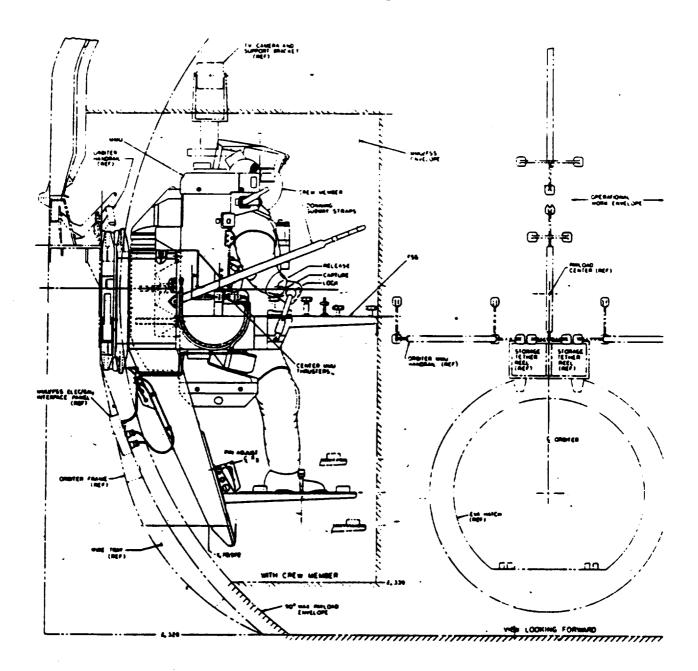


Figure 7 - MMU-FSS ENVELOPE - PORT SIDE

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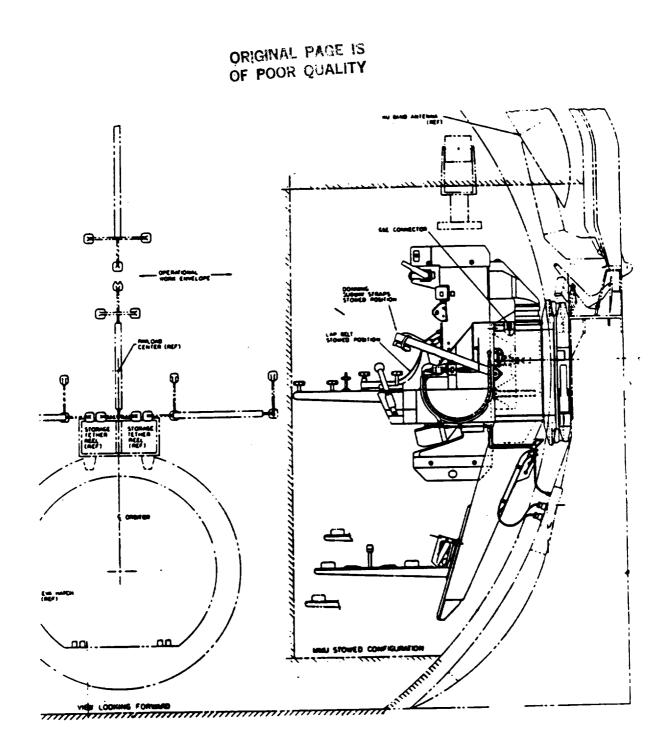
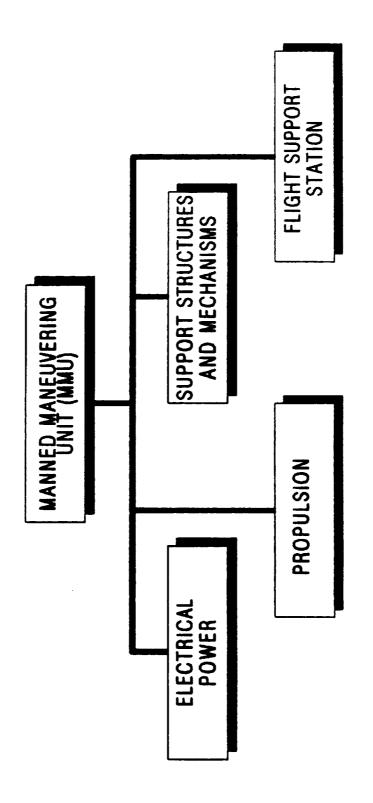
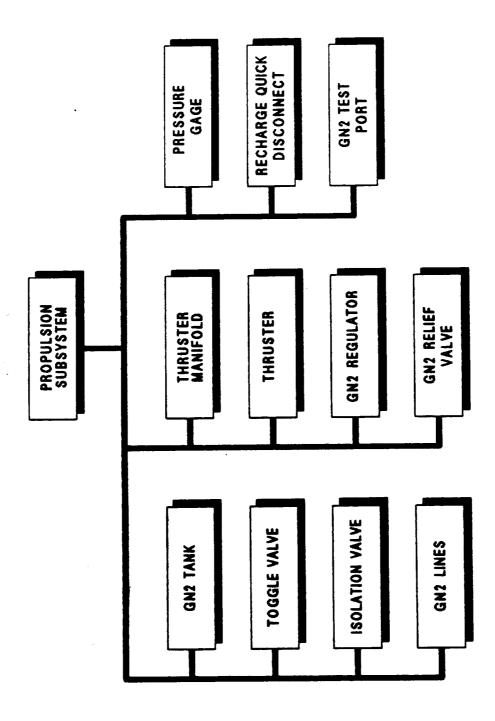


Figure 8 - MMU-FSS ENVELOPE - STARBOARD SIDE



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Figure 9 - MMU - TOP LEVEL HIERARCHY



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Figure 10 - PROPULSION SUBSYSTEM HIERARCHY

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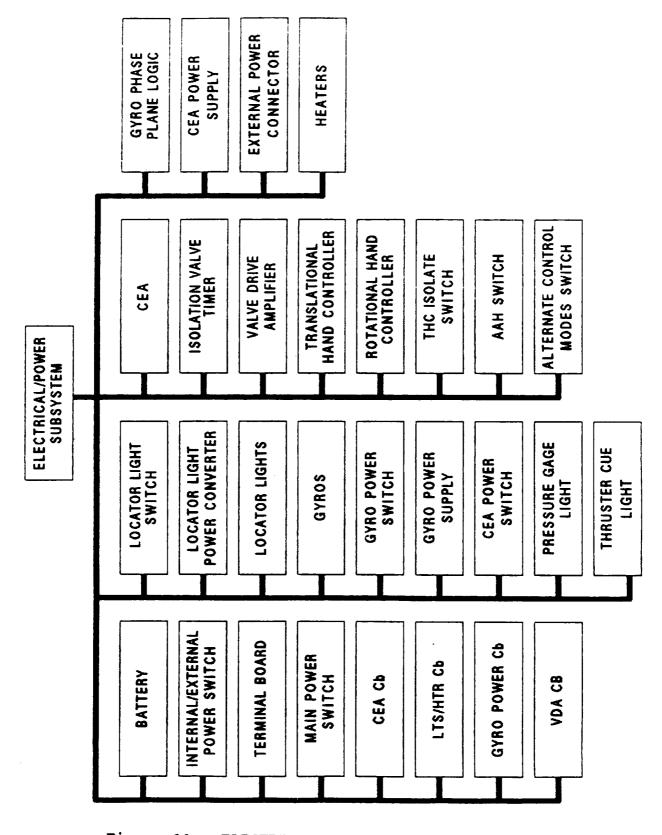
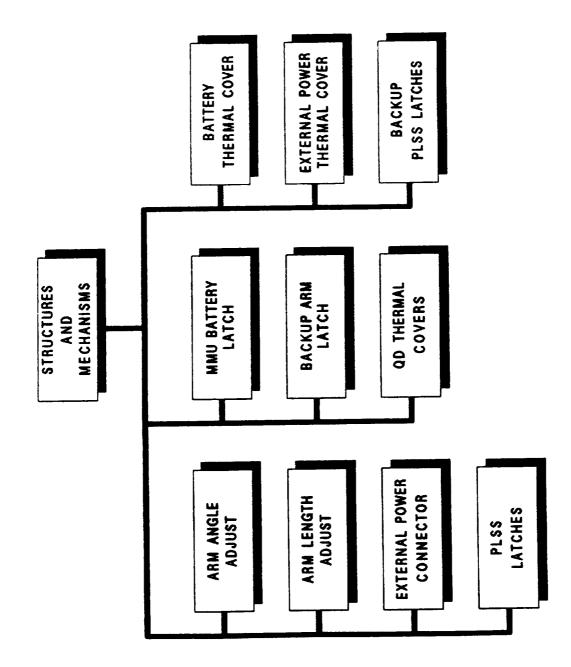
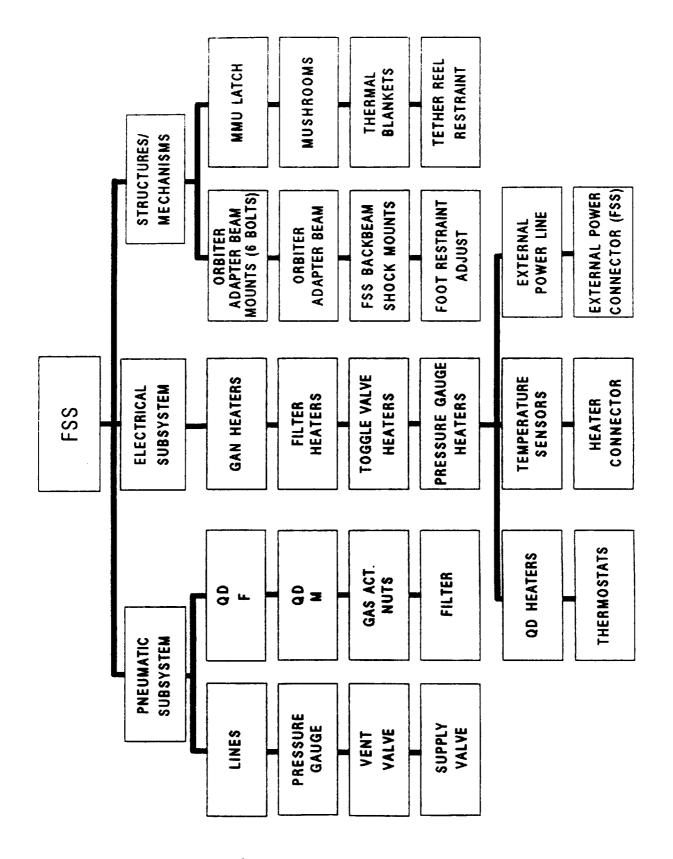


Figure 11 - ELECTRICAL/POWER SUBSYSTEM HIERARCHY



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Figure 12 - HIERARCHY OF SUPPORT STRUCTURES AND MECHANISMS



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Figure 13 - FSS HIERARCHY

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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 <u>NSTS-22206</u>. 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 <u>NSTS-22206</u>. 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.
 - 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.
 - 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 <u>NSTS-22206 FMEA/CIL</u> 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 Summar	y of IOA F	MEA Assessm	ent 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	22 49	28 43	16 37		
Structures and Mechanism	24	17	23		
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 Summary of IOA Recommended Failure Criticalities							
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Propulsion Electrical/ Power Structures and	1 9	23 26 3	2 8 12	6	8 17 10	2 21 10	36 87 35
Mechanism FSS	_	-	5	2	27	12	46
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 Recor	nmended	Critica	al Iter	ns
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

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

- 1. 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
CIL	-	Critical Items List
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
GN ₂	-	Gaseous Nitrogen
НŴ		Hardware
		Hand Controller
HUT	-	Hard Upper Torso
IOA	-	Independent Orbiter Assessment
IVA	-	Intravehicular Activity
JSC	-	Johnson Space Center
LED		
Lts	-	• =
MDAC	-	McDonnell Douglas Astronautic Company
MMU		Manned Maneuvering Unit
NSTS	-	
PCI	-	Potential Critical Item
PLB	-	Payload Bay
PLSS	-	Portable Life-Support System
QD	-	Quick Disconnect
RHC		
Sat Stab	-	Satellite Stabilization
SMM	-	
SOS	-	Space Operations Simulator
STS	-	Space Transportation System
TCS		
		Translational Hand Controller
TPAD	-	Trunnion Pin Attach Device
VDA	-	Valve Drive Amplifier

VDA - Valve Drive Amplifier

APPENDIX B

DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

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

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

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

INTACT ABORT DEFINITIONS:

<u>RTLS</u> - 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

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

 \underline{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

EARLY MISSION TERMINATION - termination of onorbit phase prior to planned end of mission

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

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

<u>MAJOR MODE (MM)</u> - major sub-mode of software operational sequence (OPS)

<u>MC</u> - Memory Configuration of Primary Avionics Software System (PASS)

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

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

OPS - software operational sequence

<u>PRIMARY MISSION OBJECTIVES</u> - worst case primary mission objectives are equal to mission objectives

PHASE DEFINITIONS:

<u>PRELAUNCH PHASE</u> - 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)

<u>ONORBIT PHASE</u> - begins at transition to OPS 2 or OPS 8 and ends at transition out of OPS 2 or OPS 8

<u>DEORBIT PHASE</u> - 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</u> <u>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.

 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

 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 (onorbit) 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: = Loss of life or vehicle 1 = Loss of mission or next failure of any redundant item 2 (like or unlike) could cause loss of life/vehicle = All others 3 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 = Baseline with Proposed Post 51-L Changes New CIL Item : X = Included in CILCompare Row : N = Non compare for that column (deviation)

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-100 1.1.2		1	NASA DATA: BASELINE [] NEW [X]				
	MMU 100 GN2 TANK							
LEAD ANALYST:	DUFFY, HUY	JFFY, HUYNH, SAIIDI						
ASSESSMENT:								
CRITICAL FLIGH	ITY RI	EDUNDANCY		CIL ITEM				
HDW/FU		В	C	2	LIEM			
NASA [2 /1R IOA [2 /1R] [P]] [P]] [P]] [P]] []	.]]	[X] * [X]			
COMPARE [/] [] [1][4]	[]			
RECOMMENDATIONS:	(If diff	ferent fro	om NASA)					
[/] [] [] [[] DD/DELETE)			
* CIL RETENTION D REMARKS: IOA AGREES WITH 2		(If appl:	Ā	ADEQUATE ADEQUATE	[] []			

REPORT DATE 02/18/88 C-2

ASSESSME ASSESSME NASA FME	NT I	ID:												DAT ELIN NE	Έ			
SUBSYSTE MDAC ID: ITEM:	M:		MMU 102 TOGGLI	e VA	/L/	VE												
LEAD ANA	LYS	T:	DUFFY	, н	JYI	NH,	SI	AI	I	I								
ASSESSMENT:																		
		TICAL FLIGH	ITY	F	Œ	DUNI	DAI	NC	Y	SCR	EENS	5				CII		
		DW/FU		2	1				В			С				* * *	•	
NASA IOA	[[3 /2R 3 /2R]	[] []	2]		((P P]]	[[P]]			[[]]	*
COMPARE	[/]	[]		[]	[N]			[]	
RECOMMEN	DAT	IONS:	(If	di	f	erer	nt	f	r	om N	asa))						
	[3 /2R]	[]	?]		[F]	[Ρ]	(AI	۲] D/D/D		ETE)
REMARKS:																		
IOA AGRE DETECTED	ES DU	WITH RING	THE FMI FLIGHT	EA, UN	H II	OWE	VE. HE	к, Т	l' Il'	IE W	f FA. HEN	ы О	NE '	TANF	נ א			BE

DETECTED DURING FLIGHT UNTIL THE TIME WHEN ONE TANK IS TO BE ISOLATED, OR A RECHARGE IS ATTEMPTED AFTER EVA.

.

BE

ASSESSME ASSESSME NASA FME SUBSYSTE	NT ID: A #:				NASA DATA: BASELINE [] NEW [X]				
MDAC ID: ITEM:		103							
LEAD ANA	LYST:	DUFFY,	UFFY, HUYNH, SAIIDI						
ASSESSMENT:									
	CRITICAI FLIGH		REDUND	ANCY SCR	EENS	CIL ITEM			
	HDW/FU		A	В	С	1164			
NASA IOA	[2 /2 [2 /2) [] [P] P]	[P] [P]	[] [P]	[X]* [X]			
COMPARE	[/] []	[]	[N]	[]			
RECOMMEN	DATIONS:	(If d	lifferen	t from N	ASA)				
	[/] []	[]		[] ADD/DELETE)			
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEOUATE []									
REMARKS: FAIL CLO LEFT BLA		A AGREES	WITH T	HE FMEA,	INADEQUATE BUT THE SCR				

REPORT DATE 02/18/88 C-4

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-104		N	IASA DATA: BASELINE NEW					
	MMU 104 ISOLATION	VALVE							
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI						
ASSESSMENT:									
CRITICAL FLIGH	ITY R	EDUNDANCY	SCREENS		CIL ITEM				
HDW/FU		В	C	2					
NASA [2 /1F IOA [2 /2	:] [P] [P] [F] [F] [] [F]	[X] * [X]				
COMPARE [/N] [] [] [N	1]	[]				
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)						
[2 /2] [] [] [] (A)	[] DD/DELETE)				
* CIL RETENTION	RATIONALE:	(If appl	7	ADEQUATE ADEQUATE	• •				

VALVE FAILED OPEN IS NOMINAL OPERATING POSITION. HOWEVER, IT WILL RESULT IN LOSS OF CAPABILITY TO ISOLATE THE GN2 TANK FROM THRUSTERS IN THE EVENT OF A DOWNSTREAM LEAK. LOSS OF FUNCTIONAL REDUNDANCY DOES NOT RESULT IN LOSS OF LIFE AS INDICATED BY THE FMEA. IOA CONSIDERS EVA LOST WITH THIS HARDWARE CRITICALITY, SINCE THIS FAILURE ALONE MAY BE ONE STEP AWAY FROM LOSS OF LIFE (EVA CREW BEING STRANDED WITH THIS FAILURE AND A LEAK) - CANCEL THE EVA AND RETURN TO ORBITER. AN ITEM OF MAJOR CONCERN IS THAT THIS FAILURE WILL NOT BE DETECTED UNTIL A SUBSEQUENT FAILURE WHICH REQUIRES ISOLATING THE

TANK FROM THE THRUSTERS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-105 1.4.2		NASA DAT. BASELIN NE	
SUBSYSTEM: MDAC ID: ITEM:	MMU 105 ISOLATION V	VALVE		
LEAD ANALYST:	DUFFY, HUYN	NH, SAIIC	DI	
ASSESSMENT:				
CRITICAL FLIGH HDW/FU	r	DUNDANCY B	SCREENS C	CIL ITEM
NASA [2 /1R IOA [2 /1R] [P]] [P]] [P] [F] []] [F]	[X]* [X]
COMPARE [/] []	и] (] [N]	[]
RECOMMENDATIONS:	(If diffe	erent fro	om NASA)	
[/	J (] [] [] (4	[] ADD/DELETE)
* CIL RETENTION 1 REMARKS:			ADEQUATE INADEQUATE	

IOA AGREES WITH THE FMEA CRITICALITY. HOWEVER THIS FAILURE WILL NOT BE DETECTED UNTIL THRUSTERS ARE TO BE FIRED, AND THEN THE EVA CREWPERSON COULD NOT DISTINGUISH THIS FAILURE FROM A SIMILAR FAILURE FROM REGULATORS, OR THRUSTERS SOLENOID VALVES.

ASSESSME ASSESSME NASA FME	NT ID:							ASA DATA BASELINE NEW	
SUBSYSTE MDAC ID: ITEM:		MMU 106 GN2 LI	NES	(ISO	L VL	V – RE	GUL	ATOR)	
LEAD ANA	LYST:	DUFFY,	HUY	уин,	SAII	DI			
ASSESSME	NT:								
	CRITICAL FLIGH		RI	EDUND	ANCY	SCREE	NS		CIL ITEM
	HDW/FU	NC	A		В		С		
NASA IOA	[1 /1 [2 /1R]	[P [P]]	[P [P]	[[P]	[X] * [X]
COMPARE	[N /N]	[]	[]	[N]	[]
RECOMMEN	DATIONS:	(If	dif	feren	t fr	om NAS	A)		
	[2 /1R	2]	[P]	[P]	[P) (A	[] .DD/DELETE)
* CIL RE	TENTION	RATIONA	LE:	(If	appl	icable	À	DEQUATE DEQUATE	
REMARKS: LEAK. T SHARPNEL									LIFE DUE 7 MODE

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.

C-7

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA BASELINE NEW	•		
	MMU 106 GN2 LINES	(REG-THRUSTER	S)			
LEAD ANALYST:	DUFFY, HUY	(NH, SAIIDI				
ASSESSMENT:						
CRITICAL FLIGH		EDUNDANCY SCRE	ENS	CIL ITEM		
HDW/FU		В	С	l i cm		
NASA [1 /1 IOA [2 /1R] [P]] [P]] [P]] [P]	[] [P]	[X]* [X]		
COMPARE [N /N] [] []	[N]	[]]		
RECOMMENDATIONS:	(If diff	ferent from NA	SA)			
[2 /1R] [P] [P]		[] DD/DELETE)		
* CIL RETENTION H	RATIONALE:	(If applicabl	e) ADEQUATE INADEQUATE	[] []		

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.

REPORT DATE 02/18/88 C-8

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA BASELINI NEV					
SUBSYSTEM: MDAC ID: ITEM:	MMU 106 GN2 LINES (1	XFEED VLV - XFEED VLV)					
LEAD ANALYST:	DUFFY, HUYN	H, SAIIDI					
ASSESSMENT:							
CRITICAL FLIGH HDW/FU	T	UNDANCY SCREENS B C	CIL ITEM				
NASA [1 /1 IOA [3 /3] [P]] [P]	[P] [] [P] [P]	[X]* [X]				
COMPARE [N /N] []	[N] [N]	[]				
RECOMMENDATIONS:	(If diffe	erent from NASA)					
[2 /1R] [P]	[P] [P] (.	[] ADD/DELETE)				
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS:							

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.

C-9

	12/05/86 MMU-106C 1.7.2	NASA DATA BASELINE NEW	•			
	MMU 106 GN2 LINES (TANK-I					
LEAD ANALYST:	DUFFY, HUYNH, SAI					
ASSESSMENT:						
CRITICAL FLIGH	CIL ITEM					
HDW/FU	—	в с	IIEM			
NASA [1 /1 IOA [2 /1R] [P] [] [P] [P] [] P] [P]	[X] * [X]			
COMPARE [N /N] [] [и] [И]	[]			
RECOMMENDATIONS:	(If different f	rom NASA)				
[2 /1R] [P] [[] DD/DELETE)			
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS:						
LEAK. LOSS OF G		SS OF A SYSTEM. L GS OPS COULD BE CA				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/8 MMU-110			NASA DATA BASELINE NEW			
SUBSYSTEM: MDAC ID: ITEM:	MMU 110 THRUSTE						
LEAD ANALYST:	DUFFY,	UFFY, HUYNH, SAIIDI					
ASSESSMENT:							
CRITICAI FLIGH		REDUNI	DANCY SCRE		CIL ITEM		
HDW/FU	INC	A	В	С			
NASA [/ IOA [2 /1F] [2] [] P]	[] [P]	[] [P]	[] * [X]		
COMPARE [N /N] [N]	[N]	[N]	[N]		
RECOMMENDATIONS:	(If d	ifferer	nt from NA	ISA)			
[2 /1F	2] [P]	[P]	[P] (A	[A] ADD/DELETE)		
* CIL RETENTION	RATIONAL	E: (If	applicabl	.e) ADEQUATE INADEQUATE			
REMARKS: LEAK.							

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-111	NASA DATA: BASELINE NEW					
SUBSYSTEM: MDAC ID: ITEM:	MMU 111 THRUSTER MANIFOLD						
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI						
ASSESSMENT:							
CRITICAL FLIGH		3	CIL ITEM				
HDW/FU	NC A B	С					
NASA [/ IOA [2/1R] [] [] [] [P] [P] [] P]	[] * [X]				
COMPARE [N /N] [N] [N] [И]	[N]				
RECOMMENDATIONS:	(If different from NASA)						
[2 /1R] [P] [P] [P] (AI	[A] DD/DELETE)				
* CIL RETENTION		ADEQUATE	[]				
REMARKS: CONSTRICTION.	IN	IADEQUATE	[]				

REPORT DATE 02/18/88 C-12

	12/05/86 MMU-112 1.6.2				NASA BASE	LINE]]
SUBSYSTEM: MDAC ID: ITEM:	MMU 112 THRUSTER							
LEAD ANALYST:	DUFFY, H	UYNH,	SAII	DI				
ASSESSMENT:								
CRITICAL FLIGH		REDUND	ANCY	SCREE	NS		CIL ITE	
HDW/FU		A	В		С			
NASA [2/1R IOA [2/1R		P] P]	[P [P]]	[] [P]		[X [X] *
COMPARE [/] []	[]	[N]		[]
RECOMMENDATIONS:	(If di	fferen	t fro	om NAS.	A)	. •		
[/] []	[]	[]	(A)] DD/D] ELETE)
* CIL RETENTION	RATIONALE	: (If	appl) ADEQU INADEQU		[[]
IOA AGREES WITH	THE FMEA.							

REPORT DATE 02/18/88 C-13

ASSESSME ASSESSME NASA FME	NT	I		MM	U-11		6							ASA DA BASELI N		
SUBSYSTE MDAC ID: ITEM:				MM 11 TH		ſEI	R									
LEAD ANA	LY	ST	:	DU	FFY,	, 1	HUY	YNH,	SA	II	DI					
ASSESSME	NT	:														
		F	ICAL LIGH	T				EDUNI	DAN		SCREI	EN			CIL ITEM	
		HD	W/FU	NC			A			В			С			
NASA IOA	[[3 2	/2R /1R]]		[[P P]	[[P P]]	[[P]]	[] * [X]	
COMPARE	[N	/N]		[]	[]	[N]	[N]	
RECOMMEN	DA'	rI(ons:		(If	đ	if	ferer	nt	fr	om NAS	5A)			
	[2	/1R]		[P]	[P]	[P]	[A] (ADD/DELETE)	
* CIL RE	TE	NT	ION	RAT	IONA	٩Ľ	Е:	(If	aŗ	pl	icable	≥)	AI	DEOUAT	CE []	

ADEQUATE [] INADEQUATE []

REMARKS:

FAIL CLOSED. LOSS OF CONTROL, SAT STAT, AND AAH RESULTING IN MISSION IMPACT OR EVA LOSS. FUNCTIONAL LOSS WILL LEAVE THE EVA CREWPERSON STRANDED DURING OPS.

ASSESSMENT D. ASSESSMENT I NASA FMEA #:	D: MMU-1	14		NASA DAT. BASELIN NE	
SUBSYSTEM: MDAC ID: ITEM:	MMU 114 THRUS	STER			
LEAD ANALYST	: DUFFY	, HUYNH,	SAIIDI		
ASSESSMENT:					
		REDUN	DANCY SCRE	EENS	CIL ITEM
	LIGHT W/FUNC	A	В	С	l i cm
NASA [2 IOA [2	/1R] /1R]	[P] [P]	[P] [P]	[] [P]	[X]* [X]
COMPARE [/]	[]	[]	[N]	[]
RECOMMENDATI	ONS: (II	f differe	nt from NA	ASA)	
[/]	[]	[]	[]]	[] ADD/DELETE)
* CIL RETENT	ION RATION	NALE: (If	applicabl	le) ADEQUATE INADEQUATE	
REMARKS: IOA AGREES W 113.	ITH THE FN	MEA, BASE	d on the H	EXPLANATION	GIVEN IN MMU-

ASSESSME ASSESSME NASA FME	NT I	D:	MMU-1	16				NASA DA Baseli N]
SUBSYSTE MDAC ID: ITEM:	M:		MMU 116 GN2 RI	EGUL	ATOR					
LEAD ANA	LYSI	::	DUFFY	, HU	YNH,	SAII	DI			
ASSESSME	NT:									
	F	ICAL	ſ				SCRE		CII ITE	
	HL	W/FUI	NC	A		B	Ì	С		
NASA IOA	[2 [2	2 /1R 2 /1R]]	[P [P]	[P [P	'] ']	[] [P]	[X [X] *]
COMPARE	[/]	[]	[]	[N]	[]
RECOMMEN	DATI	ONS:	(If	dif	feren	t fr	om NA	SA)		_
	[/]	[]	[]	[]	[(ADD/D] ELETE)
* CIL RE	TENI	ION I	RATION	ALE:	(If	appl	icabl	e) ADEQUAI INADEQUAI	•]
REMARKS:	ES W	י אידד	PHE EMI	E D	ношт	VFD	тите	FATIIDE C	•	J DDF-ODG

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 #:	12/05/86 MMU-117 1.2.3			NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 117 GN2 REGULI	ATOR			
LEAD ANALYST:	DUFFY, HUY	YNH, SZ	AIIDI		
ASSESSMENT:					
CRITICAL FLIGH		EDUNDAI	NCY SCREI	ENS	CIL ITEM
HDW/FU			В	С	
NASA [2 /1R IOA [2 /1R]]	[P] [P]	[] [P]	[X] * [X]
COMPARE [/] []	[]	[N]	[]]
RECOMMENDATIONS:	(If dif	ferent	from NAS	SA)	
[/] []	[]	[] (A	[] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If a	pplicable	e) ADEQUATE INADEQUATE	[]
REMARKS: IOA AGREES WITH	THE FMEA.				

REPORT DATE 02/18/88 C-17

ASSESSMI ASSESSMI NASA FMI	ENT	I	D:		MM			5									ASA DAT BASELIN NI		[]]	
SUBSYST MDAC ID ITEM:					MM 119 GN	9	EGI	JF	ATOR													
LEAD AND	ALY	ST	:		DUI	FFY,	, I	ΗUY	(NH,	Sž	AI	II	DI									
ASSESSM	ENT	:																				
		F	LI	ALI GHT FUN				RF A	EDUNI	DAI	NC	Y B	sc	REI	ENS	s c				IL TEN	1	
NASA IOA	[[3 2	1	2R 2]]		[[P P]]		[[P F]]		[[P]]		[[x]]	*
COMPARE	[N	/1	N]		[]		[N]		[N]		[N]	
RECOMME	NDA	TI	ON	s:		(If	d:	iff	ferer	nt	f	r	m	NAS	SA))						
]	2	1	1R]		[P]		נ	P]		[P		(AC				TE)
* CIL R	ETE	NT	10	N F	RAT	IONZ	LI	Ξ:	(If	aj	þţ)]j	lca	ıbl€)EQUATI)EQUATI		[]	
DEMADIZO																		-	L		1	

REMARKS:

LOSS OF PRESSURE REGULATION WITH VERY LOW TOLERANCE. FUNCTIONAL LOSS DURING OPS MAY LEAVE THE CREW STRANDED - POTENTIAL LOSS OF LIFE. THE FAILURE MODE MAY BE MORE APPROPRIATELY CALLED OUT OF TOLERANCE (HIGH/LOW RESPONSE) - SEE MMU-1191.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-120 1.2.2			NASA DATA BASELINE NEW								
SUBSYSTEM: MDAC ID: ITEM:	MMU 120 GN2 RELIE											
LEAD ANALYST:	DUFFY, HU	YNH, S	AIIDI									
ASSESSMENT:												
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM												
HDW/FU	NC A		В	С								
NASA [2 /1F IOA [2 /1F	[] [P]]]	[P] [P]	[] [P]	[X]* [X]							
COMPARE [/] []	[]	[N]	[]							
RECOMMENDATIONS:	(If dif	ferent	from NA	5A)								
[/] []	[]	[] (A	[] DD/DELETE)							
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []												
REMARKS: IOA AGREES WITH THE FMEA. IOA WITHDRAWS THE CAUSES OF THE FAILURE AND ACCEPTS THE FMEA CAUSES.												

ASSESSMENT DATE: 12/05/86 NASA DATA: ASSESSMENT ID: MMU-121 BASELINE [] NEW [X] NASA FMEA #: MMU SUBSYSTEM: MDAC ID: 121 ITEM: **GN2 RELIEF VALVE** LEAD ANALYST: DUFFY, HUYNH, SAIIDI ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C NASA [ASA [/] IOA [3 /1R] [] [] [] [P] [P] [P]] * 1 COMPARE [N/N] [N] [N] [N] []**RECOMMENDATIONS:** (If different from NASA) [3/2R] [P] [F] [P] [A] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [] INADEQUATE []

REMARKS:

FAIL CLOSED. THE RELIEF VALVE FAILED CLOSED DOES NOT POSE ANY IMMEDIATE PROBLEM. HOWEVER, THE VENT CAPABILITY IS LOST AND NOT 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).

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ASSESSME ASSESSME NASA FME	NT	ID:		MM	/05/ J-12 3.1		i								ASA DATA BASELINE NEW	E []
SUBSYSTE MDAC ID: ITEM:	M:			MMI 12: PRI	2	IRE	G	AGE	1									
LEAD ANA	LYS	T:		DU	FFY,	H	UY	NH,	S	AI	II	DI						
ASSESSME	NT:																	
	CRI						RE	DUN	DA	NC	Y	SCRE	EN	S			IL TEN	A
		FLI DW/		-			A				в			С		4		1
NASA IOA	[[2 / 2 /	1R 1R]]		[[P P]]		[[P P]]	[[P]	[x x] *]
COMPARE	[1]		[]		[]	[N]	[]
RECOMMEN	DAT	ION	s:		(If	di	fi	fere	nt	f	r	om NA	SA)				
	E	/]		[]		[]	[]		D/DI] ELETE)
* CIL RE	TEN	TIO	N I	RAT	IONF	LF	::	(If	a	pŗ	51	icabl			DEQUATE DEQUATE]
REMARKS: IOA AGRE		WIT	'H	FHE	FMI	EA.	,						-				•	

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ASSESSME ASSESSME NASA FME	NT	I		MM	J-12		6										A DAT SELIN NE	E	[[X		
SUBSYSTE MDAC ID: ITEM:				MMI 123 PRI	3	JR	EC	GAGE	E												
LEAD ANA	LYS	ST	:	DUI	FY,	, 1	HUY	ZNH,	S	A:	[]]	DI									
ASSESSME	NT	:																			
		F	ICAL LIGH	Г			RI	EDUN	IDA	N	CY	SC	REI	ENS	5				CII ITE		
	1	HDI	W/FUI	NC			A				В				С						
NASA IOA	[[3 3	/3 /3]] [P P]]		[[P F]		[[P]]			((]]	*
COMPARE	[/]		[]		[N]		[N]			[]	
RECOMMEN	DA'	FI (ONS:	((If	d:	iff	fere	ent	: 1	fro	m	NAS	SA))						
	נ	3	/2R]		[P]		[P]		[P]	(2	AD	[D/ D] EL	ETE)
* CIL RE	TEI	T.	ION	RATI	[ON]	ΔLJ	E:	(If	a	p	j li	lca	ble				UATE UATE		[r]	
REMARKS: LOSS OF	AC	ວບາ	RATE	GN2	2 PF	RES	SSI	JRE	IN	D]		TT	ON				-		•	•	WTT.T

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.

	12/05/86 MMU-124 1.8.2	5		NASA DAT. BASELIN NE	
MDAC ID:	MMU 124 PRESSURI	E GAGE			
LEAD ANALYST:	DUFFY, H	HUYNH, S	SAIIDI		
ASSESSMENT:					
CRITICAI FLIG		REDUND	NCY SCRI	CENS	CIL ITEM
HDW/FU	INC	A	В	с	
NASA [3 /3 IOA [3 /3] [] [P] P]	[P] [F]	[] [P]	[]*
COMPARE [/] []	[N]	[א]	[]
RECOMMENDATIONS	(If di	ifferent	: from NA	ASA)	
[3 /2]	2] [P]	[P]	[P] ([] ADD/DELETE)
* CIL RETENTION	RATIONALI	E: (If a	applicabl	Le) ADEQUATE INADEQUATE	
REMARKS: LOSS OF ACCURATE	E GN2 PRES	SSURE IN	IDICATION	~	

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.

ASSESSME ASSESSME NASA FME	NT ID:]	NASA DA' BASELII Ni	
SUBSYSTE MDAC ID: ITEM:	M:	MMU 125 RECHAR	GE (QUICK	DIS	CONNEC	CT		
LEAD ANA	LYST:	DUFFY,	HUY	ZNH, S	SAII	DI			
ASSESSME	NT:								
	CRITICAL FLIGH		RI	EDUNDA	ANCY	SCREE	ens		CIL ITEM
	HDW/FU		A		В		(2	
NASA IOA	[2 /2 [2 /2]]	[P [P]	[P [F]]	[[]] P]	[X] * [X]
COMPARE	[/]	[]	[N]	[]	ן א	[]
RECOMMEN	DATIONS:	(If	dif	ferent	t fro	om NAS	SA)		
	[3 /3	3	[]	נ]	[[D] (ADD/DELETE)
* CIL RE	TENTION	RATIONA	LE:	(If a	appl	icable	2	ADEQUATI ADEQUATI	
REMARKS:	N/LEAK.	NO TMP	АСТ	STNC	ና ጥዝገ	E XFEE		~	ARE CLOSED. A

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.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-125A	NASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 125 RECHARGE QUICK DISCONNECT		
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI		
ASSESSMENT:			
CRITICAI FLIGH	LITY REDUNDANCY SCREEN	S	CIL ITEM
	INC A B	С	
NASA [3 /2F IOA [2 /2	C] [P] [P] [] [P] [F] [] P]	[] * [X]
COMPARE [N /N] [] [М] [N]	[N]
RECOMMENDATIONS:	(If different from NASA	.)	
[3/3	3 [3 [3 [] (Al	[] DD/DELETE)
	RATIONALE: (If applicable)	ADEQUATE NADEQUATE	[] []
REMARKS: FAIL OPEN/LEAK. FURTHERMORE, TH	NO IMPACT SINCE THE XFEEL 2 QD's HAVE CAP'S INSTALLED	VALVES AR	E CLOSED, AND CONNECT FROM

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.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-126 1.3.3		N	IASA DATA BASELINE NEW	•
SUBSYSTEM: MDAC ID: ITEM:	MMU 126 RECHARGE	QUICK DIS	CONNECT		
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI		
ASSESSMENT:					
CRITICAL FLIGH		EDUNDANCY	SCREENS		CIL ITEM
HDW/FU		. В	c	2	1 I EM
NASA [3 /2R IOA [3 /2R] [P] [P] [P] [P] [] [F	,]]	[] *
COMPARE [/] [] [] [N	i]	[]]
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)		
[/] [] [] [] (Al	[] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl	A	DEQUATE	[]
REMARKS: TOA AGREES WITH	THE EMEA	WITH THE	EXCEPTION	በ ጥዝልጥ የፑሪ	THARGE

IOA AGREES WITH THE FMEA, WITH THE EXCEPTION THAT RECHARGE CAPABILITY/ACTIVITY IS PART OF THE POST-OPS PHASE AND NOT PREP AS INDICATED BY THE FMEA.

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REPORT DATE 02/18/88 C-26

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NASA DATA: ASSESSMENT DATE: 12/05/86 BASELINE [] NEW [X] ASSESSMENT ID: MMU-127 NASA FMEA #: MMU SUBSYSTEM: 127 MDAC ID: GN2 TEST PORT ITEM: LEAD ANALYST: DUFFY, HUYNH, SAIIDI ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT HDW/FUNC A B C NASA [/] [] [] [] [] * IOA [2 / 1R] [P] [P] [P] [X] COMPARE [N/N] [N] [N] [N] RECOMMENDATIONS: (If different from NASA) [2/1R] [P] [P] [P] [A] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE []]

REMARKS:

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-128			NASA DAT BASELIN NE						
	MMU 128 BATTERY									
LEAD ANALYST: DUFFY, HUYNH, SAIIDI										
ASSESSMENT:										
CRITICAL FLIGH		EDUNDA	ANCY SCR	EENS	CIL ITEM					
HDW/FU	NC A		В	с						
NASA [2 /1R IOA [2 /1R]	[P] [P]	[] [P]	[X]* [X]					
COMPARE [/] []	[]	[N]	[]					
RECOMMENDATIONS:	RECOMMENDATIONS: (If different from NASA)									
[/] []	[]		[] ADD/DELETE)					
* CIL RETENTION		(If a	applicab	le) ADEQUATE INADEQUATE						
IOA AGREES WITH	THE FMEA.									

REPORT DATE 02/18/88 C-28

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:								
SUBSYSTEM: MDAC ID: ITEM:	MMU 129 INTERNAL/I							
LEAD ANALYST:	DUFFY, HUY	YNH, SAIII	DI					
ASSESSMENT:								
CRITICAL FLIGH	T	EDUNDANCY		CIL ITEM				
HDW/FU	NC A	В	С					
NASA [/ IOA [2 /1R] [] [P] [] [P] []] [P]	[] * [X]				
COMPARE [N /N] [N] [N] [И]	[N]				
RECOMMENDATIONS: (If different from NASA)								
[2 /1R	[P] [P] [P]	[A] (ADD/DELETE)				
* CIL RETENTION	RATIONALE:	(If appl:		QUATE [] QUATE []				
REMARKS:			INADE	QUATE []				

REPORT DATE 02/18/88 C-29

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ASSESSMI ASSESSMI NASA FMI	ENT	I	D:	MM	12/05/86 NASA DAT MMU-130 BASELIN 3.14.3 NE]]]							
SUBSYSTI MDAC ID: ITEM:				13	MMU 130 INTERNAL/EXTERNAL POWER SWITCH																
LEAD AND	ALYS	ST	:	DU	FFY,	, 1	HU	YNH,	SA	AII)	DI										
ASSESSMI	ENT	:																			
	CR		ICAI LIGH	LITY			RI	EDUNI	DAN	ICY	SCR	EEI	NS					IL Fen	x		
	I		W/FU				A			В				С			±.		1		
NASA IOA	[[2 2	/2 /2]]		[[P P]]	[[P P]]		(Р]		[[X X]]	*	
COMPARE	[/]		[]	[]	l	[N]		[]		
RECOMMEN	IDA	FI (ONS	:	(If	d:	if	fere	nt	fr	om N	ASI	A)								
	[1]		[]	[]	[[]	(AI] DD/	/DI] SLF	ETE)	
* CIL RI		NT:	ION	RAT	IONZ	ALI	E:	(If	aŗ	opl:	icab	•			EQUAT		[[]		
REMARKS	:																				

NO EFFECT DURING MMU OPS SINCE THIS IS NORMAL POSITION. DURING THE FIRST PRE AND POST-OPS IT WILL RESULT IN LOSS OF DIRECT 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.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-130A	NASA D BASEI	DATA: LINE [] NEW [X]						
SUBSYSTEM: MDAC ID: ITEM:	MMU 130 INTERNAL/EXTER								
LEAD ANALYST:	C: DUFFY, HUYNH, SAIIDI								
ASSESSMENT:									
	LITY REDUNI HT	DANCY SCREENS	CIL ITEM						
HDW/F	JNC A	B C							
NASA [2 /2 IOA [2 /2] [P]] [P]	[P] [] [P] [P]	[X]* [X]						
COMPARE [/] []	[] [И]	[]						
RECOMMENDATIONS	: (If differe)	nt from NASA)							
[/] []	[][]	[] (ADD/DELETE)						
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []									
REMARKS: THE FAILURE MODE, ELECTRICALLY FAILS IN INT POSITION, AS STATED BY THE FMEA, IS NOT CREDIBLE. THE SWITCH IS A MULTI- 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									

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.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-131			1	NASA DATA BASELINE NEW					
SUBSYSTEM: MDAC ID: ITEM:	MMU 131 INTERNA	L/EX	TERNAL	POWER SW	ІТСН					
LEAD ANALYST:	DUFFY,	HUYN	H, SAII	DI						
ASSESSMENT:										
CRITICAL FLIGH		RED	UNDANCY	SCREENS		CIL ITE				
HDW/FU	NC	A	В	(C					
NASA [2/2 IOA [2/1R] [] [P] P]	[P [P] []] P]	[X [X] *]			
COMPARE [/N] []	C] []	ן א	[]			
RECOMMENDATIONS:	RECOMMENDATIONS: (If different from NASA)									
[2 /1R] [P]	[P] []		ן נס/סכ] ELETE)			
* CIL RETENTION	RATIONAL	Æ: (If appl:		ADEQUATE ADEQUATE	[]			
REMARKS: NO EFFECT DURING	PRE/POS	T OP	S ACTIVI							

NO EFFECT DURING PRE/POST OPS ACTIVITY SINCE THAT IS ITS NOMINAL 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 #:				NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 131 Internal,	/EXTERN	AL POWER	SWITCH	
LEAD ANALYST:	DUFFY, H	UYNH, S	AIIDI		
ASSESSMENT:					
CRITICAL FLIGH	JITY I	REDUNDA	NCY SCREI	Ens	CIL ITEM
HDW/FU	INC .	A	В	С	
NASA [2/2 IOA [2/1F] [] [P] P]	[P] [P]	[] [P]	[X] * [X]
COMPARE [/N] []	[]	[N]	[]
RECOMMENDATIONS:	(If di	fferent	from NAS	SA)	
[3 /3] []	[]	[] (A	[D] .DD/DELETE)
* CIL RETENTION	RATIONALE	: (If a	pplicable	e) ADEQUATE INADEQUATE	
REMARKS: THIS FMEA FAILUF				N-CREDIBLE,	SINCE THE

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 AND THE BATTERIES IF THE MAIN POWER SWITCH REMAINS ON. THIS CASE WAS REJECTED SINCE DURING EXT POWER.

REPORT DATE 02/18/88

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-132			ASA DATA: BASELINE NEW	•		
	MMU 132 TERMINAL						
LEAD ANALYST:	DUFFY, HU	IYNH, SAIII	DI				
ASSESSMENT:							
CRITICAL FLIGH	ITY R T	REDUNDANCY	SCREENS		CIL ITEM		
HDW/FU	NC A	В	С				
NASA [/ IOA [2 /1R] [] [P) [P] [] [P]]	[] * [X]		
COMPARE [N /N] [N	и] [И] [N]	[N]		
RECOMMENDATIONS:	(If dif	ferent fro	om NASA)				
[2 /1R] [₽	P] [P] [P		[A] DD/DELETE)		
* CIL RETENTION	RATIONALE:	(If appl:	A	DEQUATE	[]		
REMARKS:			INA	DEQUATE	[]		

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ASSESSMENT DATE: 12/05/86 NASA DATA: BASELINE [] NEW [X] ASSESSMENT ID: MMU-133 NASA FMEA #: SUBSYSTEM: MMU MDAC ID: 133 ITEM: TERMINAL BOARD LEAD ANALYST: DUFFY, HUYNH, SAIIDI ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM A В С HDW/FUNC [] [] [] [] [P] [P] [P] [X] NASA [/] IOA [2 /1R]] * COMPARE [N/N] [N] [N] [N] [N]RECOMMENDATIONS: (If different from NASA) [2/1R] [P] [P] [P] [A] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] **REMARKS:**

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	• •			NASA DATA BASELINE NEW	
MDAC ID:	MMU 134 MAIN POWE	R SWITC	сн		
LEAD ANALYST:	DUFFY, HU	YNH, SA	IIDI		
ASSESSMENT:					
CRITICAL FLIGH		EDUNDAN	ICY SCREI	ENS	CIL ITEM
HDW/FU	-		В	С	IIEM
NASA [2/2 IOA [2/1R] [P] [P		P] P]	[] [P]	[X]* [X]
COMPARE [/N] [] (1	[N]	[]
RECOMMENDATIONS:	(If dif	ferent	from NAS	SA)	
[2 /1R] [P	') ([P]	[P] (A	[] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If ap	plicable	2) ADEQUATE INADEQUATE	
REMARKS:					. J

THE FMEA CONSIDERED THIS FAILURE DURING PREP ONLY WHEN THE BATTERY POWER IS TURNED OFF (SWITCH OFF). HOWEVER, DURING OPS PERIOD, THE INADVERTENT SWITCHING ACTION TO OFF POSITION MUST BE CONSIDERED DUE TO SHOCK OR VIBRATION. THIS LATER CASE MAY BE ANALYZED BY A SEPARATE FMEA.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA: Baseline New			
•••••	MMU 134 MAIN POWER SWI	ІТСН			
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI			
ASSESSMENT:					
CRITICAL FLIGH	ITY REDUNI	DANCY SCREENS	CIL ITEM		
HDW/FU		B C			
NASA [2 /1R IOA [2 /1R	[P] [P]	[P] [] [P] [P]	[X]* [X]		
COMPARE [/] []	[] [И]	[]		
RECOMMENDATIONS:	(If differen	nt from NASA)			
[2 /2] [].	[][] (A)	[] DD/DELETE)		
* CIL RETENTION	RATIONALE: (If	applicable) ADEQUATE INADEQUATE	[]		
REMARKS: THIS FAILURE SHOULD ONLY CONSIDER A SINGLE CONTACT OPEN OR CLOSED 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 MUL-1354 FOR A SINGLE CONTACT CLOSED.					

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.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA: BASELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 135 MAIN POWER SWITCH	
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI	
ASSESSMENT:		
CRITICAL FLIGH		IS CIL ITEM
HDW/FU	NC A B	C
NASA [3 /3 IOA [2 /2] [] [] [] [P] [P] [] []* P] [X]
COMPARE [N /N] [И] [И] [N] [N]
RECOMMENDATIONS:	(If different from NASA	2)
[/] [] [] [] [] (ADD/DELETE)
* CIL RETENTION REMARKS: IOA AGREES WITH		ADEQUATE [] NADEQUATE []

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA: BASELINE [] NEW [X]	
	MMU 135 MAIN POWER	SWITCH		
LEAD ANALYST:	DUFFY, HUYN	NH, SAIIDI		
ASSESSMENT:				
CRITICAL FLIGH	r	OUNDANCY SCREENS	ITEM	
HDW/FU	NC A	В	С	
NASA [3 /3 IOA [2 /2] [P]] [P]] [P] [] [P] [P] []*	
COMPARE [N /N] []] [] [м] [М]	
RECOMMENDATIONS:	(If diffe	erent from NASA)		
[1 /1] []	ן נין נ] [A] (ADD/DELETE	:)
* CIL RETENTION	RATIONALE: (ADEQUATE [] ADEQUATE []	
REMARKS: THIS FAILURE DUR	ING THE FIRS	ST PRE-OPS WILL	APPLY A 28V POWER	тс

THIS FAILURE DURING THE FIRST PRE-OPS WILL APPLY A 28V POWER TO THE BATTERY. THIS MAY RESULT IN BATTERY EXPLOSION CAUSING A POTENTIAL FOR LOSS OF LIFE/VEHICLE.

SUBSYSTEM: MDAC ID:	MMU-136 3.9.1 MMU 136		:	NASA DATA BASELINE NEW	
ITEM:	LTS/HTR.c	d: D			
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI		
ASSESSMENT:					
CRITICAL FLIGH	ITY R T	EDUNDANCY	SCREENS		CIL ITEM
HDW/FU		В	I	с	
NASA [2 /1R IOA [2 /1R] [P]] [P) [P] [P] [] P]	[X] * [X]
COMPARE [/] [] [] []	N]	[]
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)		
[/] [] [] [] (A)	[] DD/DELETE)
* CIL RETENTION		(If appl		ADEQUATE ADEQUATE	[]
IOA AGREES WITH	INE FMEA.				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-137			NASA DATA BASELINE NEW	
	MMU 137 LTS/HTR	.Cb			
LEAD ANALYST:	DUFFY,	HUYNH, SA	IIDI		
ASSESSMENT:					
CRITICAL FLIGH		REDUNDAN	CY SCREEN	S	CIL ITEM
HDW/FU		Α	В	С	
NASA [2 /1R IOA [3 /2R] [P][P][P][P][] P]	[X]* []
COMPARE [N /N] [] [] [N]	[N]
RECOMMENDATIONS:	(If d	ifferent	from NASA	.)	
[3 /3] [ן נ	່ງ [] [`] (A	[D] DD/DELETE)
* CIL RETENTION	RATIONAL	E: (If ap	plicable)		
			I	ADEQUATE NADEQUATE	
REMARKS: THE FMEA AND ORI CURRENT) HAS ALR THIS SCENARIO IS SHOULD BE STUDIE THE CB FAILED CL DETECTABLE UNLES	EADY OCC MULTIPL D SEPARA OSED HAS	URED AND LE FAILURE TELY. NO CONSE	THE CB HA CASE FOF QUENTIAL	S ALSO FAI WHICH THE EFFECT, AN	LED CLOSED. FAILURES

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.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			1	NASA DATA BASELINE NEW	-			
SUBSYSTEM: MDAC ID: ITEM:	MMU 138 CEA CIRCU							
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI					
ASSESSMENT:								
CRITICAL FLIGH	ITY R T	EDUNDANCY	SCREENS		CIL ITEM			
HDW/FU	NC A	В	C	2				
NASA [2 /1R IOA [2 /1R] [P] [P] [P]] [P] []) }	[X] * [X]			
COMPARE [/] [] [] []	4]	[]			
RECOMMENDATIONS:	(If dif:	ferent fro	om NASA)					
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* CIL RETENTION	RATIONALE:	(If appl:	7	ADEQUATE ADEQUATE	[]			
REMARKS: IOA AGREES WITH	THE FMEA.							

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-139 3.8.2			ASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 139 CEA CIRCU	IT BREAKE	R		
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI		
ASSESSMENT:					
CRITICAL FLIGH HDW/FU	T	EDUNDANCY B			CIL ITEM
NASA [2 /1R IOA [3 /2R] [P]] [P] [] [P]]	[X]* []
COMPARE [N /N] [] [] [N]	[N]
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)		
[3 /3] [] [] [] (Al	[D] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl	A	DEQUATE DEQUATE	

FMEA AND ORIGINAL IOA STUDY ASSUMED A FAILURE ALREADY IN PROGRESS WHICH DRAWS OVERCURRENT AND THE CB HAS FAILED CLOSED. THIS IS MULTIPLE FAILURE SCENARIO AND INCONSISTENT WITH THE FMEA PROCEDURE. THIS FAILURE POSES NO MAJOR PROBLEM EXCEPT FOR LOSS OF ABILITY TO DENY POWER TO THE CEA. HOWEVER, THE POWER MAY BE DENIED BY CEA OR MAIN POWER SWITCH IF NEEDED. THIS FAILURE IS NOT DETECTABLE UNTIL AN OVERCURRENT FAILURE OCCURS.

C-43

ASSESSME Assessme NASA FME	NT ID:	:	• •	40								ASA I Basei	LINE	-]
SUBSYSTE MDAC ID: ITEM:	M:		MMU 140 GYRO I												
LEAD ANA	LYST:		DUFFY	, н	UY	NH,	SA	II	DI						
ASSESSME	NT:														
	CRITIC FLI	CALI [GH]]	RE	DUND.	AN	СҮ	SCRE	EN	S			CIL ITE	•
	HDW/	FUI	NC	į	A			В			С				
NASA IOA	• •	/2R /3]]	[]	P P]	[[P P]	[[Р]]		[[] *]
COMPARE	[/	'N]	[]	[]	[N]		[]
RECOMMEN	DATION	is:	(If	di	ff	eren	t	fr	om NA	SA)				
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* CIL RE	TENTIC	ON I	RATION	ALE	:	(If	ap	pl:	icabl	·		DEQUA DEQUA		[[]]
IOA AGRE	ES WIT	נ איז	THE FM	EA.											

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	• •			NASA DATA BASELINE NEW	
MDAC ID:	MMU 141 GYRO PWR	сb			
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI		
ASSESSMENT:					
CRITICAL FLIGH		EDUNDANCY	SCREENS	5	CIL ITEM
HDW/FU	NC A	. В		с	
NASA [2/2 IOA [3/2R] [P]] [P]) [P] [P] [] [] P]	[X]* []
COMPARE [N /N] [] [] [N]	[N]
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)	
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* CIL RETENTION	RATIONALE:	(If appl		ADEQUATE NADEQUATE	
REMARKS: FMEA AND ORIGINA WHICH DREW OVERC	L IOA STUD URRENT WHI	Y ASSUMED LE THE CE	A FAIL	URE ALREAD ILED CLOSE	Y IN PROGRI D. THIS

RESS WHICH DREW OVERCURRENT WHILE THE CB HAD FAILED CLOSED. THIS SCENARIO IS MULTIPLE FAILURE CASE AND SHOULD NOT BE CONSIDERED. THIS CB FAILED CLOSED HAS NO EFFECT SINCE IT 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.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-142 3.7.1			NASA DATA: BASELINE NEW	•
	MMU 142 VDA Cb				
LEAD ANALYST:	DUFFY, HU	YNH, SAI	IDI		
ASSESSMENT:					
CRITICAL FLIGH		EDUNDANC	Y SCREEN:	S	CIL ITEM
HDW/FU			В	с	11EM
NASA [2 /1R IOA [2 /1R] [P]] [P) [] [P] [P] [] P]	[X]* [X]
COMPARE [/] [] [] [N]	[]
RECOMMENDATIONS:	(If dif	ferent f	rom NASA)	
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IOA AGREES WITH	THE FMEA.				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-143 3.7.2				NASA DA BASELI 1		x]
	MMU 143 VDA cb						
LEAD ANALYST:	DUFFY, H	JYNH, S	SAIID				
ASSESSMENT:							
CRITICAI FLIGH		REDUNDA	NCY	SCREEN	S	CI	L EM
HDW/FU		A	В		С		
NASA [2 /1F IOA [3 /2F		P] P]	[P [P] [] [] P]	[[X] *]
COMPARE [N /N] []	[] [N]	[ן א
RECOMMENDATIONS:	(If di	fferent	c fro	om NASA	.)		
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* CIL RETENTION	RATIONALE	: (If a	appli		ADEQUA']]
THE FMEA AND OR	IGINAL IOA	STUDY	ASSU	IMED A	FAILURE	ALREA	DY IN

THE FMEA AND ORIGINAL IOA STUDY ASSUMED A FAILURE ALREADY IN PROGRESS WHICH DRAWS OVERCURRENT WHILE THE CB HAS FAILED CLOSED. THIS CASE IS MULTIPLE FAILURE SCENARIO AND SHOULD NOT DRIVE THE 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.

C-47

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-144		NASA DATA: BASELINE NEW	•
	MMU 144 LOCATOR LIGHT :	SWITCH		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI		
ASSESSMENT:				
CRITICALI FLIGHT	C	ANCY SCREENS	3	CIL ITEM
HDW/FUN	NC A	В	с	
NASA [3 /3 IOA [3 /3] [P]] [P]	[P] [[P] [] F]	[] * []
COMPARE [/] []	[]][]	N]	[]
RECOMMENDATIONS:	(If different	t from NASA)		
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REMARKS: IOA AGREES WITH T BE LEFT BLANK.	THE FMEA, BUT TH			

REPORT DATE 02/18/88 C-48

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ASSESSMENT I ASSESSMENT I NASA FMEA #:	[D:		44A					ASA DATA BASELINE NEW		-
SUBSYSTEM: MDAC ID: ITEM:		MMU 144 LOCATO								
LEAD ANALYST	C:	DUFFY	, HU	YNH,	SAII	DI				
ASSESSMENT:										
	FICAL		R	EDUNI	DANCY	SCRE	ENS		CIL ITE	
	DW/FU		А		В		C	2		
NASA [3] IOA [3]	3 /3 3 /3]]	[P [P]	[P [P]	[[F] 7]	[[] *]
COMPARE [1]	[]	[]	[]	1]	ſ]
RECOMMENDAT	IONS:	(If	dif	fere	nt fr	om NA	SA)			
ľ	/]	[]	[]	[] (2] ADD/D] DELETE)
* CIL RETEN	FION	RATION	ALE:	(If	appl	icabl	A	ADEQUATE ADEQUATE	-]]
REMARKS: IOA AGREES N	HTIW	THE FM	EA C	RIT	WITH			WING TWO		

5: 1) SCREENS DO NOT APPLY - SHOULD BE LEFT BLANK 2) THE FAILURE MODE SHOULD ADDRESS ANY SINGLE CONTACT FAILED IN EITHER OPEN OR CLOSED POSITION. THIS FAILURE SEEMS TO BE A SINGLE CONTACT OPEN - SEE ALSO MMU-145A FOR A SINGLE CONTACT CLOSED.

ASSESSME ASSESSME NASA FME	NT ID		12/05/86 MMU-145 3.17.3							iasa Base	LINE	-]]
SUBSYSTE MDAC ID: ITEM:			MMU 145 LOCATO										
LEAD ANALYST: DUFFY, HUYNH, SAIIDI													
ASSESSME	NT:												
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM													
	HDW	/FUN	iC	A			B		С	2			
NASA IOA	[3 [3	/3 /3]]	[P [P]]	[[P P]]	[[P]		[[] *]
COMPARE	[/]	[]	[]	[N]		[]
RECOMMEN	DATIO	NS:	(If	dif	ferer	nt i	fro	om NA	SA)				
	[/]	[]	[]	[]	(A)] Elete)
* CIL RE	* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []												
REMARKS: IOA AGRE	ES WI	тн 1	THE FMI	EA, I	BUT I	HE	sc	REEN	s sh	OULD	BE 1	LEFT	BLANK.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				NASA DATA BASELINE NEW]				
	MMU 145 LOCATOR LI									
LEAD ANALYST:	DUFFY, HUY	YNH, SAII	DI							
ASSESSMENT:										
CRITICAL FLIGH	ITY RI T	EDUNDANCY	SCREEN	S	CIL ITEN	1				
HDW/FU	NC A	В		С						
NASA [3 /3 IOA [3 /3] [P]] [P] [P]] [P] [] [] P]	[[] *]				
COMPARE [/] [] [] [N]	ſ]				
RECOMMENDATIONS:	(If dif:	ferent fr	om NASA)						
[/] [] [] []	[ADD/DI] ELETE)				
* CIL RETENTION	RATIONALE:	(If appl		ADEQUATE NADEQUATE]				
REMARKS: IOA AGREES WITH	THE FMEA,	BUT THE S	CREENS	SHOULD BE	LEFT	BLANK				

IOA AGREES WITH THE FMEA, BUT THE SCREENS SHOULD BE LEFT BLANK. ALSO THE FAILURE MODE IS MORE APPROPRIATELY DEFINED AS A SINGLE CONTACT CLOSED FOR THIS CASE.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-146 3.17.3	NASA D BASEL	
SUBSYSTEM: MDAC ID: ITEM:	MMU 146 LOCATOR LIGHT		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICAL FLIGH	ſ	ANCY SCREENS	CIL ITEM
HDW/FUI	NC A	B C	
NASA [3 /3 IOA [3 /3] [P]] [NA]	[P] [] [NA] [NA]	[] *
COMPARE [/	ן א ן	[N] [N]	[]
RECOMMENDATIONS:	(If different	t from NASA)	
[/] []	[]][]]	[] (ADD/DELETE)
* CIL RETENTION P	ATIONALE: (If a	applicable) ADEQUA INADEQUA	
REMARKS: IOA AGREES WITH T	THE FMEA, BUT TI	HE SCREENS SHOULD	BE LEFT BLANK.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-146A	NASA DATA: BASELINE NEW									
SUBSYSTEM:MMUMDAC ID:146ITEM:LOCATOR LIGHT SWITCH											
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI									
ASSESSMENT:											
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM											
	NC A	ВС									
NASA [3 /3 IOA [3 /3] [P]] [NA]	[P] [] [NA] [NA]	[] * []								
COMPARE [/] [N]	[N] [N]	[]]								
RECOMMENDATIONS:	(If differe	nt from NASA)									
[/] []	[] [] (A)	[] DD/DELETE)								
* CIL RETENTION	RATIONALE: (If										
	ADEQUATE [] INADEQUATE []										
REMARKS: IOA AGREES WITH ALSO, THE FAILUR CONTACT CLOSED.	REMARKS: IOA AGREES WITH THE FMEA, BUT THE SCREENS SHOULD BE LEFT BLANK. ALSO, THE FAILURE MODE IS MORE APPROPRIATELY STATED AS A SINGLE										

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-147		NASA DATA: BASELINE [NEW [X								
	DAC ID: 147										
LEAD ANALYST: DUFFY, HUYNH, SAIIDI											
ASSESSMENT:											
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM											
HDW/FU	-	В	С								
NASA [3/3 IOA [3/2R] [P]] [P]] [P] [P] [] [P] [] [] *]						
COMPARE [/N] [ז נ] [М] [3						
RECOMMENDATIONS:	(If diff	erent fro	om NASA)								
[/] [] [] [] [(ADD/1] DELETE)						
* CIL RETENTION	RATIONALE:	(If appli	AD	EQUATE [EQUATE []						
REMARKS: IOA AGREES WITH	THE FMEA, B	UT THE SC	REENS SHO	ULD BE LEF	BLANK.						

ASSESSME ASSESSME NASA FME	NT ID	:	MMU-1	48							ASA DAT BASELIN NE			
SUBSYSTE MDAC ID: ITEM:			MMU 148 LIGHT											
LEAD ANA	LYST:		DUFFY	, H	JYNH	, SAI	II	DI						
ASSESSME	NT:													
		CAL IGH	ITY]	REDU	NDANC	CY	SCI	REENS	5		CII ITE	-	
	HDW)				A		В			С		***		
NASA IOA	[3] [3]	/3 /3]	[P] P]	[[P P]]	[[P]]	[[] *]	
COMPARE	[]	/]	[]	[]	[N]	[]	
RECOMMEN	DATIO	NS:	(If	di	ffer	ent f	fro	om 1	NASA)				
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* CIL RE									I	NAI	DEQUATI DEQUATI	Ξ [-	
IOA AGRE	ES WI	TH	THE FM	EA,	BUT	THE	S	CRE	ens a	SHO	OULD BI	E LEFI	BLAN	IK.

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ASSESSMENT DATE:	12/05/86	NASA DATA:
ASSESSMENT ID:	MMU-149	BASELINE []
NASA FMEA #:	3.16.1	NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 149 GYRO POWER SWITCH	

LEAD ANALYST: DUFFY, HUYNH, SAIIDI

ASSESSMENT:

	CRITICALITY FLIGHT					REDUNDANCY SCREENS								CIL ITEM		
	H		i/FU	-		A			В	1		С				
NASA IOA	[[3 3	/3 /3]]		P NZ			P N] A]] [AN		[[]]	*
COMPARE	[/]	E	N]	[N]	[ן א		[]	

RECOMMENDATIONS: (If different from NASA)

[3 /2R]	[P]	[P]	[P]	[]
				(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

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 MAINTAIN ALTITUDE MANUALLY AS A BACK-UP REDUNDANCY TO AUTOMATIC CONTROL.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-150 3.16.2	IMU-150 BASELINE								
SUBSYSTEM: MDAC ID: ITEM:	MMU 150 GYRO POWEF	R SWITCH								
LEAD ANALYST:	DUFFY, HUY	(NH, SAII	DI							
ASSESSMENT:										
CRITICAI FLIGH		EDUNDANCY	SCREENS		CIL ITEM	1				
HDW/FU		В	, c	:		-				
NASA [3 /3 IOA [3 /3] [P]] [P] [P]]) [] [N] [A]	[[] *]				
COMPARE [/] [] [] [N	r]	[]				
RECOMMENDATIONS	(If dif	ferent fr	om NASA)							
[/] [] [] [] (A] 10/00] Elete)				
* CIL RETENTION	RATIONALE:	(If appl	1	ADEQUATE	[ſ]				
REMARKS: IOA AGREES WITH	THE FMEA,	BUT THE S		-	•	BLANK.				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-151 3.3.6	NASA DATA: BASELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 151 GYRO POWER SUPPLY	
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI	
1000000		

ASSESSMENT:

		TICAL FLIGH			REDUNDANCY SCREENS							CIL ITEM		
	Н	DW/FU	NC		A			В			С			
NASA IOA	[[3 /3 3 /3]]	[[P P]]	[[P P]]	[[] NA]	[[] *]	
COMPARE	נ	/]	ſ]	ſ]	[NJ	[]	

RECOMMENDATIONS: (If different from NASA)

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				(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE	[]
INADEQUATE	Č	Ĩ

REMARKS:

THIS FAILURE WILL PREVENT AAH OPERATION, BUT, MANUAL ATTITUDE CONTROL IS AVAILABLE THROUGH RHC TO COMPENSATE FOR THE LOSS. HOWEVER, SOME MISSIONS (SOLAR MAX) WILL REQUIRE AAH OPERATION IN 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 DATE: ASSESSMENT ID: NASA FMEA #:	MMU-151A			NASA DATA BASELINE NEW	
MDAC ID:	MMU 151 GYRO POWE	R SUPP	PLY		
LEAD ANALYST:	DUFFY, HU	YNH, S	AIIDI		
ASSESSMENT:					
CRITICAL FLIGH		EDUNDA	NCY SCRE	ENS	CIL ITEM
HDW/FU	-		В	С	
NASA [3 /3 IOA [3 /3] [P]] [P]	[P] [P]	[] [NA]	[] * []
COMPARE [/] []	[]	[N]	[]
RECOMMENDATIONS:	(If dif	ferent	: from NA	SA)	
[3 /2R] [P]	[P]	[P] (A	[] .DD/DELETE)
* CIL RETENTION	RATIONALE:	(If a	applicabl	e) ADEQUATE INADEQUATE	
REMARKS: THIS FAILURE WII	L PREVENT	аан оі	PERATION,	BUT, MANUAI	ATTITUDE

THIS FAILURE WILL PREVENT AAH OPERATION, BUT, MANUAL ATTITUDE CONTROL IS AVAILABLE THROUGH RHC TO COMPENSATE FOR THE LOSS. HOWEVER, SOME MISSIONS (SOLAR MAX) WILL REQUIRE AAH OPERATION IN 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.

ASSESSME ASSESSME NASA FME	NT	I	D:	M	2/05/ W-15 12.5	52	5									DATA ELINE NEW	[
SUBSYSTE MDAC ID: ITEM:	M:			MN 15 CH		W	ER	SWI	TCH	I										
LEAD ANA	LY:	ST	:	DL	JFFY,	, 1	HU	/NH,	SZ	11	D	I								
ASSESSME	NT	:																		
		F	ICAL: LIGH: W/FUI	r	-		RI A	EDUN	IDAN	ICY E		sc	REEN	s c				il Fen		
NASA IOA	[[2 2	/1R /1R]		[[P P]]	[F	5]	[[Р]]		[[X X]	*
COMPARE	[/]		[]	[]	ָר	N]		[]	
RECOMMEN	'DA'		ONS:		(If	d:	if	fere	ent	fr	:0	m	NASA)						
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(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE	[]
INADEQUATE	[]

REMARKS:

IOA ACCEPTS THE PREP CRITICALITY AND REJECTS THIS FAILURE MODE FOR THE FLIGHT PHASE DUE TO FOLLOWING REMARKS: 1) THE FAILURE MODE "MECHANICALLY JAMS IN ISO" IS NOT REALISTIC BECAUSE THE SWITCH IS PLACED IN "ON" POSITION THROUGHOUT THE FLIGHT PHASE, AND NO MORE CREW ACTION IS ANTICIPATED/REQUIRED, 2) THE FMEA ASSUMES A FAILURE ALREADY IN PROGRESS WHICH WOULD WARRANT SWITCHING ACTION FROM "ON" TO "ISO", AND THEN JAMMING IN "ISO" POSITION. THIS IS MULTIPLE FAILURE SCENARIO, AND INCONSISTENT WITH THE NSTS-22206 GROUND RULES, 3) AN INADVERTENT OPERATION DOES NOT APPLY EITHER BECAUSE IN ORDER TO ARRIVE AT A 2/1R CRIT, THE SWITCH MUST GO THROUGH TWO FAILURES: A. INADVERTENT OPERATION FROM "ON" TO "ISO", B. "ISO" POSITION JAMMED RIGHT AFTER INADVERTENT OPERATION WHICH WOULD PREVENT THE EVA CREW FROM REACTIVATING/SWITCHING BACK TO "ON" POSITION. THEREFORE, FLIGHT CRITICALITY IS NOT APPLICABLE, AND PREP CRIT IS ACCEPTED WHICH WOULD PREVENT FLIGHT PHASE MMU OPS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-152A	NASA DATA: Baseline New	
	MMU 152 CEA POWER SWITCH		
LEAD ANALYST:	DUFFY, HUYNH, SAI	IDI	
ASSESSMENT:			
CRITICAL		CY SCREENS	CIL ITEM
FLIGH HDW/FU	NC A	вС	
NASA [2 /1R IOA [2 /1R] [P] [] [P] [P][] P][P]	[X]* [X]
COMPARE [/] [] [ן א]	[]
RECOMMENDATIONS:	(If different i	from NASA)	
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* CIL RETENTION	RATIONALE: (If app	plicable) ADEQUATE INADEQUATE	
FOR & STNGLE CON	TACT OPEN AND CLOSED IN ISO PINS	FAILURE MODE SHOUL SED. THIS FMEA SEE DUE TO CONTAMINATIO	D BE STUDIED M TO BE A

HOWEVER, THE POSSIBILITY OF THE SWITCH BEING IN "ON" POSITION (DURING FLIGHT) AND HAVING A SHORT ACROSS "ISO" OR "OFF" POSITIONS SHOULD BE INVESTIGATED ESPECIALLY IN REGARD TO THE ISOLATION VALVE POSITION.

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SUBSYSTE MDAC ID: ITEM:					MN 15 CE		OW	ER	SW	ITC	СН												
LEAD ANA	LY	ST	:		DU	JFFY	, 1	HU	YNH	, 9	SAI	[II]	DI										
ASSESSME	ENT	:																					
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COMPARE	[N	/1	1]		[]		[]		[N]			[N]	
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REMARKS:														J	LN	AL	ъQu	JATE		L		1	

THE FAILURE OF THIS SWITCH (MECHANICALLY JAMMED IN "ON" POSITION) POSES NO IMMEDIATE PROBLEM SINCE IT FAILED IN NORMAL OPERATING POSITION. HOWEVER, IT WILL DENY CAPABILITY FOR CLOSING A SYSTEM CEA DUE TO A FAILURE - THIS ACTION CAN BE COMPENSATED FOR, THROUGH MAIN POWER SWITCH OR THE THC HANDLE (SHUTS OFF BOTH ISO VALVE, TURN OFF MAIN POWER SWITCHES, REACTIVATES THE GOOD MAIN POWER SWITCH) AND RETURN TO ORBITER.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA BASELINE NEW	
MDAC ID:	MMU 153 CEA POWER SWI	Ітсн		
LEAD ANALYST:	DUFFY, HUYNH,	, SAIIDI		
ASSESSMENT:				
CRITICAI FLIGH		NDANCY SCRE	ENS	CIL ITEM
HDW/FU		В	с	
NASA [2 /1F IOA [3 /3	[P]] [P]	[P] [P]	[] [F]	[X]* []
COMPARE [N /N] []	[]	[И]	[N]
RECOMMENDATIONS:	(If differe	ent from NA	SA)	
[3 /3] []	[]		[D] .DD/DELETE)
* CIL RETENTION	RATIONALE: (I	f applicabl	.e) ADEQUATE INADEQUATE	
REMARKS: THE FAILURE (ELE IDENTIFIED AS A		r open for	EITHER "ISO"	OR "OFF"

IDENTIFIED AS A SINGLE CONTACT OPEN FOR EITHER "ISO" OR "OFF" POSITIONS. THE INABILITY TO TURN OFF A CEA WILL HAVE THE SAME EFFECT AS THE SWITCH FAILED MECHANICALLY IN "ON" POSITION - MMU-153.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-154			NASA DATA: BASELINE [] NEW [X]					
MDAC ID:	MMU 154 CEA POWER								
LEAD ANALYST:	LEAD ANALYST: DUFFY, HUYNH, SAIIDI								
ASSESSMENT:									
CRITICAL FLIGH HDW/FU	r		CY SCREE	NS C	CIL ITEM				
] [P]	()	[X]*				
NASA [2/1R IOA [2/1R	j (P	ĵ (ΡĴ	[P]	[X]* [X]				
COMPARE [/] [] []	[N]	[]				
RECOMMENDATIONS: (If different from NASA)									
[2 /2] [] [] -		[] ADD/DELETE)				
* CIL RETENTION	RATIONALE:	(If app) ADEQUATE INADEQUATE					
REMARKS: IOA ACCEPTS THE	PREP PHASE	CRITICA	LITY, B	UT REJECTS	THE OPS/FLI				

IOA ACCEPTS THE PREP PHASE CRITICALITY, BUT REJECTS THE OPS/FLT PHASE CRITICALITY BASED ON THE EXPLANATION GIVEN FOR MMU-152.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				NASA DATA: BASELINE [] NEW [X]					
MDAC ID:	MMU 154 CEA POWER	SWITCH							
LEAD ANALYST:	LEAD ANALYST: DUFFY, HUYNH, SAIIDI								
ASSESSMENT:									
CRITICAL FLIGH	ITY R	EDUNDAN	CY SCREEN	IS	CIL ITEM				
HDW/FU			В	с					
NASA [2 /1F IOA [2 /1F] [P] [P) [] [P] [P] [] P]	[X]* [X]				
COMPARE [/] [] [] [ן א]	[]				
RECOMMENDATIONS: (If different from NASA)									
[/] [] [] [[] (A	[] DD/DELETE)				
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS:									
IOA ACCEPTS THE CRITICALITY, BUT SUGGEST THAT THE FAILURE MODE									

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.

REPORT DATE 02/18/88

C-65

ASSESSMENT DATE: 12/05/86 NASA DATA: BASELINE [ASSESSMENT ID: MMU-155] NEW [X] NASA FMEA #: SUBSYSTEM: MMU MDAC ID: 155 ITEM: CEA POWER SWITCH LEAD ANALYST: DUFFY, HUYNH, SAIIDI ASSESSMENT: REDUNDANCY SCREENS CRITICALITY CIL FLIGHT ITEM HDW/FUNC A B C NASA [[] [P] [] * [] [] [] [P] [P]] IOA [3 /3] COMPARE [N/N] [N] [N] [N] []**RECOMMENDATIONS:** (If different from NASA) ſ 1 (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] **REMARKS:** THIS FAILURE MODE IS SAME AS EITHER "FAILED IN ON" OR "FAILED IN OFF" AS STUDIED BY MMU-153 AND MMU-154 RESPECTIVELY. THIS

REPORT DATE 02/18/88

ANALYSIS MAY BE WITHDRAWN.

C-66

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA: BASELINE [] NEW [X]						
MDAC ID:	MMU 156 PRESSURE (GAGE LIGH	IT						
LEAD ANALYST:	DUFFY, HUY	YNH, SAII	DI						
ASSESSMENT:									
CRITICALITY FLIGHT		EDUNDANCY	SCREEN	IS	CIL ITEM				
	NC A	E	3	С					
NASA [3 /2R IOA [3 /3] [P]] [P]] []) [] [] P]	[] *				
COMPARE [/N] [] [] [ן א]	[]				
RECOMMENDATIONS: (If different from NASA)									
[· · /] [] [] [[] (A	[] DD/DELETE)				
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []									
REMARKS: IOA AGREES WITH THE FMEA, SINCE THE TOTAL LOSS OF PRESSURE GAGE WILL RESULT IN LOSS OF CREWPERSON ABILITY TO DETECT GN2 LEVEL A									

IOA AGREES WITH THE FMEA, SINCE THE TOTAL LOSS OF PRESSURE 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.

ASSESSME ASSESSME NASA FME	NT I	D:	12/05/86 MMU-157 3.3.4					NASA DATA: BASELINE [] NEW [X]				
SUBSYSTE MDAC ID: ITEM:			MMU 157 THRUSTER CUE LT.									
LEAD ANA	ANALYST: DUFFY, HUYNH, SAIIDI											
ASSESSMENT:												
CRITICALITY FLIGHT			F	REDUNDANCY SCREE			REENS	Ins			l Em	
	HD	W/FU	NC	A	L	В			С			
NASA IOA	[3 [3	/3 /3]	[] [])]	[P [P]]	[[P]]	[[] *]
COMPARE	[/]	[]	[]	[N]	[ן
RECOMMENDATIONS: (If different from NASA)												
	[1]	[]	[]	נ] ADD/I] DELETE)
* CIL RETENTION RATIONALE: (If applicable)												
DENIDVO								IN		DEQUATE DEQUATE]
REMARKS: IOA IS IN AGREEMENT WITH FMEA, BUT THE SCREEN SHOULD BE LEFT BLANK. SEE ALSO MMU-157A (3.20.1).												

REPORT DATE 02/18/88 C-68

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ASSESSME ASSESSME NASA FME	NT I		MMU-						NASA DATA: BASELINE [] NEW [X]					
SUBSYSTE MDAC ID: ITEM:			MMU 157 THRU											
LEAD ANA	LYST	:	DUFF	DUFFY, HUYNH, SAIIDI										
ASSESSMENT:														
CRITICALITY REDUNDANCY						Y S	CREEN	S			CIL ITEN	a		
		LIGH W/FU	NC	A	1	B C			1 1 EM					
NASA IOA	[3 [3	/3 /3]]	[] []	>] >]	[[P] P]	[[P]]		[[]]	*
COMPARE	[/]	[]	[]	C	N]		[]	
RECOMMEN	DATI	ons:	(I	f dif	fere	ent f	iron	NASA)					
	[/]	[]	[]	[]	(A] וס/סם		TE)
* CIL RE	* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []													
IOA IS I BLANK.	N AG						BU	JT THE	S	CREEN	SH	OULD	BE	LEFT

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-158		NASA DATA BASELINE NEW	•
SUBSYSTEM: MDAC ID: ITEM:	MMU 158 Control E	LECTRONICS ASS	EMBLY	
LEAD ANALYST:	DUFFY, HU	YNH, SAIIDI		
ASSESSMENT:				
CRITICAL FLIGH	T	EDUNDANCY SCRE	ENS	CIL ITEM
HDW/FU	NC A	B	С	
NASA [/ IOA [2/1R] [] [P] []] [P]	[] [P]	[] * [X]
COMPARE [N /N) [М] [N]	[N]	[N]
RECOMMENDATIONS:	(If dif	ferent from NA	SA)	
[2 /1R] [P] [P]		[A] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If applicabl	ADEQUATE	• •
REMARKS:			INADEQUATE	L J

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-159	NASA DATA: BASELINE [] NEW [X]					
MDAC ID:	MMU 159 CONTROL ELECTRONICS ASSEM	BLY					
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI						
ASSESSMENT:							
CRITICAL		S CIL ITEM					
FLIGH HDW/FU	NC A B	С					
NASA [2 /1R IOA [2 /1R	[P] [P] [] [P] [P] [] [X]* P] [X]					
COMPARE [/] [] [] [] [[]] [и					
RECOMMENDATIONS:	(If different from NASA)					
[/] [] [] [] [] (ADD/DELETE)					
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []							
REMARKS: IOA IS IN AGREEMENT WITH THE FMEA, HOWEVER, EACH PIECE OF ELECTRONIC EQUIPMENT IN THE CEA SHOULD BE STUDIED SEPARATELY AND ITS FAILURE MODE(S) INVESTIGATED.							

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-160 3.3.3	NASA DATA: BASELINE [] NEW [X]				
SUBSYSTEM: MDAC ID: ITEM:	MMU 160 CONTROL ELECTRONICS ASSE	MBLY				
LEAD ANALYST: DUFFY, HUYNH, SAIIDI						
ASSESSMENT:						
CRITICALI FLIGHT HDW/FUN	r	NS CIL ITEM C				
NASA [2/2 IOA [2/1R] [P] [P]] [P] [P]	[] [X] * [P] [X]				
COMPARE [/N] [] []	[и] []				
RECOMMENDATIONS:	(If different from NAS	A)				
[2 /1R] [P] [P]	[P] [] (ADD/DELETE)				
* CIL RETENTION F	ATIONALE: (If applicable) ADEQUATE [] INADEQUATE []				

REMARKS:

THE ERRATIC RESPONSE FROM THE THRUSTERS MAY FORCE THE EVA CREWPERSON TO SHUTDOWN A SYSTEM IN ORDER TO MAINTAIN ATTITUDE CONTROL. LOSS OF BOTH SIDES UNDER SEVER ERRATIC RESPONSE MAY LEAVE THE EVA CREWPERSON STRANDED. SEE ALSO NOTE MMU-159.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/80 MMU-161 3.3.3	6		NASA DATA BASELINE NEW			
SUBSYSTEM: MDAC ID: ITEM:	MMU 161 CONTROL	ELECTRO	EMBLY				
LEAD ANALYST:	DUFFY, H	DUFFY, HUYNH, SAIIDI					
ASSESSMENT:							
CRITICAL FLIGH		REDUNDA	NCY SCREI	Ens	CIL ITEM		
HDW/FU		A	В	С			
NASA [2 /2 IOA [2 /1R] [] [P] P]	[P] [P]	[] [P]	[X]* [X]		
COMPARE [/N] []	[]]	[N]	[]		
RECOMMENDATIONS:	(If d	ifferent	: from NAS	5A)			
[2 /1R	.) [P]	[P]	[P] (A	[] .DD/DELETE)		
* CIL RETENTION	RATIONAL	E: (If a	applicable	e) ADEQUATE INADEQUATE	[]		
REMARKS: The erratic resp	ONSE FROI	M THE TH	IRUSTERS 1	MAY FORCE TH	E EVA		

THE ERRATIC RESPONSE FROM THE THRUSTERS MAY FORCE THE EVA CREWPERSON TO SHUTDOWN A SYSTEM IN ORDER TO MAINTAIN ATTITUDE CONTROL. LOSS OF BOTH SIDES UNDER SEVER ERRATIC RESPONSE MAY LEAVE THE EVA CREWPERSON STRANDED. SEE ALSO NOTE MMU-159.

ASSESSMEN ASSESSMEN NASA FMEA	T ID:	12/05/86 MMU-162			NASA DATA BASELINE NEW	-		
SUBSYSTEM MDAC ID: ITEM:	:	MMU 162 ISOLATION						
LEAD ANALYST: DUFFY, HUYNH, SAIIDI								
ASSESSMEN	ASSESSMENT:							
с	RITICAL FLIGH HDW/FU	T		ANCY SCR B	EENS	CIL ITEM		
	•			_	-			
NASA IOA	[2 /2] [] [P]	[] [F]	[P]	[] * [X]		
COMPARE	[N /N] [N]	[N]	[N]	[N]		
RECOMMEND	ATIONS:	(If dif	feren	t from N	ASA)			
	[2 /2] []	[]		[A] DD/DELETE)		
* CIL RET REMARKS:	ENTION 1	RATIONALE:	(If a	applicab	le) ADEQUATE INADEQUATE	[] []		

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-163		NASA DATA BASELINE NEW				
MDAC ID:	MMU 163 ISOLATION						
LEAD ANALYST:	DUFFY, HUY	YNH, SAII	DI				
ASSESSMENT:	ASSESSMENT:						
CRITICAL FLIGH HDW/FU	T	EDUNDANCY E		с	CIL ITEM		
•				1	r] *		
NASA [/ IOA [2 /2] [P] [F	rj [P]	[] * [X]		
COMPARE [N /N] [N] [N	1] [N]	[N]		
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)				
[2 /2] [] [] [] (A	[A] DD/DELETE)		
* CIL RETENTION	RATIONALE:	(If app]		ADEQUATE ADEQUATE			
REMARKS:							

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ASSESSME Assessme NASA FME	NT ID:		12/05/86 MMU-164					NASA DAI BASELIN NE	
SUBSYSTE MDAC ID: ITEM:	M:	MMU 164 ISOLATI							
LEAD ANA	LYST:	DUFFY,	HUY	NH, S	SAII	DI			
ASSESSME	ASSESSMENT:								
(CRITICAL FLIGH		RI	EDUNDA	ANCY	SCRE	ens		CIL ITEM
	HDW/FU	NC	A		В			с	
NASA IOA	[/ [2 /1R) [] [Р]	[[F]]	[] P]	[] * [X]
COMPARE	[N /N] [N]	[N]	[N]	[N]
RECOMMEN	DATIONS:	(If d	lifi	ferent	t fr	om NAS	SA)		
	[2 /1R] [P]	[F]	[[A] ADD/DELETE)
	* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []								
REMARKS: CONTINUO	US SIGNA	L TO THE	: 15	SOLAT	ION	VALVE	MO	TOR TO C	LOSE THE VAL

MAY BURN THE MOTOR AND DRAIN THE BATTERY.

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ASSESSMENT DA ASSESSMENT ID NASA FMEA #:	MMU-1	L66		BASELINE	NASA DATA: BASELINE [] NEW [X]			
SUBSYSTEM: MDAC ID: ITEM:	MMU 166 Valvi	E DRIVER						
LEAD ANALYST:	DUFF	Y, HUYNH,	SAIIDI					
ASSESSMENT:								
	ALITY GHT	REDUN	DANCY SCRI	EENS	CIL ITEM			
HDW	FUNC	A	В	С				
NASA [2] IOA [2]	1R] 1R]	[P] [P]	[F] [F]	[] [P]	[X]* [X]			
COMPARE []	[]	[]	[N]	[]			
RECOMMENDATIO	s: (I	f differe	nt from NA	ASA)				
[]	[]	[]	[] (A	[] DD/DELETE)			
* CIL RETENTI	N RATIO	NALE: (If	applicab	le) ADEQUATE INADEQUATE	[] []			
REMARKS: IOA IS IN AGR	EMENT W	ITH THE F	MEA - SEE	ALSO REMARKS	FOR MMU-159.			

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-167		DATA: ELINE [] NEW [X]				
SUBSYSTEM: MDAC ID: ITEM:	MMU 167 Valve Driver						
LEAD ANALYST:	DUFFY, HUYNH	DUFFY, HUYNH, SAIIDI					
ASSESSMENT:							
CRITICAL FLIGH	T	NDANCY SCREENS	CIL ITEM				
HDW/FU	NC A	B C					
NASA [/ IOA [2 /1R] []] [P]	[] [] [P] [P]	[] * [X]				
COMPARE [N /N] [И]	[N] [N]	[N]				
RECOMMENDATIONS:	(If differ	ent from NASA)					
[2 /1R] [P]	[P] [P]	[A] (ADD/DELETE)				
* CIL RETENTION	RATIONALE: (I	ADEQU					
REMARKS: FAIL ON		INADEQU	JATE []				

NASA DATA: ASSESSMENT DATE: 12/05/86 BASELINE [ASSESSMENT ID: MMU-168] NEW [X] NASA FMEA #: SUBSYSTEM: MMU MDAC ID: 168 VALVE DRIVER AMPLIFIER ITEM: LEAD ANALYST: DUFFY, HUYNH, SAIIDI ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С В HDW/FUNC A IASA [/] IOA [2 /1R] [] [] [] [P] [P] [P] NASA [[]* ΓΧΊ COMPARE [N/N] [N] [N] [N] **RECOMMENDATIONS:** (If different from NASA) [] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE 1 **REMARKS:** NOISY THIS ANALYSIS MAY BE WITHDRAWN.

ASSESSME ASSESSME NASA FME	NT ID:		69					ASA DATA BASELINE NEW	•
SUBSYSTE MDAC ID: ITEM:		MMU 169 TRANS	LATI	ONAL	HAND	CONT	ROLL	ER	
LEAD ANA	LYST:	DUFFY	UFFY, HUYNH, SAIIDI						
ASSESSME	ASSESSMENT:								
	CRITICAI FLIGH		R	EDUNI	DANCY	SCRE	ENS		CIL
	HDW/FU		A		В		С		ITEM
NASA IOA	[1 /1 [1 /1]]	[P [P]]	[P [P]]	[[P]]	[X]* [X]
COMPARE	[/]	[]	ſ]	[N]	[]
RECOMMEN	DATIONS	(If	dif	fere	nt fro	om NA	SA)		
	[/]	[]	[]	[] (A	[] DD/DELETE)
* CIL RE	TENTION	RATION	ALE:	(If	appl:	icabl	A	DEQUATE DEQUATE	• •
REMARKS: FAIL ON	1-3 AXES	5					*11 V	<i>DE</i> QUATE	LJ

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/8 MMU-169 3.2.2							
SUBSYSTEM: MDAC ID: ITEM:	MMU 169 TRANSLA							
LEAD ANALYST:	DUFFY,	HUYNH	, SAIII	I				
ASSESSMENT:								
CRITICAL FLIGH		REDU	NDANCY	SCREEN		CIL ITEM		
HDW/FU	NC	A	В		С			
NASA [2 /1R IOA [1 /1] [[P] [P]	[P [P] [] [] P]	[X]* [X]		
COMPARE [N /N] [[]	ſ] [N]	[]		
RECOMMENDATIONS:	(If d	liffer	ent fr	om NASA)			
[1 /1]	[₽]	[P] [P] (A	[] .DD/DELETE)		
* CIL RETENTION	RATIONA	LE: (]	[f appl		ADEQUATE NADEQUATE			
REMARKS: FAIL ON 1-3 AXES	5							

ASSESSME ASSESSME NASA FME	NT	I	_	/	05/86 -170					TA: NE [] EW [X]
SUBSYSTE MDAC ID: ITEM:	M:			MMU 170 TRA	1	ONA	L HAND	со	NTROLLER	
LEAD ANA	LYS	ST	:	DUF	FY, HU	YNH,	, SAII	DI		
ASSESSME	NT	:								
		F	LIGH	LITY IT JNC			IDANCY B		REENS C	CIL ITEM
NASA IOA	[[1	/ /1]]	[[P]]	[[N.] A]	[] [NA]	[] * [X]
COMPARE	[N	/N]	[N]	[N]	[N]	[N]
RECOMMEN	DAJ	SIC.	ONS:	(If diff	fere	ent fro	om 1	NASA)	
	[/]	[]	[]	[]	[] (ADD/DELETE)
* CIL RE	ren	T	ON	RATI	ONALE:	(If	appl	ical		۰ ۲
REMARKS: THIS ASSESSMENT AND CORRESPONDING WORKSHEETS ARE VOIDED. THEY ARE SUPERCEEDED BY ITEMS MMU 1701X, 1702X, 1703X, AND 1704X.										

	2/05/86 NASA DATA: MU-171 BASELINE [] 1.1 NEW [X]									
MMU 171 ROTATIONAL	1									
LEAD ANALYST: DUFFY, HUYNH, SAIIDI										
CRITICALITY REDUNDANCY SCREENS FLIGHT										
NC A	В	C								
] [P]] [P]] [P]] [NA]	[] [NA]	[X] * [X]							
] [[]							
(If dif	ferent from NAS	A)								
] [] []	[] (A)	[] DD/DELETE)							
		ADEQUATE								
	171 ROTATIONAI DUFFY, HUY TTY RE NC A] [P] [P	171 ROTATIONAL HAND CONTROLLE DUFFY, HUYNH, SAIIDI TY REDUNDANCY SCREEN NC A B] [P] [P]] [P] [P]] [P] [NA]] [] [N] (If different from NAS2] [] [] [] RATIONALE: (If applicable	171 ROTATIONAL HAND CONTROLLER DUFFY, HUYNH, SAIIDI TY REDUNDANCY SCREENS NC A B C] [P] [P] []] [P] [NA] [NA]] [P] [NA] [NA]] [] [N] [N] (If different from NASA)] [] [] [] [] (A RATIONALE: (If applicable) ADEQUATE INADEQUATE							

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ASSESSMENT ID:	ASSESSMENT DATE:12/05/86NASA DATA:ASSESSMENT ID:MMU-171ABASELINE []IASA FMEA #:3.1.2NEW [X]									
MDAC ID:	MMU 171 ROTATIONAL HAND									
LEAD ANALYST: DUFFY, HUYNH, SAIIDI										
ASSESSMENT:										
CRITICAL FLIGH	ITY REDUNDA T	NCY SCREENS	CIL ITEM							
HDW/FU	NC A	B C								
NASA [2 /1R IOA [1 /1] [P]] [P]	[P] [] [NA] [NA]	[X]* [X]							
COMPARE [N /N] []	[N] [N]	[]							
RECOMMENDATIONS:	(If different	from NASA)								
[1 /1] []		[] DD/DELETE)							
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE []										
REMARKS: INADEQUATE []										
FAIL ON (1-3 AXES). FAILURE CANNOT BE ISOLATED. ABORT REQUIRED. RESCUE REQUIRED. CREW PERSON STRANDED.										

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:										
SUBSYSTEM: MDAC ID: ITEM:	MMU 172 ROTATIONAI									
LEAD ANALYST:	DUFFY, HUY	JFFY, HUYNH, SAIIDI								
ASSESSMENT:										
CRITICAI FLIGH		EDUNDANCY SCREE	ENS	CIL ITEM						
HDW/FU		В	С							
NASA [/ IOA [1 /1] [] [P] []] [NA]	[] [NA]	[] * [X]						
COMPARE [N /N] [N] [И]	[и]	[N]						
RECOMMENDATIONS:	(If dif	ferent from NAS	5A)							
[/] [] []	[] (A)	[] DD/DELETE)						
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []										
REMARKS: FAIL OFF (1-3 AXES). THIS ASSESSMENT AND CORRESPONDING ANALYSIS WORKSHEETS ARE VOIDED. THEY ARE REPLACED WITH ITEMS MMU-1721X, 1722X, 1723X, AND 1724X.										

ASSESSMI ASSESSMI NASA FMI	ENT	I	D:	MMU-1								NASA DAT BASELIN NE		٢		
SUBSYSTI MDAC ID: ITEM:				MMU 173 THC I	SOL	AJ	te sv	/IT	СН							
LEAD AND	ALY	ST	:	DUFFY	, н	U	NH,	SA	II	DI						
ASSESSMI	ENT	:														
		F	ICAL LIGH W/FU			RH A	EDUNI	AN	CY B		EENS	S C			IL TEN	1
NASA IOA	[[2 1	/1R /1]	[[P P]]	[[P N] A]	[[] NA]		[[x x] *]
COMPARE	[N	/N]	[]	[N]	[N]		נ]
RECOMMEN	NDA'	TI(ons:	(If	di	fi	ferer	nt	fr	om N	ASA)				
	[/]	[]	[]	[(AC	[)D/	DF] ELETE)
* CIL RI	ETE	NT	ION	RATION	ALE	:	(If	ap	pl	icab	-	ADEQUATI NADEQUATI]
	-															

REMARKS:

IF THE FAILURE IS ELECTRICAL, ISO SWITCH HAS ONE BACKUP IN THE ALTERNATE SYSTEM. IF THE FUNCTION IS LOST, THE ISO VALVES ARE CLOSED. THE PILOT IS STRANDED WITH NO PROPULSIVE POWER. IOA ACCEPTS THE CRITICALITY.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA: BASELINE [NEW [
MDAC ID:	MMU 174 Thc Isolate SV	VITCH		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI		
ASSESSMENT:				
CRITICAL FLIGH	T	DANCY SCREENS	I	IL Fem
HDW/FU	NC A	В	С	
NASA [2 /1R IOA [2 /2] [P]] [P]	[P] [[NA] [] [NA] [X] * X]
COMPARE [/N] []	[א]	м][3
RECOMMENDATIONS:	(If differe	nt from NASA)	
[1 /1] []	[]][] [(ADD)] /delete)
* CIL RETENTION	RATIONALE: (If		ADEQUATE [NADEQUATE []]
REMARKS: THE THC ISOLATE	SWITCH IS ONLY	USED DURING	CONTINGENCY	SITUATIO

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.

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	12/05/86 MMU-174A 3.2.10			NASA DATA BASELINE NEW	
MDAC ID:	MMU 174 THC ISOLAT	re swi	тсн		
LEAD ANALYST:	DUFFY, HUY	YNH, S	AIIDI		
ASSESSMENT:					
CRITICAL FLIGH HDW/FU	r	EDUNDA	NCY SCREE	ENS C	CIL ITEM
		1	[P]	۲ I	ſ X 1 *
IOA [2 /2] [P]] [P	j	[NA]	[NA]	[X]* [X]
COMPARE [/N] []	[N]	[N]	[]
RECOMMENDATIONS:	(If dif	ferent	: from NAS	SA)	
[1 /1] []	[]	[] (A	[] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If a	pplicable	>) ADEQUATE INADEQUATE	
	HC ISOLATE	SWITC	H IS ONLY	USED DURIN	G CONTINGEN

FAIL OFF. 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. OTHER RESCUE IS NOT CONSIDERED AS CONTINGENCY FOR COMPONENT FAILURE MODE EFFECTS ANALYSIS.

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ASSESSME ASSESSME NASA FME	NT	II		MM	/05/86 U-175 1.8	5							A SA E Basei		[x]]	
SUBSYSTE MDAC ID: ITEM:				MM 17 AU		c	AT	FITU	DE	HO	LD SI	VI	гсн					
LEAD ANA	LY	ST	:	DU	FFY, H	IUY	NH	, SA	III	DI								
ASSESSME	NT	:																
	CR		ICAL LIGH			RE	DU	NDAN	CY	SC	REENS	5			C1 די	IL PEM	ſ	
]		W/FU			A			B			С			-		•	
NASA IOA			/3 /2]]	[[P P]]	[[P F]]	[[F]]		[[x]	*
COMPARE	[N	/N]	ĺ]	[N]	[N]		[N]	
RECOMMEN	'DA'	ri(ons:		(If di	lff	er	ent	fro	om (NASA)						
	[1]	[]	[]	[]	(A] DD,	DE/DE] LE	TE)
* CIL RE		NT	ION	RAT	IONALI	2:	(I	f ap	pl :	ica	-		DEQUI DEQUI]]	
REMARKS: FAIL ON. POWER IS					NO MIS SIVE U								S ACT N BE					

0 POWER IS ON. EXCESSIVE USE OF PROPELLANT CAN BE AVOIDED BY TURNING GYRO POWER OFF FOR ROTATIONAL MANEUVERS. IOA ACCEPTS THE FMEA.

ASSESSMENT DATE:	12/05/86	NASA DATA:
ASSESSMENT ID:	MMU-176	BASELINE []
NASA FMEA #:	3.1.7	NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 176 AUTOMATIC ATTITUDE	E HOLD SWITCH

LEAD ANALYST: DUFFY, HUYNH, SAIIDI

ASSESSMENT:

	CR:		ICAI LIGH			REDUNDANCY SCREENS						CIL ITEM				
	I		W/FU			A			В			С				
NASA IOA	[[3 3	/3 /3]	[[P]]	[[Ρ]	[[P]]	[[]]	*
COMPARE	[/]	[N]	[N]	[N]	[]	

RECOMMENDATIONS: (If different from NASA)

[3 /2R]	[P]	[P]	[P]	[].
				(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [] INADEQUATE []

REMARKS:

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.

C-90

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-17	7		NASA DATI BASELINI NEV	
SUBSYSTEM: MDAC ID: ITEM:	MMU 177 Altern	IATE CONT	ROL MODES	SWITCH	
LEAD ANALYST:	DUFFY,	HUYNH,	SAIIDI		
ASSESSMENT:					
CRITICA		REDUND	ANCY SCRE	ENS	CIL ITEM
FLIG HDW/F		A	В	С	
NASA [3 /3 IOA [2 /2]	[P] [P]	[P] [F]	[] [F]	[] * [X]
COMPARE [N /N]	[]	[И]	[א]	[א]
RECOMMENDATIONS	: (If	differer	nt from NA	SA)	
[3 /2	R]	[P]	[P]	[P]	[] (ADD/DELETE)
* CIL RETENTION	RATION	ALE: (If	applicabl	.e) ADEQUATI INADEQUATI	
REMARKS: THIS FAILURE MC INCREASED BY TH		TTTV TO	ENGAGE AAF	1 WITH MAID	ORKLOAD MAY INHIBIT. I MED DUE TO T

REMARKS: THIS FAILURE MODE IS "FAILS IN NORM". THE PILOT WORKLOAD MAY BE INCREASED BY THE INABILITY TO ENGAGE AAH WITH AXIS INHIBIT. IN 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 UNCERTANINTIES WILL HAVE TO BE EVALUATED AND A GO/NO GO DECISION MADE REAL TIME.

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ASSESSM ASSESSM NASA FM	ENT	!]	D:	MM	′05/8 J-177 .5.4									DATA: Eline [] New [X]
SUBSYST MDAC ID ITEM:				MMU 177 Alt	,	TE	C	ontro	L	MODE	is s	WI	тсн	
LEAD AND	ALY	ST	:	DUF	'FΥ,	HU	YN	H, SA	II	DI				
ASSESSMI	ENT	:												
	CR		ICA: LIGI	LITY HT		R	EDI	UNDAN	CY	SCR	EEN	S		CIL
			W/F			A			B			С		ITEM
NASA IOA	[[3 2	/3 /2]]	[[P P]	[[P F]]	[[F]]	[] * [X]
COMPARE	[N	/N	1	[]	ľ	N]	ſ	N]	[N]

RECOMMENDATIONS: (If different from NASA)

[3 /2R]	[P]	[P]	[P]	• <u>-</u>
				(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

•		
ADEQUATE	ſ	1
INADEQUATE	Ì	j

REMARKS:

THE FAILURE MODE IS "FAILS IN NORM". THE PILOT WORKLOAD MAY BE INCREASED BY THE INABILITY TO ENGAGE AAH WITH AXIS INHIBIT. IN 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.

ASSESSME ASSESSME NASA FME	NT I	D:		MU-178 BASELINE []] (]
SUBSYSTE MDAC ID: ITEM:	M:		MMU 178 Alter										
LEAD ANALYST: DUFFY, HUYNH, SAIIDI													
ASSESSME	NT:												
CRITICALITY REDUNDANCY SCREENS FLIGHT HDW/FUNC A B C							CII ITH						
	пD	W/FU		А			D			Ŭ			
NASA IOA	[3 [3	/2R /3]]	[P [P]]	[[P F]	[[F]	[[] *]
COMPARE	[/N]	[]	[N	ן	[N	ו	[]
RECOMMEN	DATI	ONS:	(If	dif	fere	ent f	rc	om NZ	ASA))			
	ſ	/]	[]	נ]	[]	[ADD/I] DELETE)
* CIL RE	TENI	'ION	RATION	ALE:	(If	f app	oli	.cab			EQUATE EQUATE	•]]
	REMARKS: FAIL ON SATELLITE STABILIZER. THIS FAILURE MAY TERMINATE MISSI DUE TO THE DILOT INABILITY TO CONTROL TRANSLATIONS AND THE HIGH												

FAIL ON SATELLITE STABILIZER. THIS FAILURE MAY TERMINATE MISSION DUE TO THE PILOT INABILITY TO CONTROL TRANSLATIONS AND THE HIGH RATE OF GAS USED. PILOT'S ACTION IS REQUIRED TO TURN OFF ONE CEA SIDE TO INITIATE BACKUP LOGIC. UNDER THIS MODE, THE AAH 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	MU-178A BASELINE []											
SUBSYSTE MDAC ID: ITEM:			MMU 178 Alter												
LEAD ANALYST: DUFFY, HUYNH, SAIIDI															
ASSESSMENT:															
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM															
		W/FU		A			B			С			TTE	M	
NASA IOA	[3 [3	/2R /3]	[P [P]]	[[P F]]	[[F]]		[[]	*
COMPARE	[/N]	[]	[N]	[N]		[]	
RECOMMEN	DATI	ONS:	(If	dif	fere	nt i	Er	om 1	NASA)					
	[/]	۵	·]	נ]	[]	(AE	[00/0		TE)
* CIL RE	TENT	ION	RATION	ALE:	(If	app)]:	ical	•		DEQUAT		[]	
INADEQUATE [] REMARKS: FAIL ON SATELLITE STABILIZER. SEE REMARKS FOR MMU-178-IOA AGREES WITH THE FMEA.															

ASSESSME	ASSESSMENT DATE: 12/05/86 NASA DATA: ASSESSMENT ID: MMU-179 BASELINE NASA FMEA #: 3.15.5 NEW]]	
SUBSYSTE MDAC ID: ITEM:	M:	MMU 179 ALTERNATE CONTROL MODES SWITCH									
LEAD ANA	LEAD ANALYST: DUFFY, HUYNH, SAIIDI										
ASSESSME	NT:										
	CRITICAL		RI	EDUNE	ANCY	SCRI	eens		CIL ITE		
	FLIGH HDW/FU		A		B		С				
NASA IOA	[3 /3 [3 /3]]	[P [P]]	[P [F]	[[F]]	[[]]	*
COMPARE	[/]	[]	[N]	[N]	נ]	
RECOMMEN	IDATIONS:	(If	dif	ferei	nt fr	om N	ASA)				
	[3 /21	٤]	[P]	[]	']	[₽) ([ADD/I] DELE	TE)
* CIL RI	ETENTION	RATION	ALE:	(If	app]	icab	A	DEQUATE DEQUATE]]	
REMARKS				mu	E CVC	: መም	FATIS	TO FLY	ААН	IN	THE

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.

ASSESSMI ASSESSMI NASA FMI	NASA DATA: BASELINE [] NEW [X]											
SUBSYSTI MDAC ID: ITEM:			MMU 179 Alte									
LEAD ANALYST: DUFFY, HUYNH, SAIIDI												
ASSESSMENT:												
		ICAL LIGH	ITY T	R	EDUN	IDANCY	SCRI	EENS	5		CII ITI	
	HDW/FUNC			A		В			С		***	J 11
NASA IOA	[3 [3	/3]]	[P [P]]	[P [F]]	[[F]]	[[] *]
COMPARE	ſ	/]	C]	[N]	[N]	[]
RECOMMEN	DATI	ONS:	(1:	f difi	fere	ent fro	m NA	SA)				
	[3	/2R]	[P]	[P]	[P	-] DD/D] DELETE)
* CIL RE	TENT	ION	RATIO	NALE:	(If	appli	cabl	e)				
REMARKS:										EQUATE EQUATE	[[]]
THE SYST	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 GO/NO GO DECISION MADE REAL TIME.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:											
SUBSYSTEM: MDAC ID: ITEM:	MMU 180 GYRO PHASE PLANE LOGIC	30									
LEAD ANALYST: DUFFY, HUYNH, SAIIDI											
ASSESSMENT:											
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM											
HDW/FU	NC A B	С									
NASA [/ IOA [3 /3] [] [] [] [P] [NA] [] NA]	[] * []								
COMPARE [N /N] [И] [И] [N]	[]								
RECOMMENDATIONS:	(If different from NASA)										
[3 /2R	<pre><] [P] [P] [</pre>	P] (AI	[] DD/DELETE)								
* CIL RETENTION	* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []										
REMARKS: FAILS OFF 1-3 CH. AUTOMATIC ATTITUDE HOLD DOES NOT WORK WITHOUT THIS ITEM, SEE MMU-176.											

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/ MMU-18									
	MMU 181 GYRO PI									
LEAD ANALYST: DUFFY, HUYNH, SAIIDI										
ASSESSMENT:										
CRITICAL FLIGH HDW/FU	Т	RE A	DUNDA	NCY SCR B	REENS C	CIL ITEM				
NASA [/ IOA [3 /3]]	[[P]	[] [NA]	[] [NA]	[] * []				
COMPARE [N /N]	[N]	[N]	[N]	[]				
RECOMMENDATIONS:	(If	diff	erent	: from N	IASA)					
[3 /2R]	[P]	[₽]	[P]	[] (ADD/DELETE)				
* CIL RETENTION	RATIONA	LE:	(If a	pplicab	ole) Adequat Inadequat					
NOISY/FALSE OUTP AAH, SEE MMU-176		HIS	FAILU	RE WILI	FORCE THE	SHUTDOWN OF				

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ASSESSMEN ASSESSMEN NASA FMEA	II TV			MMU-182 BASELINE							
SUBSYSTEN MDAC ID: ITEM:	1:		MMU 182 CEA P	WR SI							
LEAD ANALYST: DUFFY, HUYNH, SAIIDI											
ASSESSME	ASSESSMENT:										
	CRIT			R	EDUND.	ANCY	SCRE	EENS		CIL ITEN	4
		LIGH N/FU		A		E	5	с			-
NASA IOA	[2 [2	/1R /1R]	[P [P]]	[] []))	[[P]]	[X [X] *]
COMPARE	[/]	٢]	[]	[N]]	[]
RECOMMEN	DATI	ons:	(If	dif	feren	t fi	om NI	ASA)			
	.[/]	נ]	[.]	[] (A	[[] []] ELETE)
* CIL RE	TENT	ION	RATION	ALE:	(If	appl	licab	AD	EQUATE	[[]
REMARKS:								INAD	EQUATE	L	J .

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-183 3.4.1		NASA DATA: BASELINE [] NEW [X]						
SUBSYSTEM: MDAC ID: ITEM:	MMU 183 WIRE HARM	1ESS							
LEAD ANALYST: DUFFY, HUYNH, SAIIDI									
ASSESSMENT:									
CRITICAL FLIGH		REDUNDANCY	SCREENS		CIL ITEM				
HDW/FU	NC A	C A B C							
NASA [2 /1R IOA [2 /1R] [H] [H	2] [P 2] [P) [] [P]]	[X]* [X]				
COMPARE [/] [] [] [И]	[]]				
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)						
[/] [][] [] (AD	[] D/DELETE)				
* CIL RETENTION 1	RATIONALE:	(If appl	AI	DEQUATE DEQUATE	[]				
REMARKS: SHORT OR OPEN CIN	RCUIT.		TNAL	LEGORIE	ι.]				

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ASSESSMENT ID:										
SUBSYSTEM: MDAC ID: ITEM:	MMU 184 EXTERNAL									
LEAD ANALYST: DUFFY, HUYNH, SAIIDI										
ASSESSMENT:										
CRITICA FLIG	CIL ITEM									
HDW/F	JNC A	В	c							
NASA [2 /2 IOA [2 /2] [] [F] [P] [P] [] [F]]	[X]* [X]					
COMPARE [/] [N	N] [N] [N]	[]					
RECOMMENDATIONS	: (If dif	fferent fr	om NASA)							
[/] [] [] []	[] DD/DELETE)					
* CIL RETENTION	RATIONALE:	: (If appl	AD	EQUATE EQUATE						
REMARKS: FAIL OPEN, 1 OR MORE PINS.										

ASSESSMI ASSESSMI NASA FMI	ENT	I		M	Ŵ-18		6								ASA DA BASELI N		[
SUBSYSTI MDAC ID: ITEM:				M1 18 H1		RS															
LEAD ANA	LY	ST	:	D	JFFY	, 1	HUY	(NH,	SA	I	I	DI									
ASSESSMENT:																					
		F	ICAL LIGH	Г	č			EDUNI	DAN			SCI	REEN				C) I]	[L [EN	1		
]	HD	W/FU	NC			A				B			С							
NASA IOA	[[2 2	/1R /2]]		[[P P]]	[F P]]	[[F]]		[[X X]]	*	
COMPARE	[/N]		נ]	[]	N]	[N]		[]		
RECOMMENDATIONS: (If different from NASA)																					
	[/]		[]	[]	[]	(AD	[)D/	DI] Elf	ETE)	
* CIL RE	TE	NT	ION	RAJ		۲IJ	E:	(If	aŗ	p	1 i	.cal	ble)								
													I		DEQUA1 DEQUA1]]		

REMARKS:

FAIL OFF. HEATER FUNCTION IS TO MAINTAIN THE MMU AND FSS STRUCTURE AND COMPONENTS WITHIN AN ACCEPTABLE TEMPERATURE 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.

ASSESSMENT DATH ASSESSMENT ID: NASA FMEA #:	2: 12/05/8 MMU-18 4.2.1									DATA: LINE NEW	[х]]	
SUBSYSTEM: MDAC ID: ITEM:	MMU 185 HEATER:	S												
LEAD ANALYST:	DUFFY,	HUY	NH,	SAI	IC	I								
ASSESSMENT:														
CRITIC FLI		RI	EDUNI	DANC	Y	SCRI	EENS				CI IT		ſ	
HDW/1		A			B			С						
NASA [2 / 2 IOA [2 / 2	2] 2]	[P [P]	[[F P]	[[F]]		[[X X]]	*
COMPARE [/]	[]	[N]	[N]		ĺ]	
RECOMMENDATIONS: (If different from NASA)														
[2/	1R]	[P	ן. נ	[F]	C	P]	(A)] DD/] ELI	ETE)
* CIL RETENTIO	N RATIONA	LE:	(If	apr)]:	icab				ATE ATE]]	
REMARKS:	TER FUNCT	NOI	IS	TO N	1 A:	INTA	IN 1	CHI	e mm	U AN	DI	rs:	5	

FAIL OFF. HEATER FUNCTION IS TO MAINTAIN THE MMU AND FSS STRUCTURE AND COMPONENTS WITHIN AN ACCEPTABLE TEMPERATURE 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 CASES, AND LOCATOR LIGHT CONTROL (FOR THIS REASON SCREEN B IS FAILED). SECOND SYSTEM HEATER FAILURE IS LIFE THREATENING.

C-103

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/8 MMU-186			NASA DATA BASELINE NEW	••				
SUBSYSTEM: MDAC ID: ITEM:	MMU 186 HEATERS	5							
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI								
ASSESSMENT:									
CRITICAL FLIGH	Г		ANCY SCREE		CIL ITEM				
HDW/FU	NC	A	В	С					
NASA [/ IOA [2 /1R] [] [] P]	[] [P]	[] [P]	[] * [X]				
COMPARE [N /N] [N]	[N]	[И]	[א]				
RECOMMENDATIONS: (If different from NASA)									
[/	ן נ]	[]	[] (AI	[] DD/DELETE)				
* CIL RETENTION RATIONALE: (If applicable)									
ADEQUATE [] INADEQUATE []									
FAIL ON (CEA). THIS FMEA IS VOIDED. THE ITEM FAILED IS THE THERMOSTAT FOR THE CEA HEATERS. THIS ITEM AND FAILURE ARE COVERED WITH FMEA 1861 AND ASSESSMENT WORKSHEET MMU-1861.									

ASSESSME ASSESSME NASA FME	NT II		• •									ASA DATA BASELINI NEV			
SUBSYSTE MDAC ID: ITEM:	M:		MMU 187 GYROS												
LEAD ANA	LYST	:	DUFFY	, н	UY	NH,	SAI	II	DI						
ASSESSME	NT:														
	CRIT	ICAL LIGH			RI	EDUN	DANC	CY	SCR	EEN	S		CII ITI	-	
		W/FU	_		A			В			С				
NASA IOA	[3 [3	/3 /3]]	[[P]]] [F]]	[[F]	([]	*
COMPARE	[/]	[N]	[N]	[N]	[]	
RECOMMEN	DATI	ons:	(If	di	f	fere	nt 1	fr	om N	IASA)				
	[3	/2R]	[P]	[P]	[P] ADD/] DEL	ETE)
* CIL RE	TENT	ION	RATION	ALE	2:	(If	ap]	p1	icat			DEQUATE DEQUATE	-]]	
REMARKS: DRIFT WI 176.	TH D	EGRA	DED GY	RO	P	ERFC	RMA	NC	E A <i>i</i>	лн с	AN	NOT OPE	RATE	, s	EE MMU-

REPORT DATE 02/18/88 C-105

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ASSESSME ASSESSME NASA FME	ENT	II	D:	М	MU-1		6									DATA ELINE NEW			
SUBSYSTE MDAC ID: ITEM:				M 18 G															
LEAD ANA	LYS	T:		D	JFFY	, 1	HU	YNH,	S	\I]		I							
ASSESSME	ENT :																		
	CRI		ICAL: LIGH		ć		RI	EDUN	DAI	1C3	2	SCRE	EN	S			CII ITE		
	H	[DV	V/FUI	NC			A			E	3			С					
NASA IOA		3 3	/3 /3]]		[[P]		Ē	7]	[[F]]		[[]]	*
COMPARE	ľ		/]		[N]	l	Ň	1]	[N]		[]	
RECOMMEN	DAT	IC	ONS:		(If	d:	if	fere	nt	fr	:0	m NA	SA)					
	[3	/2R]		[P]	(F	•]	[P]	(A	[DD/D] ELE	ETE)
* CIL RE	TEN	TI	ION I	RAI	NOI	/LJ	Ξ:	(If	aŗ	pl	i	cabl			_	ATE ATE	[]	
REMARKS: FAIL OFF		TH	IOUT	GY	ROS	A/	чн	DOE	s N	roi	•	OPER					•	•	

REPORT DATE 02/18/88 C-106

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NASA DATA: ASSESSMENT DATE: 12/05/86 BASELINE [ASSESSMENT ID: MMU-189 NEW [X] NASA FMEA #: MMU SUBSYSTEM: 189 MDAC ID: ARM ANGLE ADJUST ITEM: LEAD ANALYST: DUFFY, HUYNH, SAIIDI ASSESSMENT: CIL REDUNDANCY SCREENS CRITICALITY ITEM FLIGHT в С A HDW/FUNC
 IASA
 [/]
 []
 []

 IOA
 [3 /3]
 [P]
 [P]
] * E NASA [/] COMPARE [N/N] [N] [N] [N] []RECOMMENDATIONS: (If different from NASA) ſ (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [1 **REMARKS:** ARM DOES NOT LATCH TO FLIGHT POSITION (UNLATCHED, LATCHED STOWED,

ARM DOES NOT LATCH TO FLIGHT POSITION (UNLATCHED, ENTERIES FIGHES, LATCHED WORKSITE, LATCHED FLIGHT). THIS ASSESSMENT AND FMEA 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.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-190 2.1.9		NASA DAT BASELIN NE	
	MMU 190 ARM LENGTH	ADJUST		
LEAD ANALYST:	DUFFY, HUYN	H, SAIIDI		
ASSESSMENT:				
CRITICAL FLIGH	Т	UNDANCY SCRE		CIL ITEM
HDW/FU	NC A	В	C	
NASA [2 /2 IOA [2 /2] []] [P]	[] [P]	[] [P]	[X]* [X]
COMPARE [/] [N]	[N]	[N]	[]
RECOMMENDATIONS:	(If diffe	rent from NA	SA)	
[/] []	[]		[] ADD/DELETE)
* CIL RETENTION	RATIONALE: ()	If applicabl	ADEQUATE	
REMARKS: FAIL UNLATCHED			INADEQUATE	L J

NASA DATA: ASSESSMENT DATE: 12/05/86 BASELINE [ASSESSMENT ID: MMU-191 1 NASA FMEA #: NEW [X] SUBSYSTEM: MMU MDAC ID: 191 ARM LENGTH ADJUST ITEM: LEAD ANALYST: DUFFY, HUYNH, SAIIDI ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT HDW/FUNC A В С NASA [/] [] [] [] [] * IOA [2 /2] [P] [P] [P] [X] COMPARE [N/N] [N] [N] [N] **RECOMMENDATIONS:** (If different from NASA) [2/2] [P] [P] [P] [A] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] **REMARKS:** FAIL LATCHED SHORT

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ASSESSMEN ASSESSMEN NASA FMEA	T II	2.1.7 MMU				NASA DATA: BASELINE [] NEW [X]							
SUBSYSTEM	:		MMU										
MDAC ID:			192										
ITEM:			ARM	LENGT	H AD	JUST							
LEAD ANAL	EAD ANALYST: DUFFY, HUYNH, SAIIDI												
ASSESSMEN	T:												
С	RITI	CAL	ITY	R	EDUN	DANCY	SCR	EENS			CII	J	
	FI	LIGH	Т								ITI	EM	
	HDW	V/FU	NC	А		E	3	С					
	r -				•		•	r	-				
NASA	[1 [2	/1	ļ	l r r	ļ	l	1	[[P	ļ			(]* (]	
IOA	[2	/2	1	Ĺ₽]	[]	']	Ĺ₽]		[]	r l	
COMPARE	[N	/N	1	[N	1	[N	[]	[N	ו		[]	
	•	•	-	•	-	-	-	-	•		-	2	
RECOMMEND	ATIC	ons:	(1	f dif	fere	nt fr	om N	ASA)					
	[2	/2]	נ]	ſ]	[]	(AI	{ DD/I] DELETE)	
* CIL RET	ENTI	ION I	RATIO	NALE:	(If	appl	icab.	A		ATE ATE]]	
REMARKS:											-	-	
PILOTS IN	CON	/ENI	ENCE,	POOR	FIT	AND	DIFF	ICULT	ТО	OPERA	ΔTE	THE	

CONTROLS FOR TRANSLATIONS OR ROTATIONS. THE DESIGN IS SUCH THAT, THE SMALLEST PILOT CAN OPERATE A FULLY EXTENDED ARM.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-192A 2.1.8				[] [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 192 ARM LENGTI	H ADJUST			
LEAD ANALYST:	DUFFY, HUY	YNH, SAII	DI		
ASSESSMENT:					
CRITICAL FLIGH		EDUNDANCY	SCREENS		CIL ITEM
HDW/FU		В	С		11011
NASA [2 /1R IOA [2 /2] [P] [P] [P] [P] [] [P]]	[X]* [X]
COMPARE [/N] [] [] [N]	[]
RECOMMENDATIONS:	(If dif:	ferent fro	om NASA)		
[2 /2	J [] [] [] (AD	[] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl	A	DEQUATE DEQUATE	[]
		TETO AND			

PILOTS INCONVENIENCE, POOR FIT AND DIFFICULT TO OPERATE THE CONTROLS FOR TRANSLATIONS OR ROTATIONS. THE DESIGN IS SUCH THAT, THE SMALLEST PILOT CAN OPERATE A FULLY EXTENDED ARM.

ASSESSME ASSESSME NASA FME	NT I	D:	12/05, MMU-1 3.6.1	94				1	NASA DATA BASELINI NEV]
SUBSYSTE MDAC ID: ITEM:			MMU 194 Exteri	NAL	POWEI	r con	NECTO	R			
LEAD ANA	LYST	:	DUFFY	, ни	YNH,	SAII	DI				
ASSESSME	NT:										
		ICAL LIGH	ITY T	R	EDUNI	DANCY	SCRE	ENS		CIL ITEN	ન
	HD	W/FU	NC	A		В		C	C		-
NASA IOA	[2 [2	/2 /2]]	[P [P]	[P [P]]	[[1] P]	[X [X] *]
COMPARE	[/]	[]	[]	[]	N]	[]
RECOMMEN	DATI	ons:	(If	dif	ferer	nt fr	om NA	SA)			
	[/]	[]	[]	[]	[\DD/DI] Elete)
* CIL RE	TENT	ION	RATION	ALE:	(If	appl	icabl	7	ADEQUATE ADEQUATE] 1
REMARKS: FAIL CON		ED							-	•	-

ASSESSMENT ID:	ASA FMEA #: 3.6.2 UBSYSTEM: MMU						
SUBSYSTEM: MDAC ID: ITEM:	195	POWER CONNI	ECTOR				
LEAD ANALYST:	DUFFY, HU	YNH, SAIIDI	C				
ASSESSMENT:							
CRITICAI FLIG		EDUNDANCY S	SCREENS	CIL ITEM			
HDW/FU		В	С				
NASA [2 /2 IOA [2 /2] [P]] [P]] [P]] [P]] []] [F]	[X]* [X]			
COMPARE [/] [] [] [N]	[]			
RECOMMENDATIONS	(If dif	ferent from	m NASA)				
[/] [] [] [] (A	[] .DD/DELETE)			
* CIL RETENTION	RATIONALE:	(If appli	cable) ADEQUATE INADEQUATE	[] []			
REMARKS: FAIL DISCONNECT	ED						

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ASSESSME ASSESSME NASA FME	ent i	[D:	12/05 MMU-1 2.5.1	W-196 5.1							A DATA SELINE NEW			
SUBSYSTE MDAC ID: ITEM:			MMU 196 PLSS :	LATC	HES									
LEAD ANA	Lysi	:	DUFFY	, HU	YNH,	SA	II	DI						
ASSESSME	NT:													
	F	ICAL	Г		EDUND	AN		SCRE	EENS			CI IT	L EM	
	HD	W/FUI	NC	A			В			С				
NASA IOA	[2 [2	/1R /1R]]	[P [P]]	[[P F]]	[[] P]		[[X] X]	*
COMPARE	[/]	[]	[N]	[N]		[]	
RECOMMEN	DATI	ons:	(If	dif	feren	t	fro	om NA	SA))				
	[/]	[]	[].	[]	(A	[DD/] DEL	ETE)
* CIL RE REMARKS: FAIL OPE		ION P	RATION	LE:	(If a	apj	pl i	icabl	-		QUATE QUATE	[[]	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	• • .	NASA DATA BASELINI NEW	
MDAC ID:	MMU 196 PLSS LATCHES		
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICAL FLIGH		DANCY SCREENS	CIL ITEM
HDW/FU	NC A	B C	
NASA [2 /2 IOA [2 /1R] [P]] [P]	[P] [] [F] [P]	[X]* [X]
COMPARE [/N] []	[И] [И]	[]
RECOMMENDATIONS:	(If differen	nt from NASA)	
[2 /1R] [P]	[P] [P] (4	[] ADD/DELETE)
* CIL RETENTION	RATIONALE: (If	applicable) ADEQUATE INADEQUATE	• •
REMARKS: FAIL OPEN			

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	12/05/86 MMU-197 2.5.2			DATA: CLINE [] NEW [X]
MDAC ID:	MMU 197 PLSS LATC	CHES		
LEAD ANALYST:	DUFFY, HU	JYNH, SAII	DI	
ASSESSMENT:				
CRITICAL FLIGH		REDUNDANCY	SCREENS	CIL ITEM
HDW/FU		A B	С	
NASA [2 /1R IOA [3 /2R] [F]]	P] [P P] [F] []] [P]	[X]* [X]
COMPARE [N /N] [и] [] [N]	[]
RECOMMENDATIONS:	(If dif	fferent fr	om NASA)	
[3 /2R] [F	P] [P] [P]	[D] (ADD/DELETE)
* CIL RETENTION	RATIONALE:	: (If appl	icable) ADEQU INADEQU	
REMARKS:		CH NEEDS	TO ODEDATE FO	D DICC DEIENCE

FAIL CLOSED. ONLY ONE LATCH NEEDS TO OPERATE FOR PLSS RELEASE. IF ALL LATCHES FAIL CLOSED, CREWMEMBER ENTERS AIRLOCK WITH MMU ATTACHED AND SUBSEQUENT MISSIONS ARE IMPACTED.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-198			NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 198 MMU BATTE	RY LAT	CHES		
LEAD ANALYST:	DUFFY, HU	YNH, S	AIIDI		
ASSESSMENT:					
CRITICAL		EDUNDA	NCY SCREE	NS	CIL ITEM
FLIGH HDW/FU			В	С	
NASA [/ IOA [2 /2] [] [P]	[] [P]	[] [P]	[] * [X]
COMPARE [N /N	א] [א]	[N]	[N]	[И]
RECOMMENDATIONS	(If dif	ferent	: from NAS	SA)	
[3 /3] []	[]	[] (A	[] .DD/DELETE)
* CIL RETENTION	RATIONALE:	(If a	applicable	e) ADEQUATE INADEQUATE	
REMARKS: FAIL UNLATCHED. LAUNCH/LANDING. POST-OPS) HAS NO	THE LATCH	I FAIL	URE ONORB.	NALYSIS DURI IT (PRE-OPS,	NG OPS, AND

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ASSESSM ASSESSM NASA FM	ENT	ID:	: 12/0 MMU- 2.3.					N	IASA I BASEI		[]	
SUBSYST MDAC ID ITEM:			MMU 199 MMU	BATTE	RY	LATCHE	s						
LEAD AN	ALYS	ST:	DUFF	Y, HU	YNH	, SAII	DI						
ASSESSM	ENT:												
		TICAI FLIGH		R	EDU	NDANCY	SC	REENS			CIL ITE		
	H	IDW/FU	INC	A		В	B C						
NASA IOA	[[2 /2 2 /2]]	[[P]]	[[P]]	[[P]		[X [X]	*
COMPARE	[1]	[N]	[N]	[N]		[]	
RECOMMEN	IDAT	IONS:	(1	f dif:	fer	ent fro	om 1	NASA)					
	[/]	[]	[]	[]	(AD	[D/D] ELE:	ΓE)
* CIL RE REMARKS: FAIL LAT	:								DEQUA DEQUA NLATC	TE	[]]	

REPORT DATE 02/18/88 C-118

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-200	NASA DATA: BASELINE [] NEW [X]										
SUBSYSTEM: MDAC ID: ITEM:	MMU 200 Backup ARM Latch											
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI											
ASSESSMENT:												
CRITICAL FLIGH	ENS CIL ITEM											
HDW/FU	NC A B	C										
NASA [/ IOA [2 /2] [] []] [P] [P]	[] [] * [P] [X]										
COMPARE [N /N] [N] [N]	[N] [N]										
RECOMMENDATIONS:	(If different from NA	SA)										
[2 /2] [] []	[] [A] (ADD/DELETE)										
* CIL RETENTION	RATIONALE: (If applicabl	e) ADEQUATE [] INADEQUATE []										
REMARKS: FAIL LATCHED												

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-201	NASA DATA: Baseline New										
SUBSYSTEM: MDAC ID: ITEM:	MMU 201 BACKUP ARM LATCH											
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI											
ASSESSMENT:												
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C												
nDw/r0	NC A B	C										
NASA [/ IOA [2 /2] [] [] [] [P] [P] [] P]	[] * [X]									
COMPARE [N /N] [N] [N] [и ј	[N]									
RECOMMENDATIONS:	(If different from NASA)											
[2 /2] [] [] [] (AI	[A] DD/DELETE)									
	RATIONALE: (If applicable)	ADEQUATE IADEQUATE	[] []									
REMARKS: FAIL UNLATCHED.	SCREENS ARE NOT REQUIRED W	VITH THIS C	RITICALITY.									

ASSESSMEI ASSESSMEI NASA FMEI	NT	II):		MMU-202 BASELII 4.6.1 NI													
SUBSYSTE MDAC ID: ITEM:	M:			MMU 202 QD THE	ERI	IAN	2 CO	VE	RS									
LEAD ANA	LYS	ST	:	DUFFY,	, 1	HUY	(NH,	Si	AI:	ΓĹ	I							
ASSESSMENT:																		
CRITICALITY REDUNDANCY SCREENS FLIGHT											CIL ITEM							
	J		W/FU		A B C										1154			
NASA IOA]]	[[P P]		[] []	P P]]	[[P]]	[[х]]	*
COMPARE	ſ	N	/N]	[]		[]	[N]	[N]	
RECOMMEN	DA	FI (ons:	(If	d	if	fere	nt	f	r	om NAS	SA)					
	[3	/2R]	[P]		[P]	[P] (A		D /D		ETE)
* CIL RE	TE)	NT	ION	RATION	AL	Е:	(If	a	pp	1:	icable			DEQUATE DEQUATE]	
REMARKS: FAIL OPE	N											ш.		DIQUALL	L		L	

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ASSESSMEN ASSESSMEN NASA FMEA	I TI	D:		-									
SUBSYSTEM MDAC ID: ITEM:	1:		MMU 203 BATTE	RY 7	HERM	IAL C	OVER	2					
LEAD ANAI	LYST	:	DUFFY	, н	YNH,	SAI	IDI						
ASSESSMEN	ASSESSMENT:												
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C													
	HD	W/FUI	NC	P	L								
NASA IOA		/1R /2		[] [])))	[[P] P]	[[P]]	[X] X]	*
COMPARE	[/N]	[]	[]	[N]	[]	
RECOMMEND	ATI	ONS:	(If	dif	fere	ent f	rom	NASA)				
	[2	/2]	[]	[]	[[ADD/1] DELE	TE)
* CIL RET	TENT	ION	RATION	ALE:	(If	app	lica	·		DEQUATE DEQUATE]]	
REMARKS: FAIL OPEN RECOMMEND					SCR	REENS	ARE	NOT	RE	QUIRED	FOR	THE	1

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ASSESSMENT ASSESSMENT NASA FMEA	ID:		MMU-204 BASEL 4.6.1 1]	
SUBSYSTEM: MDAC ID: ITEM:		MMU 204 Batter	XY T	HERMA	L (201	/ER							
LEAD ANALY	ST:	DUFFY,	HU	YNH,	SA	III	DI							
ASSESSMENT:														
CR	ITICAL FLIGH		R	EDUNE	AN	СЧ	sc	REENS	5			IL Ten	ł	
	HDW/FU		CABC										•	
	2 /1R 3 /3								[[х]]	*		
COMPARE [N /N]	[]	[N]	[N]	[N]	
RECOMMENDA	TIONS:	(If	dif	ferer	nt	fr	om	NASA)					
[3 /3]	[]	[]	[] (2		ם [ס/		ETE)
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []														

ASSESSMI ASSESSMI NASA FMI	INT	I	D:	• •	MMU-205 BASEL 4.6.1										ELIN]
SUBSYSTE MDAC ID: ITEM:				MMU 205 EXT.	PWI	R.	THER	M	AL	C	OVEI	2						
LEAD ANA	LY	ST	:	DUFFY	, I	HUY	ľΝΗ,	Si	AII	D	I							
ASSESSME	NT	:																
	CR		ICAL LIGH	ITY F		RI	EDUND	A	NCY	2	SCRE	EN	s				L L Len	1
	•	HD	W/FU	NC		A			E	3			C	2				
NASA IOA	[[2 3	/1R /3]	[[P P]]	ļ	[F [F	>]]	[[F] ']		[[x] *]
COMPARE	[N	/N]	[]		[]	[N]		[N]
RECOMMEN	'DA'	TI	ons:	(If	dj	lf1	feren	t	fr	:0	m NA	SA)					
	[3	/3]	[]	ł	[]	נ]	(2	-	D 'DE] LETE)
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []																		
REMARKS: FAIL OPE RECOMMEN						5	CREE	NS	5 A	R	e no			-		•		ΪĒ

ASSESSME ASSESSME NASA FME	NT 🛛	ID:		MMU-206 BASEL 5.4.1]]	
SUBSYSTE MDAC ID: ITEM:	M:		MMU 206 BACKUI												
LEAD ANA	LYS	T:	DUFFY,	, HU	YNH, S	SA:	III	I							
ASSESSMENT:															
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEN												1			
	H	DW/FUI	NC	C A B C											
NASA IOA		2 /1R 2 /1R	с а в с] [Р] [Р] []									[[x x]]	*
COMPARE	[1]	[]	[]	[N]	[]	
RECOMMEN	DAT	IONS:	(If	dif	feren	t	fro	om NA	SA)					
	[1]	[]	Į]	נ] (A] ,DD	/DI] ELE	TE)
* CIL RE		TION	RATION	ALE:	(If	ap	pl:	icabl			DEQUATE DEQUATE	[[]]	
FAIL OPE		URING	FLIGH	r											

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-207	MMU-207 BASELI									
SUBSYSTEM: MDAC ID: ITEM:	MMU 207 BACKUP PL	207 BACKUP PLSS LATCHES									
LEAD ANALYST:	DUFFY, HU	UFFY, HUYNH, SAIIDI									
ASSESSMENT:											
CRITICAL FLIGH	T	ITEM									
HDW/FU	NC A	A B C									
NASA [/ IOA [2 /2] [] [P]]	[] [P]	[] [P]	[] * [X]						
COMPARE [N /N] [N]	[N]	[N]	[N]						
RECOMMENDATIONS:	(If dif:	ferent	from N	ASA)							
[2 /2] []	[]	[]	[A] ADD/DELETE)						
* CIL RETENTION	RATIONALE:	(If a	pplicab	ADEQUATE							
REMARKS:				INADEQUATE	[]						
FAIL CLOSED											

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FAIL CLOSED

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-208 1.9.1										
SUBSYSTEM: MDAC ID: ITEM:	MMU 208 GN2 LINI	ES									
LEAD ANALYST:	DUFFY, I	HUYNH,	SAIII	I							
ASSESSMENT:											
CRITICAL FLIGH		REDUN	IDANCY	SCREE	NS	CIL ITEM					
HDW/FU		A	В		С						
NASA [1 /1 IOA [3 /2R] [] P]	[[P]]	[] [P]	[X]* []					
COMPARE [N /N] [N]	[]]	[N]	ן א]					
RECOMMENDATIONS:	(If d	iffer	ent fr	om NAS	A)						
[3 /2R	2] [P]	[P]	[₽]	[D] ADD/DELETE)					
* CIL RETENTION	RATIONAL	Æ: (I	f appl	icable	e) ADEQUATE INADEQUATE						
REMARKS:			COTC P	A T T I I D F	FOR THESE	LINES. AN					

LEAK. RUPTURE IS NOT A REALISTIC FAILURE FOR THESE LINES. AN EXTERNAL LEAK IN THE FSS LINES MAY LIMIT THE CHARGE OR FAIL TO CHARGE THE MMU TANKS.

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	: 12/05/86 MMU-210		NASA DATA: BASELINE [] NEW [X]							
SUBSYSTEM: MDAC ID: ITEM:	MMU 210 GN2 LINES	10								
LEAD ANALYST:	DUFFY, HUY	NH, SAIII	DI							
ASSESSMENT:										
CRITICA FLIG	LITY RE HT	DUNDANCY	SCREENS		CIL ITEM					
HDW/F	JNC A									
NASA [/ IOA [3 /2]] [R] [P] [] [P] [] [P]	[] * []					
COMPARE [N /N] [И] [N] [N]	[]					
RECOMMENDATIONS	(If diff	erent fro	om NASA)							
[3 /2]	R] [P] [P] [P		[] D/DELETE)					
* CIL RETENTION	RATIONALE:	(If appli	A	DEQUATE DEQUATE	[]					
REMARKS: FSS BLOCKED LINE	S HAS NOT BI	EEN ASSES			• •					

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ASSESSMENT D ASSESSMENT I NASA FMEA #:	D:		IMU-211 BASELINE [] 10.1 NEW [X]												
SUBSYSTEM: MDAC ID: ITEM:		MMU 211 PRESSI	JRE	6 0	GAUGE	E									
LEAD ANALYST	:	DUFFY	, H	١U	(NH,	SA	III	JI							
ASSESSMENT:															
	ICAL LIGH			RI	EDUNI	AN	ICY	SCRE	ENS	5			CIL ITE		
	W/FU		A B C									I I EM			
NASA [3 IOA [3	/2R /2R]]	[[P P]]	((P P]	[[P]]		[[]]	*
COMPARE [/]	[]	(•]	[N]		[]	
RECOMMENDATI	ons:	(If	đj	lf:	ferer	nt	fr	om NA	SA)					
I	/]	[]	1		<u>ן</u>	[]	(A] DD/D] ELI	ETE)
* CIL RETENT	ION	RATION	ALI	2:	(If	aŗ	opl.	icabl			DEQUAT DEQUAT]]	
REMARKS: FSS PRESSURE	GAU	GE LEA	ĸv	VH:	ILE (CHI	ARG	ING T	HE	M	MU TAN	ĸs	WIL	LI	FORC

RCE A SWITCH TO THE REDUNDANT SYSTEM. LOSS OF REDUNANCY IS MISSION FAILURE.

ASSESSME ASSESSME NASA FME	NT I	[D :	12/05, MMU-2: 1.12.:	12						NASA DATA: BASELINE [] NEW [X]]
SUBSYSTE MDAC ID: ITEM:			MMU 212 VENT	VAL	VE											
LEAD ANA	LYSI	: :	DUFFY, HUYNH, SAIIDI													
ASSESSME	NT:															
		LIGH		1	RED	UND	ANG	CY	SCREI	ENS	5			CI		
		W/FUI		j	REDUNDANCY SCREE						С			ITEM		
NASA IOA	[3 [3	3 /3 3 /2R]]	[] []	P] P]		[[P P]]	[[P]]		[[-] *
COMPARE	ſ	/N]	[]		[]	[N]		[)
RECOMMEN	DATI	ons:	(If	di	ffe	rent	t 1	fro	om NAS	5A))					
	[1]	[]	· ·	[]	[•]	(AI	[DD/:	DEI] LETE)
* CIL RE	TENI	TION I	RATION	ALE	: (If a	apı	pli	icable	•)EQUAT)EQUAT		[[]
REMARKS: DIFFICUL	л тс) MATI	E FSS/I	MU	QD	DUI	E 7	0	HIGH	PI	RES	SURE	LIN	JE,	CI	REW

DIFFICULT TO MATE FSS/MMU QD DUE TO HIGH PRESSURE LINE, CREW INCONVENIENCE. IOA AGREES WITH THE FMEA, EXCEPT THAT THE SCREENS DO NOT NEED TO BE SPECIFIED.

ASSESSME ASSESSME NASA FME	NT	IC		12/05/86 MMU-213 1.12.1											SA DATA BASELINE NEW] ()		
SUBSYSTE MDAC ID: ITEM:	M:			MM 21 VE		'AI	LVE	2											
LEAD ANA	LYS	ST:	:	DU	FFY,	ł	IUY	NH,	SA	NI]	ID	I							
ASSESSME	NT :	;																	
	CRI		CAL		•		RI	DUNE	A	IC!	Y	SCRE	ENS	5		CI IT			
	F		N/FUI	_			A			1	B			С					
NASA IOA			/2R /2R]]		[[P P]]	[([]	P P]]	[[Р]]	[[:) *]	
COMPARE	[/]		[]	I	[]	[N]	[]	
RECOMMEN	DA'	FI (ons:		(If	đ	if	ferei	nt	f	r	om NA	SA)					
	[/]		[]		[]	[]] ADD/	DE] LET	E)
* CIL RE	TE	NT	ION	RAT	CION.	AL	Е:	(If	aj	pp	1:	icabl			DEQUATE DEQUATE	[[]]	
REMARKS :																			

ASSESSMI ASSESSMI NASA FMI	ENT]	[D:	MMU-2	214				NASA D. BASEL		x]
SUBSYSTI MDAC ID: ITEM:			MMU 214 VENT	VALV	Έ					
LEAD ANA	LYSI	:	DUFFY	, ни	YNH,	SAII	DI			
ASSESSME	ENT:									
	F	'LIGH	-			DANCY			CI IT	L EM
	HC	W/FU	NC	A		В		C		
NASA IOA	[3 [3	/2R /2R]]	[P [P]]	[P [P]	[] [P]	[[] *]
COMPARE	[1]	[]	ſ]	[א]	[]
RECOMMEN	DATI	ONS:	(If	dif	fere	nt fro	om Ni	ASA)		
	[/]	[]	ſ]	[]	[(ADD/] DELETE)
* CIL RE	TENT	ION	RATION	ALE:	(If	appl:	icab:	ADEQUAT]
REMARKS:								INADEQUAT	'E []

.

ASSESSME ASSESSME NASA FME	NT I	D:	MMU-2	J-215 BASELINE []								
SUBSYSTE MDAC ID: ITEM:			MMU 215 QD-HO	SE E	ND							
LEAD ANA	LYST	:	DUFFY	, но	YNH,	SAI	IDI					
ASSESSME	ASSESSMENT:											
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM												
			NC	A			В	c	:	LIL		
NASA IOA	[3 [3	/2R /3]]	[P [P]	[P] P]	[[I))	[[] *]	
COMPARE	[/N]	[]	[]	[]	[]	C]	
RECOMMEN	DATI	ONS:	(If	dif	fere	nt f	rom N	iasa)				
. •	[1	j	[]	[]	[]	[ADD/D] DELETE)	
* CIL RE	* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []											
REMARKS: LOSS OF FAILS.	REMARKS: LOSS OF RECHARGE CAPABILITY, LOSS OF MISSION IF REDUNDANT SYSTEM											

ASSESSME	ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-216 NASA FMEA #: 1.3.3									ASA DAT BASELIN NE		-	X]]	
SUBSYSTE MDAC ID: ITEM:			MMU 216 QD-HOS												
LEAD ANA	LYST	:	DUFFY	, HU	YNH,	SAII	DI								
ASSESSME	NT:														
	CRIT	ICAL		R	EDUNE	ANCY	SCREI	ENS	5			CI			
		W/FUI		A		В			С			ITI	SM		
NASA IOA	[3 [3	/2R /2R]]	[P [P]]	[P [P]]	[[P]]		[[] *]	
COMPARE	[/]	[]	[]	[N]		[]	
RECOMMEN	DATI	ons:	(If	dif	feren	t fro	om NAS	5A))						
	Ì	/]	[]	[]	[(AD	[D/1	DE:] LETE	:)
* CIL RE REMARKS:		ION I	RATION	ALE:	(If	appl	icable	-		DEQUATE DEQUATE		[[]	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	: [] [X]									
	ID: 217 QD-FIXED HALF									
LEAD ANALYST:	DUFFY, H	HUYNH, S	AIIDI							
ASSESSMENT:										
CRITICAL FLIGH		REDUNDA	NCY SCREE	ENS	CIL ITEM					
HDW/FU		A	В	С						
NASA [2 /2 IOA [3 /2R] [] [P] P]	[P] [P]	[] [P]	[X]* []					
COMPARE [N /N] []	[]	[N]	[N]					
RECOMMENDATIONS:	(If di	ifferent	: from NAS	SA)						
[3 /2R	[]	P]	[P]	[P] (A	[D] .DD/DELETE)					
* CIL RETENTION	RATIONALI	E: (If a	applicable	e) ADEQUATE INADEQUATE						
REMARKS: LEAK, FAILED OPE	:N									

ASSESSME ASSESSME NASA FME	NT ID:	,	218			NASA DAT BASELIN NE	
SUBSYSTE MDAC ID: ITEM:	M:	MMU 218 QD-F	IXED HAL	F			
LEAD ANA	LYST:	DUFF	Y, HUYNH	, SAII	DI		
ASSESSME	NT:						
		CALITY GHT	REDU	NDANCY	SCREEN	IS	CIL ITEM
	HDW/	FUNC	A	В		с	
NASA IOA	[3/ [3/	'2R] '2R]	[P] [P]	[P [P] [] P]	[] * []
COMPARE	[/	′]	[]	ſ] [NJ	[]
RECOMMEN	DATION	IS: (I	f differe	ent fro	om NASA	.)	
	[/	3	[]	[] [[] ADD/DELETE)
* CIL RE	TENTIO	N RATION	NALE: (II	f appli		ADEQUATE	
REMARKS:					I	NADEQUATE	[]

	12/05/86 MMU-219 2.6.2	MMU-219 BASELIN							
MDAC ID:	MMU 219 GAS ACTUA	19 AS ACTUATED NUTS (4)							
LEAD ANALYST:	DUFFY, HU	YNH, SAIID	DI						
ASSESSMENT:									
CRITICAL FLIGH HDW/FU	T	EDUNDANCY B	SCREENS C	CIL ITEM					
NASA [3 /1R IOA [3 /1R] [P]] [P] [P]] [P] []] [P]	[] * []					
COMPARE [/] [] [] [N]	[]]					
RECOMMENDATIONS:	(If dif	ferent fro	om NASA)						
[/] [] [] []	[] (ADD/DELETE)					
* CIL RETENTION	RATIONALE:	(If appli	Cable) ADEQUA INADEQUA						

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/8 MMU-219 2.6.3								ASA DATA BASELINE NEW	[]	
SUBSYSTEM: MDAC ID: ITEM:	MMU 219 GAS ACT	UAT	ED N	UTS	5 ((4)						
LEAD ANALYST:	DUFFY,	HUY	NH,	SAJ	III	DI						
ASSESSMENT:												
CRITICAI FLIG		RE	EDUND	ANG	CY	SCREI	ENS	5		CII ITE	-	
HDW/FC		A			B			С				
NASA [3 /21 IOA [3 /11		P P]]	[[P P]]	[[P]	[[]]	*
COMPARE [/N] []	[]	[N]	[]	

RECOMMENDATIONS: (If different from NASA)

[3 /1R]	[P]	[P]	[P]	[]
				(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable) ADI

ADEQUATE [] INADEQUATE []

REMARKS:

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FAIL OPEN. THIS FMEA WILL RESULT IN THE SAME EFFEDCT AS 2.6.2, AND THEREFORE TREATED THE SAME WAY.

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	: 12/05/86 MMU-220 2.6.1	NU-220 BASELINE []										
SUBSYSTEM: MDAC ID: ITEM:	MMU 220 GAS ACTUA	TED NU	TS (4)									
LEAD ANALYST:	DUFFY, HU	NH, S	AIIDI									
ASSESSMENT:												
CRITICA FLIG		EDUNDA	NCY SCREI	ENS	CIL ITEM							
HDW/F		A B C										
NASA [2/2 IOA [2/2] [P]] [P]]	[P] [P]	[] []	[X] * [X]							
COMPARE [/] []	[]	[]	[]							
RECOMMENDATIONS	: (If dif	ferent	from NA	SA)								
[/] []	[]	[] ()	[] ADD/DELETE)							
* CIL RETENTION	RATIONALE:	(If a	pplicabl	e) ADEQUATE INADEQUATE								
REMARKS:												

ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-221 NASA FMEA #:														DATA ELINI NEV	2 [] X]
SUBSYST MDAC ID ITEM:				MMU 221 FILTE	R											
LEAD AN	ALY	ST	:	DUFFY	,	HU	YNH,	SA	II	DI						
ASSESSM	ENT	:														
	CR		ICAL LIGH	CTY P		R	EDUN	DAN	СУ	SCRE	EN	s				IL Tem
			W/FUI			A			B			С			+	ICM
NASA IOA	[[3	/ /2R]	[[₽]]	[[P]]	[[Р]]		[[] *]
COMPARE	נ	N	/N]	[N]	[N]	[N]		[]
RECOMMEN	IDA'	FI C	ONS:	(If	d:	ifi	ferei	nt :	fro	om NA	SA))				
	[3	/2R]	[P]	[P]	[P]	(A] DD/] 'DELETE)
* CIL RE	ETEI	T	ION R	ATIONA	L	2:	(If	apj	pli	cabl	e)	AC	DEQI	JATE	ſ]
REMARKS :													_	JATE	Ì]
LEAK. F	SS	FJ	LTER	LEAK	HZ	S	NOT	BEI	EN	ASSE	SSE	D	BY	A NAS	SA	FMEA.

BASELINE (

NEW [X]

]

NASA DATA: ASSESSMENT DATE: 12/05/86 ASSESSMENT ID: MMU-222 NASA FMEA #: SUBSYSTEM: MMU MDAC ID: 222 ITEM: FILTER

LEAD ANALYST: DUFFY, HUYNH, SAIIDI

ASSESSMENT:

	CRITICALITY FLIGHT		Z	REDUNDANCY			SCREENS				CIL ITEM									
			/FUN	-		7	ł				в				с		±.	141	1	
NASA IOA	[[, 3,	/ /2R]	(I	þ]		ן נ	F]		[[P]]	[[x]]	*
COMPARE	[]	N ,	/N]	[ł	I]		[N]		[N]	[N]	
RECOMMEN	DAT	IOI	NS:		(If d	ii	f	er	ent	. 1	fro	m	NAS	A)						

[3/2R] [P] [F] [P] [A] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []

REMARKS: FRACTURE. FSS FILTER FRACTURE HAS NOT BEEN ASSESSED BY A NASA FMEA.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA BASELINE NEW	-
MDAC ID:	MMU 223 Gan Heater	S		
LEAD ANALYST:	DUFFY, HUY	NH, SAIIDI		
ASSESSMENT:				
CRITICAL FLIGH		DUNDANCY SCRE	ENS	CIL ITEM
HDW/FU		В	С	
NASA [2 /2 IOA [3 /3] [] [P] []] [P]	[] [P]	[X]* []
COMPARE [N /N] [N] [N]	[N]	[N]
RECOMMENDATIONS:	(If diff	erent from NA	SA)	
[3 /2R] [P] [[P]	[₽] (A	[D] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If applicabl	e) ADEQUATE INADEQUATE	[]
REMARKS:				

OPEN. THE ASTRONAUT, USING A SPECIAL TOOL STOWED ON THE FSS CAN MANUALLY UNBOLT AND REBOLT ALL NUTS AND BOLTS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-224 4.2.1	NASA DATA: BASELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 224 HEATER FOR FSS RECHARGE	SYSTEM PNEUMATIC FILTER
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI	
ASSESSMENT:		
CRITICAL FLIGH HDW/FU	T	ENS CIL ITEM C
NASA [2/2 IOA [3/3] [] []] [P] [P]	[] [X] * [P] []
COMPARE [N /N] [N] [N]	[N] [N]
RECOMMENDATIONS:	(If different from NA	SA)
[3 /2R] [P] [F]	[P] [] (ADD/DELETE)
* CIL RETENTION	RATIONALE: (If applicabl	e) ADEQUATE [] INADEQUATE []

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.

REPORT DATE 02/18/88 C-143

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			:	NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 225 TOGGLE VA	LVE HEATE	RS		
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI		
ASSESSMENT:					
CRITICAL FLIGH	ITY R	EDUNDANCY	SCREENS		CIL ITEM
HDW/FU	-	В	1	с	
NASA [2 /2 IOA [3 /2R] [] [P] [P] [P] [] [] P]	[X]* []
COMPARE [N /N] [N	и] [И] []	N]	[N]
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)		
[3 /2R] [P	P] [P] [[D] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl		ADEQUATE ADEQUATE	[] []
OPEN CIRCUIT, SH	ORT CIRCUI	т			

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA Baselini Nev	
MDAC ID:	MM U 226 PRESSURE GAUGE	HEATERS	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICAL FLIGH		ANCY SCREENS	CIL ITEM
HDW/FU	-	вС	I I EM
NASA [2 /2 IOA [3 /3] []] [P]	[] [] [P] [P]	[X]* []
COMPARE [N /N] [N]	[N] [N]	[N]
RECOMMENDATIONS:	(If differen	nt from NASA)	
[3 /3] []	[][]()	[D] ADD/DELETE)
* CIL RETENTION REMARKS: FAIL OPEN, SHORT		applicable) ADEQUATE INADEQUATE	

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ASSESSMI ASSESSMI NASA FMI	ENT	I		-	05/8 -227 .1								ASA I BASE:	DATA: LINE NEW	: [[x]	
SUBSYSTI MDAC ID: ITEM:				<u>ММ</u> 227 QD		ER	S											
LEAD AND	ALY:	ST	:	DUF	FY,	HU	YNI	I, SA	II	DI								
ASSESSMI	ent	:																
	CR		ICAL			R	EDU	JNDAN	CY	sc	REEN	S				[L		
]		W/FU	-		A			в			С			T	ren	1	
NASA IOA	[[2 3	/2 /2R]]	[P]] [P]	[[P]]		[[х]]	;
COMPARE	נ	N	/N]	[N]	C	N]	C	N]		[N]	

RECOMMENDATIONS: (If different from NASA)

[3 /2R]	[P]	[P]	[P]	[D]
				(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [] INADEQUATE [] *

REMARKS:

FAIL OFF, OPEN CIRCUIT, SHORT CIRCUIT. FSS QD MAY BE INOPERABLE OR FAIL CAUSING THE LOSS OF ONE RECHARGE SIDE. LOSS OF BOTH SIDES IS LOSS OF MISSION.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-228		1	NASA DATA BASELINE NEW	
	MMU 228 Heater Th	ERMOSTATS			
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI		
ASSESSMENT:					
CRITICAL FLIGH	ITY R T	EDUNDANCY	SCREENS		CIL ITEM
HDW/FU	-	В	(С	
NASA [3 /2R IOA [3 /2R] [P] [P] [P] [P] []] P]	[] * []
COMPARE [/] [] [] []	N]	[]
RECOMMENDATIONS:	(If dif	ferent fr	om NÀSA)		
[2 /2] [] [] [] (A)	[A] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl		ADEQUATE ADEQUATE	
REMARKS: FAIL OPEN. MISS			HEN FLIG	HT CRITIC	AL COMPONE

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

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 229 HEATER THERMOS	STATS	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICAL FLIGH		DANCY SCREENS	CIL
HDW/FU		ВС	ITEM
NASA [3 /2R IOA [3 /3] [P]] [P]	[F] [] [P] [P]	[X]* []
COMPARE [/N] []	[N] [N]	[N]
RECOMMENDATIONS:	(If differer	nt from NASA)	
[2 /2] []	[][] (AD	[] DD/DELETE)
* CIL RETENTION	RATIONALE: (If	applicable) ADEQUATE INADEQUATE	[]
		INADEQUATE NATE WHEN FLIGHT CRITIC JT A REDUNDANT SYSTEM A	AL COMPONENT

REPORT DATE 02/18/88 C-148

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ASSESSME ASSESSME NASA FME	NT I	D:	MMU-2	30							SA DATA BASELINE NEW]]	
SUBSYSTE MDAC ID: ITEM:	M:		MMU 230 TOGGL	e va	LVE	TEMF	>.	SEN	SORS	;				
LEAD ANA	lyst	:	DUFFY	, HU	унн,	SAI	II	I						
ASSESSME	NT:													
		ICAL LIGH	ITY	R	EDUN	DANC	CY	SCR	EENS	5		CIL ITE		
	-		NC	A			в			С				
NASA IOA	[3 [3	/3 /3]]	[[P]]	[[P]]	[[P]	[[]]	*
COMPARE	[/]	[N]	[N]	[N]	[]	
RECOMMEN	DATI	ONS:	(If	dif	fere	nt i	fro	om N	ASA))				
	[1]	[]	נ]	[]] DD/D] ELI	ETE)
* CIL RE	TENI	ION	RATION	IALE:	(If	apı	91 :	icab			DEQUATE DEQUATE]]	
REMARKS: LOSS OF IS NOT M	SIGN					Y TO S Fi	OG(AI)	gle Lure	VALV MOI	VE DE	TEMPERA DOES NO	ATURE DT RE	S	ENSOR IRE

SCREENS.

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ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #:	2: 12/05/86 MMU-231	5		NASA DATA BASELINI NEI	
SUBSYSTEM: MDAC ID: ITEM:	MMU 231 TOGGLE V	VALVE TEM	P. SENS	ORS	
LEAD ANALYST:	DUFFY, H	HUYNH, SA	IIDI		
ASSESSMENT:					
FLI	HT	REDUNDAN			CIL ITEM
HDW/	TUNC	A	В	С	
NASA [/ IOA [3 /] [] [] [P] [] P]	[] [P]	[] * []
COMPARE [N /	1] [м] [N]	[N]	[]
RECOMMENDATION	: (If di	fferent	from NAS	SA)	
[3/] [] []	[]	[] ADD/DELETE)
* CIL RETENTIO REMARKS: FAIL HIGH	RATIONALE	: (If ap	plicable	a) ADEQUATE INADEQUATE	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-232	NASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 232 Toggle valve temp. Sensor	S	
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI		
ASSESSMENT:			
CRITICAL FLIGH		S	CIL ITEM
HDW/FU		С	
NASA [/ IOA [3 /3] [] [] [] [P] [P] [] P]	[] *
COMPARE [N /N] [И] [И] [N]	[]
RECOMMENDATIONS:	(If different from NASA)	
[3 /3] [] [] [] [] (A)	[] DD/DELETE)
* CIL RETENTION	RATIONALE: (If applicable)	ADEQUATE	[]]
REMARKS: FAIL LOW	I	NADEQUATE	[]

ASSESSMENT DAY ASSESSMENT ID NASA FMEA #:	E: 12/05/8 MMU-233			NASA DATA BASELINE NEW	-
SUBSYSTEM: MDAC ID: ITEM:	MMU 233 ORBITER	R POWER CO	ONNECTOR		
LEAD ANALYST:	DUFFY,	HUYNH, SA	IIDI		
ASSESSMENT:					
CRITIC	ALITY GHT	REDUNDAN	ICY SCREENS	5	CIL
	FUNC	A	В	с	ITEM
NASA [/ IOA [3 /] [3] [] [P] [] [P] [] F]	[] * []
COMPARE [N /	4) [[N] [N] [м ј	[]
RECOMMENDATION	S: (If d	lifferent	from NASA)		
[/] [] [] [[] DD/DELETE)
* CIL RETENTIO	RATIONAL	E: (If ap		ADEQUATE ADEQUATE	[]
REMARKS: THIS ITEM AND MMU-184.	AILURE MO	DE ARE VO			RED WITH ITEM

ASSESSME ASSESSME NASA FME	NT	II			U-234 BASELINE [] NEW [X]															
SUBSYSTE MDAC ID: ITEM:				MM 23 EX		IA]	Ŀ	owe	RI	IJ	NE	:/C	ONNE	СТ	OR					
LEAD ANA	LY	ST	:	DU	FFY,	ł	ŧυy	NH,	SI	\I	:10	I								
ASSESSME	NT	:																		
	CR		ICAI LIGH				RI	EDUN	IDAI	10	CY.	SC	REEN	S			CIL ITE			
]	_	W/FU			A B C ITEM														
NASA IOA	[[3	/ /3]]		[[Р]]			P]]	[F]		[[]]	*	
COMPARE	[N	/N]		[N]		[N]	[N]		[]		
RECOMMEN	DA	TI	ons :		(If	đ	if	fere	ent	1	fro	m	NASA	\)						
	[/]		[]		[]	(•]	(A] .DD/D] DEL	ETE))
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []																				
REMARKS: OPEN CIRCUIT. THIS IOA IS SAME AS MMU-184, AND MAY THEREFORE BE VOIDED.								BE												

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ASSESSME ASSESSME NASA FME	NT	I	D:		MU-235 BASELIN									[]]		
SUBSYSTE MDAC ID: ITEM:				MMU 235 ORBIS	5 BITER ADAPTOR BEAM MOUNTS (6)													
LEAD ANA	LY	ST	:	DUFF	к, н	UY	(NH,	Sł	VII	DI								
ASSESSME	NT	:																
	CR		ICAL LIGH			RE	EDUN	DAN	ICY	S	CREEN	S				i l Fen	1	
]	HD	W/FUI	NC		A			E	\$		С						
NASA IOA	[[1 3	/1 /1R]]	[[Р]]	[F]	[[Р]		[[x]]	*
COMPARE	[N	/N]	[N]	[N]	[N]		[N]	
RECOMMEN	'DA'	rI(ONS:	(11	f di	ff	iere	nt	fr	om	NASA)						
	[/]	[]	(]	[]	(Al		/DF		TE)
* CIL RE	TEI	NT:	ION I	NOITAS	IALE	:	(If	ar	pl	ica	able)							
REMARKS:								_			I		DEQUA DEQUA		[[]	
THE RECO																		

THE RECOMMENDATION IS NOT TO CONSIDER THESE FAILURES SINCE THEY ARE NOT WITHIN THE SPECIFICATION OF 22206. THIS ITEM IS PART OF STRUCTURE, AND ITS FAILURE MODE AND CAUSE RELATIONSHIP ARE VERY UNLIKELY.

ASSESSME ASSESSME NASA FME	NT ID:	12/05/ MMU-2:					N	IASA DAT BASELIN NE		
SUBSYSTE MDAC ID: ITEM:		MMU 237 BACKBI	EAM S	SHOCK	(MOUN	NTS (4	L)			
LEAD ANA	LYST:	DUFFY	, HU	YNH,	SAIII	DI				
ASSESSME	NT:									
	CRITICAL FLIGH	T	R	EDUND		SCREI			CIL ITE	
	HDW/FU	NC	A		В		C	2		
NASA IOA	[/ [3 /2F]	[[P]]	[[P]]	[[I]	[[] *]
COMPARE	[N /N	1	[N]	ן א]	[]	1]	[]
RECOMMEN	DATIONS:	(If	dif	ferer	nt fro	om NAS	5A)			
	[/]	[]	[]	[] (] Delete)
* CIL RE		RATION	ALE:	(If	appl	icable	7	ADEQUATE ADEQUATE	C [C []]
REMARKS: THE RECO ARE NOT	MMENDATI	HE SPE	CIFI	CATIC	ON OF	NSTS	-222	FAILURE 206. TH CAUSE E	IIS II	YEM IS

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

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-238	• •						
	MMU 238 FOOT RESTRAI	INT ADJUST						
LEAD ANALYST:	DUFFY, HUYNH	I, SAIIDI						
ASSESSMENT:								
CRITICAL FLIGH		NDANCY SCREE	NS	CIL				
HDW/FU	_	В	С	ITEM				
NASA [/ IOA [3 /3] []] [P]	[] [P]	[] [P]	[]*				
COMPARE [N /N] [N]	[N]	[N]	[]				
RECOMMENDATIONS:	(If differ	ent from NAS	A)					
[3 /3] [P]	[P]	[P] (A	[] DD/DELETE)				
* CIL RETENTION	RATIONALE: (I) ADEQUATE INADEQUATE	[]				
REMARKS:								

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-239 2.2.2	MU-239 BASELINE []								
SUBSYSTEM: MDAC ID: ITEM:	MMU 239 FOOT RESTR									
LEAD ANALYST:	DUFFY, HUY	NH, SAIIDI								
ASSESSMENT:										
CRITICAL FLIGH		DUNDANCY SC	CREENS	CIL ITEM						
HDW/FU	NC A	В	С							
NASA [3 /3 IOA [3 /3] [] [P] []] [P]	[] [P]	[] * []						
COMPARE [/] [N] [N]	[N]	[]						
RECOMMENDATIONS:	(If diff	erent from	NASA)							
[/] [] []	[]	[] ADD/DELETE)						
* CIL RETENTION	RATIONALE:	(If applica	able) ADEQUATE INADEQUATE	[]						
REMARKS: JAM LOCKED			INADEQUALE	LJ						

ASSESSME ASSESSME NASA FME	NT I	D:	MMU-2	40							ASA DAT BASELIN NE]]	
SUBSYSTE MDAC ID: ITEM:			MMU 240 MMU L	АТСН											
LEAD ANA	lyst	:	DUFFY	, HU	YNH,	SAI	III	DI							
ASSESSME	NT:														
	F	LIGH	ITY F NC	R) A		DANC	CY B	SCR	EENS	s c			CIL (TE		
										-					
NASA IOA	[3 [3	/2R /3]	[P [P]	[[P P]	[[Ρ]]	((•] *]	r
COMPARE	נ	/N]	[]	[]	[N]	[]	
RECOMMEN	DATI	ons:	(If	dif	ferer	nt f	<u>î</u> ro	om Ni	ASA)	þ					
	[/]	[]	[]	[)/D] ELEI	E)
* CIL RE	TENT	ION I	RATION	ALE:	(If	app	51	icab:	-	AI IAI	DEQUATE DEQUATE		•]]	
REMARKS: JAM OPEN															oss

JAM OPEN. LOSS OF FUNCTION (TO LATCH MMU TO FSS) COULD BE LOSS OF MISSION, IF THE UNIT CANNOT BE RECHARGED. HOWEVER PRIOR TO REENTRY, THE MMU CAN BE STRAPPED DOWN IN THE MIDDECK. IOA AGREES WITH THE FMEA.

ASSESSME ASSESSME NASA FME	NT]	D:	12/05 MMU-2 2.7.1	MU-241 BASELINE [.7.1 NEW [X]		
SUBSYSTE MDAC ID: ITEM:			MMU 241 MMU L	J. LATCH										
LEAD ANA	LYSI	C:	DUFFY	, но	YNH,	SAI	II	DI						
ASSESSME	NT:													
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM														
		W/FU		A B C										
NASA IOA		3 /2R 3 /3]]	[F [F]	[[P P]]	[[P]]	[[]]	*
COMPARE	[/N]	[]	[]	[N]	[]	
RECOMMEN	DAT	lons:	(If	dif	fere	nt 1	fro	om Nž	ASA)					
	[1	〕	[]	Ċ]	[] (#			TE)
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []														
REMARKS: JAM CLOSED. THE MISSION IS TERMINATED IF REDUNDANT LANYARD ATTACHED TO THE FAILED LATCH DOES NOT BREAK THE SHEAR PIN. IOA AGREES WITH THE FMEA.														

ASSESSMENT ASSESSMENT NASA FMEA #	ID:	12/05/ MMU-24		IASA DATA BASELINE NEW]				
SUBSYSTEM: MDAC ID: ITEM:		MMU 242 MUSHRO	DOM :	KNOBS	; (8)					
LEAD ANALYS	ST:	DUFFY,	HU	улн,	SAII	DI				
ASSESSMENT:	1									
CRI	TICAL: FLIGH		R	EDUND	ANCY	SCRE	ens		CIL ITE	
H	IDW/FU		A		В		C	2		171
NASA [IOA [/ 3 /3]]	[[P]]	[[P]]	[[1	>]	[[] *]
COMPARE [N /N]	[N]	[N]	[]	1]	(]
RECOMMENDAT	lons:	(If	dif	feren	t fr	om NA	SA)			
ſ	3 /3]	[P]	[P	j	[]] d \ da.] ELETE)
* CIL RETEN	TION 1	RATIONA	LE:	(If	appl	icabl	7	DEQUATE	[[]
REMARKS:								-	•	-

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/ MMU-24				NASA DATA: BASELINE [] NEW [X]					
SUBSYSTEM: MDAC ID: ITEM:	MMU 243 THERM									
LEAD ANALYST:	DUFFY	UFFY, HUYNH, SAIIDI								
ASSESSMENT:										
CRITICA FLIGH HDW/FU	IT	RI A		DANCY	SCRE	ENS		CIL ITE		
nbw/ r	inc.	А		D			•			
NASA [/ IOA [3 /2]] 2]	[[P]]	[[P]]	[[I)]	[[] *]	
COMPARE [N /N]	[N]]	[N]	[]	1]	ſ]	
RECOMMENDATIONS	(If	dif	fere	nt fro	om NA	SA)				
[3 /2]	8]	[P]	[₽]	[]		[ADD/D] ELETE)	
* CIL RETENTION	RATION	ALE:	(If	appl	icabl	Ĩ	DEQUATE]	
REMARKS: FSS THERMAL BLAI RESULT IN LOSS (MISSION.						ISITI		NENT		

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-244	NASA DATA: BASELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 244 TETHER REEL RESTRAINT	
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI	
ASSESSMENT:		
CRITICAL FLIGH	ITY REDUNDANCY SCREENS	CIL ITEM
HDW/FU		C
NASA [/ IOA [3 /3] [] [] [] [P] [P] [] []* P] []
COMPARE [N /N] [N] [N] [м] []
RECOMMENDATIONS:	(If different from NASA)	
[/] [] [] [] [] (ADD/DELETE)
* CIL RETENTION		ADEQUATE [] ADEQUATE []
REMARKS: FRACTURE. THIS	MALFUNCTION IS VOIDED SINCE	THE ITEM IS CONNECTED

TO THE EMU.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/05/86 MMU-245									
	MMU 245 TETHER REEL RE	5 THER REEL RESTRAINT								
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI								
ASSESSMENT:										
CRITICAL FLIGH		ANCY SCREENS	CIL ITEM							
HDW/FU		B C								
NASA [/ IOA [3 /3] []] [P]	[] [[P] [P] []*] []							
COMPARE [N /N] [И]	[N] [N] []							
RECOMMENDATIONS:	(If differen	nt from NASA)								
ſ /] []	[][] [] (ADD/DELETE)							
* CIL RETENTION	RATIONALE: (If	AL	DEQUATE [] DEQUATE []							
REMARKS: THIS MALFUNCTION EMU.	N IS VOIDED SING	CE THE ITEM IS	CONNECTED TO THE							

.

ASSESSMENT DATE:NASA DATA:ASSESSMENT ID:MMU-1001XBASELINE []NASA FMEA #:1.1.1NEW [X]									E []		
SUBSYSTI MDAC ID: ITEM:			MMU 1001 GN2 T								
LEAD ANALYST: DUFFY, HUYNH, SAIIDI											
ASSESSMENT:											
CRITICALITY REDUNDANCY SCREENS FLIGHT							CIL				
	Н	DW/FU	NC	A B				I	с	ITEM	
NASA IOA	[[1 /1 1 /1]]	[[]]	[[]]	[[]]	[X]* [X]	
COMPARE	[/]	ſ]	[]	[3	[]	
RECOMMENDATIONS: (If different from NASA)											
	[/]	[]	[]	[] (1	[] ADD/DELETE)	
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] IOA IS IN AGREEMENT WITH THE FMEA.											

	NT ID: MMU-1031X BASELINE []							
SUBSYSTEM: MDAC ID: ITEM:	MMU 1031 Toggle VAI	LVES						
LEAD ANALYST: DUFFY, HUYNH, SAIIDI								
ASSESSMENT:								
CRITICAL FLIGH		EDUNDANCY	SCREENS	5	CIL ITEM			
HDW/FU	NC A	В		с				
NASA [2 /1R IOA [2 /1R] [P] [P] [P]] [P] [] [] P]	[X]* [X]			
COMPARE [/] [] [] [м]	[]			
RECOMMENDATIONS:	RECOMMENDATIONS: (If different from NASA)							
[/] [] [] [] (A	[] DD/DELETE)			
* CIL RETENTION	RATIONALE:	(If appl		ADEQUATE NADEQUATE	[]			
REMARKS: IOA IS IN AGREEMENT WITH THE FMEA.								

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1051X 1.4.3			SA DATA: ASELINE [NEW [
SUBSYSTEM: MDAC ID: ITEM:	MMU 1051 ISOLATION	-						
LEAD ANALYST: DUFFY, HUYNH, SAIIDI								
ASSESSMENT:								
CRITICAL FLIGH	T	EDUNDANCY			IL TEM			
HDW/FU	NC A	В	С					
NASA [2 /1R IOA [2 /1R] [P] [P] [] [P] [X] * X]			
COMPARE [/] [] [] [N	3 (]			
RECOMMENDATIONS: (If different from NASA)								
[/] [] [] [] [(ADD] /DELETE)			
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE []								
INADEQUATE [] REMARKS: IOA IS IN AGREEMENT WITH THE FMEA.								

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1141X 1.6.1			NASA DATA: BASELINE NEW					
SUBSYSTEM: MDAC ID: ITEM:	MMU 1141 THRUSTER 1	RIAD							
LEAD ANALYST: DUFFY, HUYNH, SAIIDI									
ASSESSMENT:									
CRITICAL FLIGH	Y SCREE	INS	CIL ITEM						
HDW/FU			В	С					
NASA [2 /1R IOA [2 /1R] [] [P] P]	[] [P]	[X] * [X]				
COMPARE [/] [] []	[N]	[]				
RECOMMENDATIONS:	RECOMMENDATIONS: (If different from NASA)								
[/] [] [1	[] (A	[] DD/DELETE)				
* CIL RETENTION	* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []								
REMARKS: IOA IS IN AGREEMENT WITH THE FMEA.									

ASSESSME ASSESSME NASA FME	NT	I			1U-1: 2.6	19	1X									DATA ELINE NEW	ີ[x]	
SUBSYSTE MDAC ID: ITEM:	M:				IU L91 EGULJ	A T	OR													
LEAD ANA	LYS	ST :	:	D	JFFY	, :	HU	YNH	I, S	5A	III	DI	•							
ASSESSME	NT:																			
		FI	ICALI LIGH	Г	Z		RI	EDU	NDA	N	СҮ	S	CREEN	s				I L FEI	1	
	H	[DV	V/FUI	1C			A				В			С						
NASA IOA			/2R /1R			[[P P]]		[[P P]	[[Р]]		[[x]]	*
COMPARE	[N	/N]		[]		[]	[N]		[N]	
RECOMMENDATIONS: (If different from NASA)																				

(ADD/DELETE)	[2 /1R]	[P]	[P]	[P]	[A] (ADD/DELETE)
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* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [INADEQUATE [ADEQUATE]

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REMARKS:

HIGH PRESSURE DOWNSTREAM WILL FORCE THE VENT VALVE OPEN, THUS LOSS OF GN2 OR LOSS OF SIDE. FUNCTIONAL LOSS MAY LEAVE THE CREW PERSON STRANDED.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA BASELINE NEW				
MDAC ID:	MMU 1211 GN2 REGULATOR						
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI					
ASSESSMENT:							
FLIGH				CIL ITEM			
HDW/FU	NC A	В	С				
NASA [1 /1 IOA [2 /1R] []] [P]	[] [[P] [] P]	[X]* [X]			
COMPARE [N /N] [N]	ן א] [N]	[]			
RECOMMENDATIONS: (If different from NASA)							
[2 /1R] [P]	[P] [P] (A	[] DD/DELETE)			
* CIL RETENTION	RATIONALE: (If		ADEQUATE NADEQUATE				
REMARKS: THE FMEA FULLY E CRITICALITY INAP							

ΉE CRITICALITY INAPPROPRIATELY. THE LOSS OF REGULATOR DOES NOT CAUSE LOSS OF LIFE IMMEDIATELY. ISO VALVE WILL BE SHUTOFF TO STOP THE LEAKAGE.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1212X 1.2.5		:	NASA DATA BASELINE NEW	-				
	MMU 1212 GN2 REGULA	-							
LEAD ANALYST: DUFFY, HUYNH, SAIIDI									
ASSESSMENT:									
CRITICAL FLIGH		DUNDANCY	SCREENS		CIL ITEM				
HDW/FU	NC A	В	1	С					
NASA [2 /1R IOA [2 /1R] [P] [P] [P] [P] [] [] P]	[X]* [X]				
COMPARE [/] [] [] []	N]	[]				
RECOMMENDATIONS: (If different from NASA)									
[/] [] [] [] (A)	[] DD/DELETE)				
* CIL RETENTION	RATIONALE:	(If appli	, i	ADEQUATE ADEQUATE	[] []				
REMARKS: IOA IS IN AGREEMENT WITH THE FMEA.									

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA BASE	DATA: LINE [] NEW [X]				
	MMU 1251 QUICK DISCONNE(СТ					
LEAD ANALYST: DUFFY, HUYNH, SAIIDI							
ASSESSMENT:							
CRITICAL FLIGH		ANCY SCREENS	CIL ITEM				
HDW/FU	NC A	B C					
NASA [1 /1 IOA [3 /2R] []] [P]	[] [] [P] [P]	[X]* []				
COMPARE [N /N] [N]	[N] [N]	[N]				
RECOMMENDATIONS: (If different from NASA)							
[3 /2R] [P]	[P] [P]	[D] (ADD/DELETE)				
* CIL RETENTION	RATIONALE: (If a	applicable) ADEQU INADEQU	ATE []				
		ACT THAT THE COUP	LER ON QD IS SE				

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.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: SUBSYSTEM: MDAC ID: ITEM:				NASA DATA BASELINE NEW	•			
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI					
ASSESSMENT:								
CRITICAL		EDUNDANCY	SCREENS	5	CIL			
FLIGH HDW/FU		В	\$	с	ITEM			
NASA [3 /2R IOA [3 /2R] [P]] [P] [P] [P] P]	[]*			
COMPARE [/] [] [] [N]	[]			
RECOMMENDATIONS: (If different from NASA)								
[/] [] [] [] (A)	[] DD/DELETE)			
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS:								

IOA IS IN AGREEMENT WITH THE FMEA, EXCEPT THAT RECHARGE IS DONE DURING POST-OPS.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1253 1.3.5	x		NASA DATA Baseline New				
SUBSYSTEM: MDAC ID: ITEM:	MMU 1253 QUICK DI	SCONNEC	T					
LEAD ANALYST: DUFFY, HUYNH, SAIIDI								
ASSESSMENT:								
CRITICAL		REDUNDA	NCY SCRI	EENS	CIL ITEM			
FLIGH HDW/FU		A	В	С				
NASA [3 /2F IOA [3 /2F	t] [t] [P] P]	[P] [P]	[] [P]	[]*			
COMPARE [/] []	[]	[N]	[]]			
RECOMMENDATIONS: (If different from NASA)								
[/] [] ·	[]	[]	[] ADD/DELETE)			
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []								
REMARKS: IOA IS IN AGREEMENT WITH THE FMEA.								

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-128	1X		NASA DA BASELII NI				
MDAC ID:	MMU 1281 BATTERY							
LEAD ANALYST: DUFFY, HUYNH, SAIIDI								
ASSESSMENT:								
CRITICAI FLIGH		REDUND	ANCY SCR	CENS	CIL ITEM			
HDW/FU	NC	A	В	С	I I EM			
NASA [2/2 IOA [3/2R] [] [] P]	[] [P]	[] [P]	[X]* []			
COMPARE [N /N] [N]	[N]	[N]	[N]			
RECOMMENDATIONS: (If different from NASA)								
[3 /2R] [P]	[P]		[D] ADD/DELETE)			
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE []								
ADEQUATE [] INADEQUATE [] FMEA DOES NOT RECOGNIZE REPLACING THE AFFECTED BATTERY WITH ANOTHER ONE STORED IN ORBITER.								

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1681X			NASA DATA: BASELINE [] NEW [X]						
MDAC ID:	MMU 1681 GYRO POWER SUPI			PLY						
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI									
ASSESSMENT:										
CRITICALITY FLIGHT		REDUNDANCY			SCREENS			CIL ITEM		
HDW/FU		A		В		C	2			
NASA [3 /3 IOA [3 /2R]	[[P]]	[[P]]	[[]	P]	[[] *]	
COMPARE [/N]	[N]	[N]	[]	ן א	[]	
RECOMMENDATIONS: (If different from NASA)										
[3 /2R]	[P]	[P]	[]	P] (#	[ADD/D] ELETE)	
* CIL RETENTION	RATIONA	LE :	(If	appl	icable	Ż	ADEQUATE ADEQUATE	-]]	
LOSS OF GYRO RESULTS IN LOSS OF AAH & ALT CONTROL SWITCH CAPABILITY NEEDED FOR CERTAIN MISSIONS LIKE SOLAR MAX. MANUAL										

LOSS OF GYRO RESULTS IN LOSS OF AAH & ALT CONTROL SWITCH CAPABILITY NEEDED FOR CERTAIN MISSIONS LIKE SOLAR MAX. MANUAL RHC CONTROL IS AVAILABLE AS A BACK-UP TO COMPENSATE FOR THE LOSS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				NASA DATA: BASELINE [] NEW [X]						
SUBSYSTEM: MDAC ID: ITEM:	MMU 1701 TRANSLA	TIONAL H	HAND CON	TROLLER						
LEAD ANALYST: DUFFY, HUYNH, SAIIDI										
ASSESSMENT:										
CRITICALITY FLIGHT		REDUND	ANCY SCF	REENS	CIL ITEM					
HDW/FU	NC	A	В	с						
NASA [2/2 IOA [3/1R] [] [P] P]	[P] [P]	[] [P]	[X]* []					
COMPARE [N /N] []	[]	[M]	[א]					
RECOMMENDATIONS: (If different from NASA)										
[3 /1R] [P]	[P]		[D] (ADD/DELETE)					
* CIL RETENTION	RATIONAL	E: (If a	applicab	ole) ADEQUATI INADEQUATI						
REMARKS: IOA CONSIDERS THE AXES REDUNDANT TO EACH OTHER.										

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA: BASELINE [] NEW [X]							
SUBSYSTEM: MDAC ID: ITEM:	MMU 1702 Translatic	ONAL HAND CON	TROLLER							
LEAD ANALYST:										
ASSESSMENT:										
CRITICAL FLIGH		EDUNDANCY SCR	EENS	CIL ITEM						
HDW/FU		В	С							
NASA [2 /2 IOA [3 /1R] [P]] [P] [P]] [P]	[] [P]	[X]* []						
COMPARE [N /N] [] []	[N]	[N]						
RECOMMENDATIONS: (If different from NASA)										
[3 /1R] [P] [P]		[D] DD/DELETE)						
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []										
REMARKS: IOA CONSIDERS THE AXES REDUNDANT TO EACH OTHER.										

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	NASA DA' BASELII Ni									
SUBSYSTEM: MDAC ID: ITEM:										
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI								
ASSESSMENT:										
CRITICAL FLIGH		DANCY SCREENS	CIL ITEM							
HDW/FU	NC A	B C								
NASA [2 /2 IOA [3 /1R] [P]] [P]	[P] [] [P] [P]	[X]* []							
COMPARE [N /N] []	[] [N]	[N]							
RECOMMENDATIONS: (If different from NASA)										
[3 /1R] [P]	[P] [P]	[D] (ADD/DELETE)							
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE []										
INADEQUATE [] REMARKS: IOA CONSIDERS THE AXES REDUNDANT TO EACH OTHER.										

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	: [] [X]								
SUBSYSTEM: MDAC ID: ITEM:									
LEAD ANALYST:									
ASSESSMENT:									
CRITICAL FLIGH		EDUNDANC	Y SCREEN	IS	CIL ITEM				
HDW/FU	—	L :	В	с					
NASA [2 /1R IOA [2 /1R] [P] [P	>] [>] [P] [P] [] P]	[X]* [X]				
COMPARE [/] [] [] [[И]	[]				
RECOMMENDATIONS:	(If dif	ferent f	rom NASA	7)					
[/] [] [] [] (A	[] DD/DELETE)				
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS:									
REMARKS: FAILS OFF IN ALL THREE AXIS. SEE ANALYSIS WORKSHEET.									

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/16/87 MMU-1721X 3.1.3	NASA DATA: BASELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 1721 ROTATIONAL HAND CONTROLLER	٤
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI	
ASSESSMENT:		

	CR	RITICALITY REDUNDANCY SCREENS FLIGHT					CIL ITEM														
	HDW/FUNC		A			В		с		I I EM											
NASA IOA	[[2 3	/2 /1R]		[[P]]		[[P]		[[Р]]	[[х]]	*	
COMPARE	[N	/N]		[N]		[N]		[N]	[N]		
RECOMMENDATIONS: (If different from NASA)																					
	r	2	/10	ı		r	D	٦		r	D	٦		r	ъ	٦	r	n	٦		

[3,	/1R] [P] [P]	[P]	[D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE	Γ]
INADEQUATE	Ī	j

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REMARKS:

FAIL OFF ONE AXIS. SEE ANALYSIS WORKSHEET 1721.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1722X BASELINE []								
	MMU 1722 ROTATIONAL HAND C								
LEAD ANALYST: DUFFY, HUYNH, SAIIDI									
ASSESSMENT:									
	ITY REDUNDANC	CY SCREENS	CIL ITEM						
FLIGH HDW/FU	INC A	B C	+ + + + + + + + + + + + + + + + +						
NASA [2 /2 IOA [3 /1F] [] [2] [P] [] [] P] [P]	[X]* []						
COMPARE [N /N] [И] [N] [N]	[N]						
RECOMMENDATIONS:	(If different s	from NASA)							
[3 /1	t] [₱] [P] [P] (A	[D] DD/DELETE)						
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []									
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 #:	NASA DATA Baseline New								
	MMU 1723 Rotational Han								
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI							
ASSESSMENT:									
CRITICAL FLIGH		ANCY SCREEN	S	CIL ITEM					
HDW/FU	NC A	В	С						
NASA [2/2 IOA [3/1R] [P]] [P]	[P] [[P] [] P]	[X]* []					
COMPARE [N /N] []	[]][м]	[N]					
RECOMMENDATIONS:	(If differen	t from NASA)						
[3 /1R] [P]	[₽] [P] (A)	[D] DD/DELETE)					
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS:									
FAIL OFF (1-3 AX	ES), SEE ALSO MI	MU-1721A.							

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	: [] [X]									
SUBSYSTEM: MDAC ID: ITEM:										
LEAD ANALYST: DUFFY, HUYNH, SAIIDI										
ASSESSMENT:										
CRITICAL FLIGH		EDUNDANCY SC	REENS	CIL ITEM						
HDW/FU		В	С							
NASA [2 /1R IOA [1 /1] [P]] []	[] []	[X]* [X]						
COMPARE [N /N] [N] [N]	[]	[]						
RECOMMENDATIONS:	(If dif:	ferent from	NASA)							
[1 /1] [] []	[] (A	[] .DD/DELETE)						
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []										
REMARKS: SEE ANALYSIS WORKSHEET 1722.										

ASSESSMI ASSESSMI NASA FMI			6/87 -1731) .8	ĸ		NASA DATA BASELINE NEW				: []	x]			
SUBSYSTEM:MMUMDAC ID:1731ITEM:TRANSLATIONAL HAND CONTROLLER															
LEAD ANALYST: DUFFY, HUYNH, SAIIDI															
ASSESSMI	ENT	:													
	CR			LITY									-		
	FLIGH HDW/FU				P	1	В	i	c		1.1	ΓEΝ	1		
NASA IOA	[[1 1	/1 /1]]	[[]]	[[]]	[[]]		[[X X]]	*
COMPARE	[/]	[]	[]	[]		[]	

RECOMMENDATIONS: (If different from NASA)

[1]	Ε]	[]	[]	[]
									(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE	[]
INADEQUATE	ĺ	j

REMARKS:

MECHANICALLY JAMS IN ISO MODE. IF THE FAILURE IS MECHANICAL, BOTH ISO VALVES ARE CLOSED. THE HANDLE CANNOT BE RETURNED TO NORMAL POSITION. PILOT IS STRANDED WITH NO PROPULSIVE POWER.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1861X		1	NASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	MMU 1861 CEA THERMO	OSTATS (2	SETS)		
LEAD ANALYST:	DUFFY, HU	YNH, SAIII	DI		
ASSESSMENT:					
CRITICAL FLIGH		EDUNDANCY	SCREENS		CIL ITEM
HDW/FU	NC A	В		С	
NASA [2 /1R IOA [2 /1R] [P] [P] [P]] [P]] [] [] P]	[X] * [X]
COMPARE [/] [J [] [ן א	[]
RECOMMENDATIONS:	(If dif	ferent fro	om NASA)		
[/] [] [] [] (A)	[] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl.		ADEQUATE IADEQUATE	[]
REMARKS: FAILS CLOSE			IN	ADEQUATE	LJ

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:			NASA DATA BASELINE NEV	••			
SUBSYSTEM: MDAC ID: ITEM:	MMU 1862 MMU THERMO						
LEAD ANALYST:	DUFFY, HU	YNH, SAIIDI					
ASSESSMENT:							
CRITICAI FLIGH		EDUNDANCY S	CREENS	CIL ITEM			
HDW/FU	INC A	В	С				
NASA [2 /1H IOA [2 /1H	R] [P R] [P] [F]] [P]	[] [P]	[X]* [X]			
COMPARE [/] [] [И]	[N]	[]			
RECOMMENDATIONS:	(If dif:	ferent from	NASA)				
[/] [] []		[] .DD/DELETE)			
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE []							
REMARKS: FAILS OPEN			INADEQUATE	[]			

REPORT DATE 02/18/88 C-186

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				DATA: JINE [] NEW [X]
MDAC ID:	MMU 1891 ARM ANGLE	ADJUST		
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI	
ASSESSMENT:				
CRITICAL FLIGH	T	EDUNDANCY		CIL ITEM
HDW/FU	NC A	. В	Ľ	
NASA [1 /1 IOA [3 /2R] [] [P] [] [P] []] [P]	[X]* []
COMPARE [N /N] [N) [N	ן א ן	[N]
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)	
[3 /2R] [P) [P] [P]	[D] (ADD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl	icable) ADEQUA INADEQUA	
REMARKS:	דא ידעד שהם	K DOSTITO		AN FLY BACK

IF THE ARM JAMS IN THE WORK POSITION, THE PILOT CAN FLY BACK SINCE IT MUST BE SHORTENED BEFORE IT IS PLACED IN THAT POSITION.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:				ASA DATA: BASELINE NEW	[] [X]		
	MMU 1892 ARM ANGLE	ADJUST					
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI				
ASSESSMENT:	ASSESSMENT:						
CRITICAL FLIGH		EDUNDANCY	SCREENS		CIL ITEM		
HDW/FU	-	В	С		licm		
NASA [2 /1R IOA [3 /2R] [P] [P] [P]] [P]] [] [P]]	[X]* []		
COMPARE [N /N] [] [] [N]	[א]		
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)				
[3 /2R] [P] [P] [P		[D] D/DELETE)		
* CIL RETENTION	RATIONALE:	(If appl	A	DEQUATE DEQUATE	[] []		
REMARKS:							

IF THE ARM JAMS IN THE WORK POSITION, THE PILOT CAN FLY BACK SINCE IT MUST BE SHORTENED BEFORE IT IS PLACED IN THAT POSITION.

ASSESSMENT DATI ASSESSMENT ID: NASA FMEA #:	MMU-1	893X				-	ASA DA BASELI N			
SUBSYSTEM: MDAC ID: ITEM:	MMU 1893 Arm Ai									
LEAD ANALYST:	DUFFY	, HUY	NH, S	AIII	DI					
ASSESSMENT:										
CRITIC		RE	DUNDA	NCY	SCRE	ENS			IL TEM	
HDW/	FUNC	A		В		С				
NASA [1 / IOA [3 /	L] 3]	[[]]	[[]]	[[]]	[] '	*
COMPARE [N /	1]	[]	[]	[]	[]	
RECOMMENDATION	5: (If	diff	erent	: fr	om NA	SA)				
[3/	3]	[]	[]	[]		D] /DELE	ΓE)
* CIL RETENTIO	N RATION	ALE:	(If a	appl	icabl		DEQUA' DEQUA'	re (re (]	
REMARKS: IF THE ARM FAI	ls to lo	CK BA	ск то) FL	IGHT	POSI	TION,	THE	PILOT	CAN

IF THE ARM FAILS TO LOCK BACK TO FLIGHT POSITION, THE PILOT CAN OPERATE THE MMU FROM THE WORK POSITION SINCE THE ARM MUST BE SHORTENED BEFORE IT IS PLACED IN THE WORK POSITION.

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:			P	VASA DATA: BASELINE NEW			
SUBSYSTEM: MDAC ID: ITEM:	MMU 1894 ARM ANGLE						
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI				
ASSESSMENT:							
CRITICA FLIG	łT	EDUNDANCY			CIL ITEM		
HDW/F	JNC A	В	C	2			
NASA [2 /1] IOA [3 /3	R] [P]] [P]] [] [] []]	[X]* []		
COMPARE [N /N) [N] [N] [3	[N]		
RECOMMENDATIONS	(If dif	ferent fro	om NASA)				
[3 /3] [] [] [[D] D/DELETE)		
* CIL RETENTION	* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []						
REMARKS: IF THE ARM FAILS	S TO LOCK B	ACK TO FL		-			

IF THE ARM FAILS TO LOCK BACK TO FLIGHT POSITION, THE PILOT CAN OPERATE THE MMU FROM THE WORK POSITION SINCE THE ARM MUST BE SHORTENED BEFORE IT IS PLACED IN THE WORK POSITION. **#**

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ASSESSME ASSESSME NASA FME	NT I	D:			x			N	ASA BASE	LINE]
SUBSYSTE MDAC ID: ITEM:			MMU 1895 ARM A									
LEAD ANA	LYST	:	DUFFY	, н	JYNH,	SAI	IDI					
ASSESSME	ASSESSMENT:											
			ITY	1	REDUN	IDANC'	sci	REENS			CIL ITE	
		LIGH W/FU	NC	2	A]	В	С			TIC	M
NASA IOA	[3 [3	/2R /3]]	[]	P]]	[P]]	[[]]		[[] *]
COMPARE	[/N]	[]	נ א	[]	N]	[]		[]
RECOMMEN	DATI	ons:	(If	di	ffere	ent f	rom 1	NASA)				
	[3	/3]	[]	[]	[]	(A)	[DD/D] DELETE)
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []												
REMARKS: IF THE ARM FAILS TO LOCK BACK TO FLIGHT POSITION, THE PILOT CAN OPERATE THE MMU FROM THE WORK POSITION SINCE THE ARM MUST BE												

OPERATE THE MMU FROM THE WORK POSITION SINCE THE ARM MUST BE SHORTENED BEFORE IT IS PLACED IN THE WORK POSITION.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-189			NASA DAT BASELIN NE			
MDAC ID:	MMU 1896 ARM ANG						
LEAD ANALYST:	DUFFY,	HUYNH,	SAIIDI				
ASSESSMENT:							
CRITICAL FLIGH		REDUNI	DANCY SCR	EENS	CIL ITEM		
HDW/FU	NC	Α	В	с			
NASA [1 /1 IOA [3 /2R] [] [] P]	[] [F]	[] [P]	[X]* [X]		
COMPARE [N /N] [[N]	[N]	[N]	[]		
RECOMMENDATIONS:	(If d	lifferer	nt from N	ASA)			
[3 /2R	ງ [P]	[F]		[] ADD/DELETE)		
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []							
INADEQUATE [] REMARKS: THE FAILURE IS, "INADVERTENTLY UNLOCKS". HOWEVER, THE ARM IS ALSO SECURED WITH A STRAP.							

ASSESSME ASSESSME NASA FME	NT I	D:	MMU-1	.897X				1	NASA DA BASELI N		x]
SUBSYSTE MDAC ID: ITEM:			MMU 1897 ARM A								
LEAD ANA	LYST	:	DUFFY	, ни	YNH,	SAII	DI				
ASSESSME	ASSESSMENT:										
		ICAL LIGH	ITY	R	EDUN	DANCY	SCF	REENS		CI	L Em
			NC	A		В		l	С		
NASA IOA	[3 [3	/2R /2R]]	(F [F)]	[P [P]]	[[] P]	[[] *]
COMPARE	[/]	[]	[]	[и]	[]
RECOMMEN	DATI	ONS:	(11	dif	fere	ent fr	om N	IASA)			
	[/]	[]	[]	ſ]] (ADD/] DELETE)
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []											
REMARKS: IF THE ARM JAMS IN THE WORK POSITION, THE PILOT CAN FLY BACK SINCE IT MUST BE SHORTENED BEFORE IT IS PLACED IN THAT POSITION.											

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MDAC ID:	MMU-1898X			ATA: INE [] IEW [X]
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI	
ASSESSMENT:				
CRITICAL FLIGH HDW/FU	Г	REDUNDANCY B	SCREENS C	CIL ITEM
NASA [3 /3 IOA [3 /2R] [] [P] [P] [P] []] [P]	[] *
COMPARE [/N] [N	и] [и] [N]	[]
RECOMMENDATIONS:	(If dif	ferent fro	om NASA)	
[3 /2R) [P	9] [P] [P]	[] (ADD/DELETE)
* CIL RETENTION D			ADEQUAT INADEQUAT	E []
IF THE ARM JAMS	TH THE WOR	W LOSTITOL	N, INE PILOT CA	IN FLI BACK

IF THE ARM JAMS IN THE WORK POSITION, THE PILOT CAN FLY BACK SINCE IT MUST BE SHORTENED BEFORE IT IS PLACED IN THAT POSITION.

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/19/87 MMU-1899X	NASA DAT BASELII NI	
MDAC ID:	MMU 1899 ARM ANGLE ADJU:	ST	
LEAD ANALYST:	DUFFY, HUYNH,	SAIIDI	
ASSESSMENT:			
CRITICAL FLIGH		ANCY SCREENS	CIL ITEM
HDW/FU	NC A	B C	
NASA [/ IOA [2 /1R] []] [P]	[] [] [P] [P]	[] * [X]
COMPARE [N /N] [И]	[N] [N]	[N]
RECOMMENDATIONS:	(If differen	t from NASA)	
[2 /1R] [P]	[P] [P]	[A] (ADD/DELETE)
* CIL RETENTION	RATIONALE: (If	applicable) ADEQUAT INADEQUAT	E [] E []

FAILS FROM WORK TO LAUNCH POSITION.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-1981X	٢	NASA DA BASELII N	
MDAC ID:	MMU 1981 MMU BATTE	RY LATCHES	S	
LEAD ANALYST:	DUFFY, HU	YNH, SAIII	DI	
ASSESSMENT:				
CRITICAL FLIGH	Т	EDUNDANCY		CIL ITEM
HDW/FU	NC A	B	С	
NASA [1 /1 IOA [3 /2R] [] [P] [?] [F] []] [P]	[X]* [X]
COMPARE [N /N] [N	[] [N] [N]	[]
RECOMMENDATIONS:	(If dif	ferent fro	om NASA)	
[3 /2R] [P	'] [F] [P]	[] (ADD/DELETE)
* CIL RETENTION	RATIONALE:	(If appli	ADEQUATE	
REMARKS:			INADEQUATE	2 []

ASSESSMEN ASSESSMEN NASA FMEN	NT ID:	MMU-2111 1.10.2	X		NASA DAT BASELIN NE	
SUBSYSTEN MDAC ID: ITEM:	1:	MMU 2111 FSS PRES	SURE G	AUGES		
LEAD ANAI	LYST:	DUFFY, H	IUYNH,	SAIIDI		
ASSESSMEN	мт:					
(CRITICAL FLIGH		REDUND	ANCY SCR	EENS	CIL ITEM
	HDW/FU		A	В	C	
NASA IOA	[3 /3 [3 /3] [] [] P]	[] [P]	[] [P]	[]*
COMPARE	[/] [М]	[N]	[N]	[]
RECOMMENI	DATIONS:	(If di	fferen	t from N	ASA)	
	[/] []	[]	[]	[] (ADD/DELETE)
* CIL RE	TENTION	RATIONALE	2: (If	applicab	le) ADEQUATI INADEQUATI	
REMARKS:					THADEQUAIL	2 L]

REPORT DATE 02/18/88 C-197

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ASSESSMENT DATE: NASA DATA: ASSESSMENT ID: MMU-2141X BASELINE [] NEW [X] NASA FMEA #: 1.13.1 SUBSYSTEM: MMU MDAC ID: 2141 ITEM: FSS SUPPLY VALVE LEAD ANALYST: DUFFY, HUYNH, SAIIDI ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT HDW/FUNC A B C NASA [3 /2R] [] [P] [] []] * IOA [/NA] Г 1 COMPARE [N/N] [] [N] [] []**RECOMMENDATIONS:** (If different from NASA) ſ (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [1 INADEQUATE []

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).

ASSESSME ASSESSME NASA FME	NT I	D:						ł		ATA: INE [NEW [X		
SUBSYSTE MDAC ID: ITEM:			MMU 2142 FSS S	SUPPL	Y VA	LVE						
LEAD ANA	LYST	:	DUFF	(, HU	YNH,	SAII	DI					
ASSESSME	NT:											
		ICAL LIGH		R	EDUN	DANCY	SCI	REENS		CII ITE		
	-		NC	A		В		C	2			
NASA IOA	[3 [3	/2R /2R]	[P [P]	[P [P]]] []] ?]	[[] *]	
COMPARE	[/]	[]	[]	[]	1]	ſ]	
RECOMMEN	DATI	ons:	(1:	f dif	fere	ent fro	om 1	NASA)				
	[1]	[]	[]	[]	[(ADD/1] DELETE)	
* CIL RE	TENT	ION	RATIO	NALE:	(If	appl	ical		ADEQUA' ADEQUA'	re (re (]]	
REMARKS: IOA IS I IS DONE	N AG				'HE F	MEA,	BUT					NG

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-2143X 1.13.3			NASA DATA Baseline New	
MDAC ID:	MMU 2143 FSS SUPPL	Y VALVE			
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI		
ASSESSMENT:					
CRITICAL FLIGH		EDUNDANCY	SCREENS		CIL
HDW/FU	-	В		с	ITEM
NASA [3 /2R IOA [2 /2] [P]] [P] [P] [P] [] [] P]	[] * [X]
COMPARE [N /N] [] [] [N]	[N]
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)		
[2 /2] [] [] [[A] DD/DELETE)
* CIL RETENTION	RATIONALE:	(If appl		ADEQUATE ADEQUATE	[]
REMARKS :					L J

IF A SEVERE LEAKAGE 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.

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ASSESSME ASSESSME NASA FME	NT ID:	: M	MU-21 .13.4						ASA DATA BASELINE NEW]
SUBSYSTE MDAC ID: ITEM:	M:	2	MU 144 SS SUPPLY VALVE								
LEAD ANA	LYST:	D	UFFY, HUYNH, SAIIDI								
ASSESSME	NT:										
	CRITIC FLI	CALIT IGHT	Y	R	EDUN	DANCY	SCR	EENS		CIL ITE	
	HDW/	FUNC		A		E	-	C			
NASA IOA	• •	/3] /3]		[P []]	[I [?]]	[[]]	[[] *]
COMPARE	[/	/]		[N]	[]	4]	[]	[]
RECOMMEN	DATION	NS:	(If	dif	fere	nt fi	com N	ASA)			
	[/	/]		[]	[]	[] (A] DD/DD.] ELETE)
* CIL RE	TENTI	ON RA	TIONA	LE:	(If	appl	licab	A	DEQUATE	-]
REMARKS: IOA IS I	N AGRI	eemen	T WIT	н т	HE F	MEA.					-

ASSESSME ASSESSME NASA FME	NT ID:	MMU-2				ATA: INE [] NEW [X]
SUBSYSTE MDAC ID: ITEM:		MMU 2181 FLEX				
LEAD ANA	LYST:	DUFFY	Y, HUYNH,	SAIIDI		
ASSESSME	NT:					
	FLIG	нт		DANCY SCR		CIL ITEM
	HDW/F	UNC	A	В	С	
NASA IOA	[3 /2] [3 /2]	R] R]	[P] [P]	[P] [P]	[] [P]	[] * []
COMPARE	[/]	[]	[]	[א]	[]
RECOMMEN	DATIONS	: (I	f differe	nt from N.	ASA)	
	[/]	[]]	[]	[]	[] (ADD/DELETE)
	TENTION	RATION	NALE: (If	applicab	le) ADEQUA INADEQUA	
REMARKS: IOA IS I UNDERSTO	N AGREE	MENT WI E DONE	TH THE F DURING P	MEA, EXCE OST-OPS P	PT THAT RE	CHARGING IS

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATI BASELINI NEV						
SUBSYSTEM: MDAC ID: ITEM:	MMU 2391 FOOT RESTRAINT	991						
LEAD ANALYST: DUFFY, HUYNH, SAIIDI								
ASSESSMENT:								
CRITICAI FLIG		DANCY SCREENS	CIL ITEM					
HDW/FU		B C						
NASA [1 /1 IOA [3 /2]] [] R] [P]	[] [] [P] [P]	[X]* []					
COMPARE [N /N] [N]	[N] [N]	[N]					
RECOMMENDATIONS	: (If differer	nt from NASA)						
[3 /2]	R] [P]	[P] [P] ([D] ADD/DELETE)					
* CIL RETENTION	RATIONALE: (If	applicable) ADEQUATE INADEQUATE						
REMARKS: CRITICALITY FOR	IOA IS PRELIMIN	NARY. FINAL ANALYSIS	IS RESERVED					

UNTIL MODIFICATION TO THE RESTRAINT IS AVAILABLE.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-2392X 2.2.3	NASA DATA: BASELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	MMU 2392 FSS FOOT RESTRAINT	
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI	

ASSESSMENT:

		TICAI FLIGH		REDUNDANCY SCREE					ENS			CIL ITEM		
		DW/FU	-	A		B	5	(2		TT	C1 M		
NASA IOA	[[3 /3 3 /3]]	[[]]	[[]]	[[]]		[[י [[*	
COMPARE	[/]	[]	[]	ſ]		[]		
RECOMMEN	IDAT	IONS:	(]	f dif	fere	ent fr	om N	ASA)						
	[/]	ſ]	[]	[]	(AI	[)D/[] DELEI	ſE)	
* CIL RE	TEN	TION	RATIC	NALE:	(If	appl	icab	•			_			
REMARKS :								A Ina	ADEQUAT ADEQUAT	'E 'E	[[]]		

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IOA IS IN AGREEMENT WITH THE FMEA.

NASA DATA:

ASSESSMENT DATE: 3/23/87

BASELINE [] NEW [X] ASSESSMENT ID: MMU-4000X NASA FMEA #: SUBSYSTEM: MMU MDAC ID: 4000 ARM STRAP ITEM: LEAD ANALYST: DUFFY, HUYNH, SAIIDI ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С HDW/FUNC A В IASA [/] IOA [3 /3] [] [] [] [P] [P] [P] []* NASA [COMPARE [N/N] [N] [N] [] RECOMMENDATIONS: (If different from NASA) [3/3] [] [] [] [] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] ADEQUATE

REMARKS:

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ASSESSME ASSESSME NASA FME	NT	I	D:		001X				1		DATA ELINE NEW	: [x]]		
SUBSYSTE MDAC ID: ITEM:				MMU 4001 ARM S										÷		
LEAD ANA	LY	ST	:	DUFFY	UFFY, HUYNH, SAIIDI											
ASSESSME	NT	:														
	CR			ITY	R	EDUNI	DANCY	SCR	EENS				IL	-		
]		LIGH W/FU		А		B	ı	(С		1.	rem	L		
NASA IOA	[[1 3	/1 /3]]	[[]]	[[]]	[[]]		[х]]	*	
COMPARE	[N	/N]	[]	[]	[]		[N]		
RECOMMEN	'DA'	ri(ons:	(If	dif	ferer	nt fr	om Na	ASA)							
	[3	/3]	[]	[]	[]	(A] .DD,	D / DE		TE))
* CIL RE	TE	NT	ION	RATION	ALE:	(If	appl	icabi	i		JATE JATE]		
TWO LATC PROJECTI								FAIL	FOR	THE	ARM	то	BE	(CO)	ME	A

ASSESSMEN ASSESSMEN NASA FMEA	T ID:	MMU-40 5.2.1)02X						ASA DATA BASELINE NEW]]
SUBSYSTEM MDAC ID: ITEM:		MMU 4002 MMU BA									
LEAD ANAL	YST:	DUFFY, HUYNH, SAIIDI									
ASSESSMEN	T:										
C	RITICAL FLIGH		R	EDUNI	DANC	ΥS	SCREEN	S		CIL ITEI	м
	HDW/FU	NC	Α			B		С			
	[1 /1 [3 /2R		[[P]]	[[Р.	[[Р]]	[X [] *]
COMPARE	[N /N]	[N]	[N] [N]	[N]
RECOMMEND	ATIONS:	(If	dif	ferei	nt f	roi	n NASA)			
	[3 /2R]	(P]	[P] [P		[D [D/D]] ELETE)
* CIL RET	ENTION	RATIONA	LE:	(If	app	lio	cable)			r.	,
							I		DEQUATE DEQUATE	L []]
REMARKS: THE FMEA THE IOA A					Y OF	BZ	ATTERY	E	PLOSION	FOR	WHICH

REPORT DATE 02/18/88

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4003X 5.2.1	NASA DATA: BASELINE [] NEW [X]					
	MMU 4003 MMU BATTERY RECHARGE C	ABLE					
LEAD ANALYST: DUFFY, HUYNH, SAIIDI							
ASSESSMENT:							
CRITICAL FLIGH		EENS CIL ITEM					
HDW/FU	NC A B	с					
NASA [1 /1 IOA [3 /2R] [] []] [P] [P]	[] [X] * [P] []					
COMPARE [N /N] [N] [N]	[N] [N]					
RECOMMENDATIONS:	(If different from N	ASA)					
[3 /2R	[P] [P]	[P] [D] (ADD/DELETE)					
* CIL RETENTION	RATIONALE: (If applicab	le) ADEQUATE [] INADEQUATE []					
REMARKS: SEE MMU-4002 REM	ARKS.	INADEQUATE []					

REPORT DATE 02/18/88 C-208

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4004X 5.3.1			NASA DATA: BASELINE [] NEW [X]		
SUBSYSTEM: MDAC ID: ITEM:	MMU 4004 TRUNNION PIN ATTACHME			DEVICE		
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI					
ASSESSMENT:						
CRITICAL FLIGH		REDUND	ANCY SCREE	NS	CIL ITEM	
HDW/FU		A	В	С		
NASA [1 /1 IOA [3 /2R] [;] [] P]	[] [P]	[] [P]	[X]* []	
COMPARE [N /N] [[N]	[N]	[N]	[N]	
RECOMMENDATIONS: (If different from NASA)						
[3 /2R	() [P]	[P]	[P] (A	[D] .DD/DELETE)	
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []						
REMARKS: THE FMEA ASSUMES THAT EQUIPMENT TO BE ATTACHED ARE NEEDED FOR RESCUE (LIFE SAVING) OPERATION. THIS ALREADY ASSUMES A CONTINGENCY SCENARIO AND THEREFORE MULTIPLE FAILURE.						

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4005X		NASA DATA: BASELINE [] NEW [X]			
	MMU 4005 Battery Transfe					
LEAD ANALYST:	DUFFY, HUYNH, S	DUFFY, HUYNH, SAIIDI				
ASSESSMENT:						
CRITICAI FLIGH		NCY SCREENS	CIL ITEM			
HDW/FU	NC A	B C				
NASA [2/2 IOA [3/2F] [P] [P]	[P] [] [F] [P]	[X]* []			
COMPARE [N /N] []	[N] [N]	[N]			
RECOMMENDATIONS: (If different from NASA)						
[3 /2F	[P]	[P] [P]	[D] (ADD/DELETE)			
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []						
REMARKS: ADDITIONAL BATTERIES EXIST TO REPLACE THE LOST ONE, AND ALSO HAS A TETHER ATTACHED - SEE FMEA 5.6.1 (MMU-4006).						

ASSESSMENT DATE: ASSESSMENT ID: MMU-4006X NASA FMEA #: 5.6.1				NASA DATA: BASELINE [] NEW [X]				
SUBSYSTE MDAC ID: ITEM:		MMU 4006 BATTEI	RY TI	ethef	STR	AP		
LEAD ANA	LYST:	DUFFY	, HU	YNH,	SAII	DI		
ASSESSME	NT:							
	CRITICAL FLIGH		R	EDUNE	ANCY	SCR	EENS	CIL ITEM
	HDW/FU		A		E	6	С	
NASA IOA	• •]]	[P [P]]	[] [])]	[] [P]	[X]* []
COMPARE	[N /N]	[]	٢]	[N]	[И]
RECOMMEN	DATIONS:	(If	dif	ferer	nt fr	om N	ASA)	
	[3 /2R]	[P]	[]	']	[P]	[D] (ADD/DELETE)
* CIL RE	TENTION	RATION	ALE:	(If	appl	.icab	le) ADEQUAT INADEQUAT	
REMARKS: IOA CONS	IDERED B							ST ONE. ALS

IOA CONSIDERED BACK-UP BATTERIES TO REPLACE THE LOST ONE. ALSO, THE FAILED TETHER CAN BE REPLACED WITH ANOTHER ONE (OTHER MMU).

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4007X 5.7.1		NASA DATA: BASELINE [] NEW [X]			
SUBSYSTEM: MDAC ID: ITEM:	MMU 4007 CONTINGENCY	TOOL				
LEAD ANALYST:	EAD ANALYST: DUFFY, HUYNH, SAIIDI					
ASSESSMENT:						
CRITICAL FLIGH		DUNDANCY	SCREENS	CIL ITEM		
HDW/FU	NC A	В	С			
NASA [2 /2 IOA [2 /2] []] [P]	[[P] []] [P]	[X] * [X]		
COMPARE [/] [N]	[N] [И]	[]		
RECOMMENDATIONS: (If different from NASA)						
[/] []	C] []	[] (ADD/DELETE)		
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS: IOA IS IN AGREEMENT WITH THE FMEA.						

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4008X 5.7.2							
	MMU 4008 CONTINGENCY							
LEAD ANALYST:	DUFFY, HUYNH	I, SAIIDI						
ASSESSMENT:								
CRITICAL FLIGH	INDANCY SCREENS	5	CIL ITEM					
HDW/FU		В	С					
NASA [3 /2R IOA [3 /2R	[P] [P]	[P] [[P] [] P]	[] * []				
COMPARE [/] []	[]][N]	[]				
RECOMMENDATIONS: (If different from NASA)								
ť /] []	[]][] (A	[] DD/DELETE)				
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS:								
REMARKS: IOA IS IN AGREEMENT WITH THE FMEA.								

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ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4009X 5.8.1								
	MMU 4009 5/16" THI								
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI								
ASSESSMENT:									
CRITICAL FLIGH		TY REDUNDANCY SCREENS					CIL ITE		
HDW/FU	NC A	A B				С			
NASA [3 /2R IOA [3 /2R] [P]] [P]]]	[P [P]	[[P]]	[[] *]	
COMPARE [/] []	[]	[И]]	[]	
RECOMMENDATIONS:	(If dif	ferent	t fro	m NAS	A)				
ί /] []	[]	[] וס / סס] ELETE)	
* CIL RETENTION	RATIONALE:	(If a	appli		A	DEQUATE DEQUATE]	
IOA IS IN AGREEM	ENT WITH T	HE FMI	EA.						

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4010X 5.8.2								
	MMU 4010 5/16" THI								
LEAD ANALYST:	DUFFY, HU	YNH, SAI	IDI						
ASSESSMENT:									
CRITICALITY REDUNDANCY SCREENS FLIGHT					CIL ITEM				
HDW/FU		. 1	В	С					
NASA [3 /2R IOA [3 /2R] [P] [P	·] []	P] (P] (] P]	[] * []				
COMPARE [/] [] [] [м ј	[]				
RECOMMENDATIONS: (If different from NASA)									
[/] [] [] [[] DD/DELETE)				
* CIL RETENTION REMARKS:				ADEQUATE NADEQUATE	[] []				
IOA IS IN AGREEM	IOA IS IN AGREEMENT WITH THE FMEA.								

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ASSESSME NASA FME SUBSYSTE MDAC ID: ITEM:	:A #: :M:	MMU-401 5.9.1 MMU 4011 SUBWAY	STRAPS				ASA DATA BASELINI NEV]
LEAD ANA		DUFFY,	HUYNH,	SAII	DI				
ASSESSME	NT:								
	CRITICAL FLIGH		REDUN	DANCY	SCREE	NS		CIL ITE	
	HDW/FU		A	В		С		LU11	
NASA IOA	[3 /3 [3 /3] [] [[[]]	[[]]	[[] *]
COMPARE	[/) (.]	[[]	[]
RECOMMEN	DATIONS:	(If d	liffere	nt fro	om NAS	A)			
	[/] []	[]	[]] Elete)
REMARKS:	* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []								

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	SSMENT ID: MMU-4012X BASELINE								
SUBSYSTEM: MDAC ID: ITEM:	MMU 4012 THRUSTER								
LEAD ANALYST: DUFFY, HUYNH, SAIIDI									
ASSESSMENT:									
CRITICALITY REDUNDANCY SCREENS FLIGHT						CIL ITEI	м		
HDW/FU						с			
NASA [3 /3 IOA [3 /3] [] [P] [] []]	[[]	[[] *]		
COMPARE [/] [N] []	[]	[]		
RECOMMENDATIONS: (If different from NASA)									
[/] [] []	[] (A] ELETE)		
* CIL RETENTION	RATIONALE:	(If app	licabl	AD	EQUATE EQUATE	[[]]		
REMARKS: IOA IS IN AGREEMENT WITH THE FMEA.									

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	MMU-4013X 5.11.1			NASA DATA BASELINE NEW			
SUBSYSTEM: MDAC ID: ITEM:	MMU 4013 Camera Bri	ACKET					
LEAD ANALYST:	DUFFY, HU	YNH, SAII	DI				
ASSESSMENT:							
CRITICAL FLIGH		EDUNDANCY	S	CIL ITEM			
HDW/FU	-	В		С	l i em		
NASA [3 /3 IOA [3 /3] [] [] [] [] [] []]	[]*		
COMPARE [/] [] [] []	[]		
RECOMMENDATIONS:	(If dif	ferent fro	om NASA)			
[/] [] [] [[] DD/DELETE)		
* CIL RETENTION : REMARKS: IOA IS IN AGREEM				ADEQUATE NADEQUATE			

ASSESSME ASSESSME NASA FME	NT A #	ID	:	4.)14	ŧX							NASA BASI	DATA ELINE NEW	; [x]]	
SUBSYSTE	M:			MM															
MDAC ID: ITEM:				403 CTT	UNSHIELD														
TIEW:				301	попт	. 6 1	Ű												
LEAD ANALYST: DUFFY, HUYNH, SAIIDI																			
ASSESSME	NT:																		
			CAL				RI	EDUN	NDA	NC	2	SCRE	ENS	•			IL Fen	۸ſ	
			/FUI				A]	3			С		-		•	
NASA	г	2	/1R	1		ſ	Ρ	٦		r 1	5	1	[[٦		ſ	х	1	*
IOA			/NA	j		č		j		Ì		j	Ì	j		Ī		j	
	-		•	•		-													
COMPARE	[N	/N]		[N]		[]	V]	[]		[N]	
RECOMMENDATIONS: (If different from NASA)																			
	[/]		[]		[]	[]	(2	-	/DI	•	ETE)
	* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []																		
REMARKS: THIS FAI	LUR	E	MODI	E W	AS C	201	NS:	[DEF	RED	N	ЭΤ	APP	LIC	ABLE	DUE	то	:	1)	THE

THIS FAILURE MODE WAS CONSIDERED NOT APPLICABLE DUE TO: 1) THE COMPONENT IS CONSIDERED IN THE SAME FASHION AS THE ORBITER SKIN, AND THEREFORE NOT CONSIDERED, 2) THE CAUSE OF FAILURE IS NOT REALISTIC, 3) THE ONLY POSSIBILITY FOR FAILURE MAY BE THROUGH VIBRATION AND SHOCK. HOWEVER THIS CAN ONLY OCCUR DURING LIFTOFF AND THE FSS ISOLATE THE SYSTEM.

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:	ASSESSMENT:							
CRITICAL FLIGH		EDUNDANCY	SCREENS	5	CIL ITEM			
HDW/FU	NC A	B	\$	с				
NASA [2/2 IOA [/NA] [P] [) [] []]	[X]* []			
COMPARE [N /N] [N] [N	j []	[N]			
RECOMMENDATIONS: (If different from NASA)								
[/]] [] [] [] (AI	[] DD/DELETE)			
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS:								
IOA RECOMMENDS D	ELETING TH	IS FAILUR	E MODE S	INCE IT IS	5 NOT			

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APPENDIX D

CRITICAL ITEMS

APPENDIX D POTENTIAL CRITICAL ITEMS

NASA FMEA	MDAC-ID	ITEM	FAILURE MODE
1.1.2	100	GN2 TANK Toggle valve	LEAK
1.5.3	102	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 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 RELIEF VALVE GN2 RELIEF VALVE PRESSURE GAGE GN2 TEST PORT BATTERY INT/EXT POWER SWITCH	FAIL CLOSE
1.7.3	106	GN2 LINES (ISOL VLV - REG	LEAK
1.7.4	106	GN2 LINES (REG-THRUSTERS)	LEAK
1./.1	106	GN2 LINES (XFEED VLV - XF	LEAK
1./.2	106	GNZ LINES (TANK-ISOL VLV)	LEAK
	110	THRUSTER MANIFOLD	
1 ()		THRUSTER MANIFOLD	CONSTRUCTION
1.0.2	112	THRUSTER	FAIL OPEN
1.0.4	113	THRUSTER	FAIL CLOSED
1.0.3	114	THRUSTER CN2 DECUL MOD	
1,2,4	117	GN2 REGULATOR	FAIL CLOSED
1.2.3	110	GN2 REGULATOR	FAIL OPEN
1.2.0	120	CNO DELTEE VALVE	FALL LOW
1.2.2	120	CN2 DELTEE VALVE	FAIL OPEN
1 0 1	122	DESCIDE CACE	FAIL CLOSED
1.0.1	122	CN2 TEST DODT	LEAR
3 11 1	122	BAMMEDV	NO OUTPUT-LOW OUTPUT
J. II. I	120	BATTERY INT/EXT POWER SWITCH INT/EXT POWER SWITCH	NO COIPOI-LOW COIPOI
3 14 3	130	INT/EXT POWER SWITCH	FALL OPEN FALL TO INTEDNAL
5114.5	130		DOGTETON
3.14.4	130	INT/EXT POWER SWITCH	FATL 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/HTR.Cb	FAIL OFF
3.13.2	134	MAIN POWER SWITCH	FAIL OFF
3.13.4	135	MAIN POWER SWITCH	FAIL ON
3.9.1	136	LTS/HTR.cb	FAIL 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
	158	CEA	FAIL ON 1-12 CH.
3.3.1	159	CEA	FAIL OFF 1-12 CH.
3.3.3	160	CEA	NOISY OUTPUT

NASA FMEA	MDAC-ID	ITEM	FAILURE MODE
3.3.3	161	CEA ISOLATION VALVE TIMER ISOLATION VALVE TIMER ISOLATION VALVE TIMER VALVE DRIVER AMPLIFIER VALVE DRIVER AMPLIFIER THC THC RHC RHC THC ISOLATE SWITCH THC ISOLATE SWITCH THC ISOLATE SWITCH THC ISOLATE SWITCH CEA PWR SPLY WIRE HARNESS EXTERNAL POWER CONNECTOR HEATERS HEATERS	LOGIC FAILURE
	162	ISOLATION VALVE TIMER	FAIL OFF
	163	ISOLATION VALVE TIMER	TOO SHORT
	164	ISOLATION VALVE TIMER	FAILS ON
3.3.2	166	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	RHC	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
<i>A</i> 1 1	185	HEATERS	FATL OFF
4 · 1 · 1	185	HEATERS HEATERS	FATL OFF
2.1.9	190	ARM LENGTH ADJUST	FATL UNLATCHED
2.1.9	101	ARM LENGTH ADJUST	FATL LATCHED SHORT
2 1 7	102	AN LENGTH ADJUST	FATL LATCHED LONG
2.1.7	192	ARM LENGTH ADJUST	FAIL LATCHED LONG
2.1.0	194	EXMEDIAL DOMED CONNECTOD	FAIL CONNECTED
3.0.1	105	ARM LENGTH ADJUST ARM LENGTH ADJUST EXTERNAL POWER CONNECTOR EXTERNAL POWER CONNECTOR	FAIL DISCONNECTED
3.0.2	195	DISC INCUES	FAIL ODEN
2.5.1	196	EXTERNAL POWER CONNECTOR PLSS LATCHES PLSS LATCHES MMU BATTERY LATCHES BACKUP ARM LATCH BACKUP ARM LATCH BATTERY THERMAL COVER BACKUP PLSS LATCHES (LAP BACKUP PLSS LATCHES GAS ACTUATED NUTS (4) FILTER HEATER FOR FSS RECHARGE S	FAIL OPEN
2.5.3	190	PLSS LAICHES	FAID OFEN FAID JAMOUED
2.3.2	199	MMU DATIERI LAICHES	FAIL LATCHED
	200	DACKUP AKM LAICH	FAIL LAICHED
	201	DACKUP AKM LAICH	FAIL ORDAICHED
4.0.1	203	BATTERI THERMAL COVER	FAIL OPEN
5.4.1	206	BACKUP PLSS LAICHES (LAP	FAIL CLOSED
	207	BACKUP PLSS LATCHES	FAIL CLOSED
2.6.1	220	GAS ACTUATED NUTS (4)	
	222	FILTER HEATER FOR FSS RECHARGE S	FRACTURE FAIL ODEN
4.2.1	447		FAIL OPEN
4.4.2	228	HEATER THERMOSTATS	
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

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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 <u>NSTS 22206, Instructions for Preparation of FMEA and</u> <u>CIL</u>, <u>10 October 1986</u>. 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: SUBSYSTEM: MMU	HIGHEST C	RITICALII	TY HDW/FUNC				
MDAC ID: 1001		FLIGHT:	1/1				
ITEM: GN2 TANK FAILURE MODE: RUPTURE							
LEAD ANALYST: DUFFY, HUYNH, SAIIDI	SUBS	YS LEAD:	M.J. SAIIDI				
BREAKDOWN HIERARCHY: 1) MMU 2) PROPULSION SYSTEM 3) 4) 5) 6) 7) 8) 9)							
CRITICA	LITIES						
FLIGHT PHASE	HDW/FU	NC					
PRE-OPS: OPS: POST-OPS:	1/1						
OPS:	1/1						
P051-0P5:	1/1						
REDUNDANCY SCREENS: A []	в[]	c []				
LOCATION: PART NUMBER:							
CAUSES: FATIGUE, MATERIAL FAILURE							
EFFECTS/RATIONALE: POSSIBLE LOSS OF CREW/VEHICLE FROM SHARPNEL AND/OR IMPULSIVE DELTA V.							

REFERENCES:

HIGHEST CRITICALITY HDW/FUNC DATE: SUBSYSTEM: MMU FLIGHT: 2/1R MDAC ID: 1031 TOGGLE VALVES ITEM: 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 2/2 PRE-OPS: 2/1R OPS: 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. **REFERENCES:**

REPORT DATE 02/18/88

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DATE: SUBSYSTEM: MMU	HIGHEST CRITICALITY HDW/FUNC
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)	
CRITICA	
FLIGHT PHASE PRE-OPS: OPS: POST-OPS:	2/2
REDUNDANCY SCREENS: A [2]	В[Р] С[Р]
LOCATION: SIDE A OR B PART NUMBER:	
CAUSES: SEAL (O-RING) FAILURE/DAMA	GE, SEAT GALLED
EFFECTS/RATIONALE: LOSS OF GN2 FROM THE SIDE WITH LEAK CREWMEMBER BY STRANDING IF OTHER GN	ING VALVE. POSSIBLE LOSS OF 2 SIDE FAILS.
REFERENCES:	

DATE: SUBSYSTEM: MMU	HIGHEST CRITICALITY HDW/FUNC FLIGHT: 2/1R
MDAC ID: 1141	
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)	
CRITICA	LITIES
FLIGHT PHASE	
PRE-OPS:	2/2
OPS: POST-OPS:	2/1R
POST-OPS:	2/2
REDUNDANCY SCREENS: A [2]	В[Р] С[Р]
LOCATION: SIDE A OR B PART NUMBER:	
CAUSES: CONTAMINATION, CHAFFING FR	OM VIBRATION, INSULATION
EFFECTS/RATIONALE: LOSS OF SIDE DUE TO CIRCUIT BREAKER DRAIN. POSSIBLE STRANDING OF THE C FAILS DURING EVA OPS.	TRIPPING OR EXCESSIVE BATTERY REW PERSON IF OTHER SIDE ALSO
REFERENCES:	

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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. **REFERENCES:**

DATE:		HIGHEST CRI	FICALITY	HDW/FUNC
SUBSYSTEM: M MDAC ID: 1		F	LIGHT:	2/1R
	GN2 REGULATOR PISTON JAMMED			
LEAD ANALYST:	DUFFY, HUYNH, SAIIDI	SUBSYS	LEAD: M.J	. SAIIDI
BREAKDOWN HIE 1) MMU 2) PROPULSI 3) 4) 5) 6) 7) 8) 9)				
	CRITICA			
	FLIGHT PHASE PRE-OPS: OPS: POST-OPS:	3/3 2/1R		
REDUNDANCY SO	CREENS: A [2]	В[Р]	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.

REFERENCES:

DATE: SUBSYSTEM:	MMU		HIGHEST CRI	TICALITY	HDW/FUNC
MDAC ID:			FI	LIGHT:	2/1R
ITEM: FAILURE MOD					
LEAD ANALYS	r: duffy, h	UYNH, SAIIDI	SUBSYS	LEAD: M.	J. SAIIDI
BREAKDOWN H 1) 2) 3) 4) 5) 6) 7) 8) 9)	IERARCHY:				
		CRITICA			
		FLIGHT PHASE PRE-OPS:	HDW/FUNC 2/2		
		OPS: POST-OPS:	2/1R		
REDUNDANCY S	SCREENS:	A [2]	B [P]	С[Р]	
LOCATION: PART NUMBER:		RB			
CAUSES:					
	E REQUIRING	IT BE ISOLAT FOTHER SIDE	ED. POSSIBLE FAILS.	LOSS OF	
REFERENCES:					

DATE:			HIGHEST C	RITICALIT	Y HDW/FUNC
SUBSYSTEM: MDAC ID:				FLIGHT:	3/2R
ITEM: FAILURE MODI	QUICK E: PREMAT	DISCONNECT URE OPERATION			
LEAD ANALYS	r: DUFFY,	HUYNH, SAIIDI	SUBS	YS LEAD:	M.J. SAIIDI
BREAKDOWN H 1) MMU 2) PROPULS 3) 4) 5) 6) 7) 8) 9)					
		CRITICA FLIGHT PHASE		NC	
		PRE-OPS: OPS: POST-OPS:	3/3		
REDUNDANCY	SCREENS:	A [2]	В[Р]	С[Р]
LOCATION: PART NUMBER	:				
CAUSES: SH	OCK, VIBRA	TION, PART FAI	LURE		

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.

REFERENCES:

DATE: SUBSYSTEM: MMU	HIGHEST CRITICALITY	HDW/FUNC
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)		
CRITICA FLIGHT PHASE		
PRE-OPS:	/NA	
OPS: POST-OPS:	/NA 3/2R	
REDUNDANCY SCREENS: A [2]	В[Р] С[Р]	
LOCATION: PART NUMBER:		
CAUSES: CORROSION, CONTAMINATION,	PIECE PART FAILURE	
EFFECTS/RATIONALE: LOSS OF RECHARGE CAPABILITY FROM ON RECHARGE CAPABILITY WILL CANCEL SUB MISSION LOSS WITH MULTIPLE MMU OPS.		

REFERENCES:

DATE: SUBSYSTEM: MMU MDAC ID: 1253	HIGHEST CRITICALITY HDW/FUNC FLIGHT: 3/2R
ITEM: QUICK DISCONNECT 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)	
CRITICA	
FLIGHT PHASE	
PRE-OPS: OPS:	3/3 /NA
POST-OPS:	3/2R
REDUNDANCY SCREENS: A [2]	В[Р] С[Р]
LOCATION: PART NUMBER:	
CAUSES: CORROSION, CONTAMINATION,	PIECE PART FAILURE
EFFECTS/RATIONALE: THE HOSE MUST BE CUT BY EMERGENCY I	

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

REFERENCES:

D ATE: SUBSYSTEM: MMU MDAC ID: 1281	HIGHEST CRITICALITY HDW/FUNC FLIGHT: 3/2R				
ITEM: BATTERY FAILURE MODE: INABILITY TO MATE	-,				
LEAD ANALYST: DUFFY, HUYNH, SAII	DI SUBSYS LEAD: M.J. SAIIDI				
BREAKDOWN HIERARCHY: 1) 2) 3) 4) 5) 6) 7) 8) 9)					
CRIT	ICALITIES				
FLIGHT PHA	SE HDW/FUNC				
PRE-OPS: OPS:					
POST-OPS					
REDUNDANCY SCREENS: A [2]	В[Р] С[Р]				
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.					

REFERENCES:

DATE: SUBSYSTEM: MDAC ID:	MMU 1681		HIGHE		TICALITY	HDW/FUNC
ITEM: FAILURE MODE		VER SUPPLY NDED OUTPUT				
LEAD ANALYST	: DUFFY, HU	JYNH, SAIIDI		SUBSYS	LEAD: N	1.J. SAIIDI
BREAKDOWN HI 1) MMU 2) ELECTRI 3) 4) 5) 6) 7) 8) 9)	ERARCHY:	rem				
		CRITICA	LITIES	5		
	1	FLIGHT PHASE PRE-OPS: OPS: POST-OPS:		DW/FUNC 3/3 3/2R 3/3		
REDUNDANCY S	SCREENS:	A [2]	B [P]	С[Р]
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.

REFERENCES:

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.

REFERENCES:

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DATE: SUBSYSTEM:		,	H	IGHEST	CRITICA	LITY	HDW/FUNC
MDAC ID:					FLIGH	r:	3/1R
ITEM: FAILURE MODI -)						+, -,	OR + AND
LEAD ANALYS	r: DUFFY,	HUYNH, S	AIIDI	SUI	BSYS LEAD	D: M.3	J. SAIIDI
BREAKDOWN HI 1) MMU 2) THC SYS 3) 4) 5) 6) 7) 8) 9)		C FLIGHT PRE-O OPS: POST-	RITICALI PHASE PS: OPS:	TIES HDW/1 2/2 3/2 2/2	FUNC 2 1R 2		
REDUNDANCY	SCREENS:	A [2]	В	[₽]	c[P]	
LOCATION: PART NUMBER	:						
CAUSES: LO				ANICAL	JAMMING	,	

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.

REFERENCES:

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.

REFERENCES:

DATE:	3/16/87		HIGHEST	CRITICALITY	HDW/FUNC
SUBSYSTEM: MDAC ID:				FLIGHT:	2/1R
		ATIONAL HAND C OFF IN ALL THR		2	
LEAD ANALYS	r: Duffy, 1	HUYNH, SAIIDI	SUE	SYS LEAD: M.	J. SAIIDI
BREAKDOWN HI 1) MMU 2) THC SYS 3) 4) 5) 6) 7) 8) 9)					
		CRITICA		TINC	
	÷	FLIGHT PHASE PRE-OPS: OPS: POST-OPS:	2/2	2 LR	
REDUNDANCY	SCREENS:	A [2]	B [P]	С[Р]	
LOCATION: PART NUMBER	:				
CAUSES: LO	OSE MAGNET	/CONNECTOR, ME	CHANICAL	JAMMING, PIR	ECE PART

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.

REFERENCES:

FAILURE

DATE: 3/16/87 SUBSYSTEM: MMU MDAC ID: 1721	HIGHEST CRITICALITY HDW/FUNC FLIGHT: 3/1R
ITEM: ROTATIONAL HAND CONTR FAILURE MODE: FAILS OFF ELECTRICALL	OLLER
LEAD ANALYST: DUFFY, HUYNH, SAIIDI	SUBSYS LEAD: M.J. SAIIDI
BREAKDOWN HIERARCHY: 1) MMU 2) RHC SYSTEM 3) 4) 5) 6) 7) 8) 9)	
CRITICAL	ITIES
FLIGHT PHASE PRE-OPS: OPS: POST-OPS:	HDW/FUNC 2/2 3/1R 2/2
REDUNDANCY SCREENS: A [2] B	
LOCATION: PART NUMBER:	
CAUSES: LOOSE MAGNET/CONNECTOR, MECH CONTAMINATION, PIECE PART FAILURE.	HANICAL JAMMING,
EFFECTS/RATIONALE: LOSS OF ROTATION IN ONE AXIS. THE PI IN OTHER AXES. LOSS OF ALL FUNCTIONS STRANDED IF UNABLE TO SIGHT THE ORBIT	S WILL LEAVE THE PILOT
REFERENCES:	

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DATE: SUBSYSTEM:	9/19/86 MMU		HIGHEST	CRITICALITY	HDW/FUNC
MDAC ID:				FLIGHT:	3/1R
ITEM: FAILURE MODE	ROTATIONA FAIL OFF	L HAND CONT MECHANICALL	ROLLER Y IN ONE	AXIS	
LEAD ANALYST	: DUFFY, HUY	NH, SAIIDI	SU	BSYS LEAD: M.	J. SAIIDI
BREAKDOWN HI 1) MMU 2) RHC SYS 3) 4) 5) 6) 7) 8) 9)					
		CRITICA	LTTTES		
	1 cr	LIGHT PHASE		FUNC	
	11	JIGHI PHASE	2 /	/2	
		PRE-UFS.	2/	2 /1D	
		PRE-OPS: OPS: POST-OPS:	2/	/2	
REDUNDANCY S	CREENS: A	[2]	B [P]	С[Р]	
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					

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

REFERENCES:

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. **REFERENCES:**

DATE: 3/16/87		HIGHEST	CRITICALI	TY HDW/FUNC	
SUBSYSTEM: MDAC ID:	MMU			FLIGHT:	1/1
ITEM: ROTATIONAL HAND CONTROLLER FAILURE MODE: FAIL OFF THREE AXES					
LEAD ANALYS	T: DUFFY, H	UYNH, SAIIDI	SUE	BSYS LEAD:	M.J. SAIIDI
BREAKDOWN H 1) MMU 2) RHC SY 3) 4) 5) 6) 7) 8) 9)					
		CRITICA FLIGHT PHASE	HDW/I	FUNC	
		PRE-OPS: OPS: POST-OPS:	1/3	1	
REDUNDANCY	SCREENS:	A []	B[]	c []
LOCATION: PART NUMBER					
CAUSES: LOOSE MAGNET/CONNECTOR, MECHANICAL JAMMING,					

EFFECTS/RATIONALE:

CONTAMINATION, PIECE PART FAILURE

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.

REFERENCES:

DATE: 3/16/87 HIGHEST CRITICALITY HDW/FUNC SUBSYSTEM: MMU MDAC ID: 1731 FLIGHT: 1/1ITEM: 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.

REFERENCES:

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DATE:			HIGHEST	CRITICALI	TY HDW/FUNC
SUBSYSTEM: MDAC ID:				FLIGHT:	2/1R
ITEM: FAILURE MOI	CEA TH DE: FAILED	ERMOSTATS (2 S CLOSED (HEATH	SETS) ERS ON CON	TINUOUSLY))
LEAD ANALYS	ST: DUFFY,	HUYNH, SAIIDI	SUE	SYS LEAD:	M.J. SAIIDI
BREAKDOWN H 1) MMU 2) CEA 3) 4) 5) 6) 7) 8) 9)	IIERARCHY:				
		CRITICA	LITIES		
		FLIGHT PHASE PRE-OPS: OPS: POST-OPS:	2/2 2/1	2 LR	
REDUNDANCY	SCREENS:	A [2]	B [P]	С[Р]
LOCATION: PART NUMBER	R:				
CAUSES:					
EFFECTS/RAT			POI FIFC	PONTO ASSI	FMRLV

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

REFERENCES:

DATE: SUBSYSTEM: MMU	HIGHEST CRITICALITY HDW/FUNC
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)	
CRITICA	LITIES
FLIGHT PHASE PRE-OPS: OPS: POST-OPS:	HDW/FUNC /NA 2/1R
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.

REFERENCES:

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: 3/2ROPS: 3/3 POST-OPS: REDUNDANCY SCREENS: A [2] B [P] C [P] LEFT OR RIGHT MMU ARM LOCATION: 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.

REFERENCES:

DATE: HIGHEST CRITICALITY HDW/FUNC SUBSYSTEM: MMU MDAC ID: 1892 FLIGHT: 3/2R 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 MECHANICAL 2) 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.

REFERENCES:

ITEM:

DATE:		HIC	GHEST (CRITICALITY	HDW/FUNC
SUBSYSTEM: MDAC ID:				FLIGHT:	3/3
ITEM: FAILURE MOD SINGLE POSI	ARM ANGLE E: LEFT ARM F IION	ADJUST AILS TO LOCK,	INADVI	ERTENTLY UNL	OCKS, ANY
LEAD ANALYS	r: DUFFY, HUYN	H, SAIIDI	SUB	SYS LEAD: M.	J. SAIIDI
BREAKDOWN H 1) MMU 2) MECHAN 3) ARM AS 4) 5) 6) 7) 8) 9)	ICAL				
	51.1	CRITICALIT		INC	
	I C	GHT PHASE RE-OPS: PS: OST-OPS:			

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.

REFERENCES:

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.

REFERENCES:

HIGHEST CRITICALITY HDW/FUNC DATE: SUBSYSTEM: MMU FLIGHT: 3/3 MDAC ID: 1895 ARM ANGLE ADJUST ITEM: 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 3/3 OPS: 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.

REFERENCES:

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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. **REFERENCES:**

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. **REFERENCES:**

REPORT DATE 02/18/88

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DATE: HIGHEST CRITICALITY HDW/FUNC SUBSYSTEM: MMU MDAC ID: 1898 FLIGHT: 3/2RITEM: 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. **REFERENCES:**

HIGHEST CRITICALITY HDW/FUNC DATE: SUBSYSTEM: MMU MDAC ID: FLIGHT: 2/1R 1899 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 2/1ROPS: 3/3 POST-OPS: 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.

REFERENCES:

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DATE:	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM: MMU MDAC ID: 1981	FLIGHT:	3/2R
ITEM: MMU BATTERY LATCHES FAILURE MODE: LATCH FAILS OPEN-LAU	NCH AND LANDING	
LEAD ANALYST: DUFFY, HUYNH, SAIIDI	SUBSYS LEAD: M.J	J. SAIIDI
BREAKDOWN HIERARCHY: 1) MMU 2) BATTERY 3) 4) 5) 6) 7) 8) 9)		
CRITICA	LITIES	
FLIGHT PHASE		
PRE-OPS: OPS:	1.1	
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 WILL HOLD THE LATCH FROM TRAVELING. IN PLACE. THE MOMENT ARM BETWEEN T HINGE POINT IS SMALL COMPARED TO TH END OF THE LATCH (AGAINST THE VELCR HINGE POINT. SHOULD THE SYSTEM FAI UNHINGED, CAUSING LOSS OF BATTERY A MISSION. REFERENCES:	THIS WILL KEEP THE E HE BATTERY PIN AND THE E MOMENT ARM BETWEEN T O COVER) AND THE SAME L, THE BATTERY MAY BEC	BATTERY E LATCH THE LATCH COME

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DATE:	1001		HIGHEST	CRITICALI	TY HDW/FUNC
SUBSYSTEM: MDAC ID:				FLIGHT:	3/3
ITEM: FAILURE MODI	FSS PRES	SSURE GAUGES US-HIGH OR LOV	4		
LEAD ANALYST	C: DUFFY, H	UYNH, SAIIDI	SUB	SYS LEAD:	M.J. SAIIDI
BREAKDOWN HI 1) 2) 3) 4) 5) 6) 7) 8) 9)	IERARCHY:				
		CRITICA	LITIES		
	I	FLIGHT PHASE PRE-OPS: OPS: POST-OPS:	3/3	A	
REDUNDANCY S	SCREENS:	A [2]]	3 [P]	С[Р]
LOCATION: PART NUMBER:					
CAUSES: CON	TAMINATION	, MECHANISM B	INDS		
EFFECTS/RAT NO EFFECT D		PACT ON THE SY	(STEMS (M	MU OR FSS).

REFERENCES:

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DATE:	1001		HIGHEST	CRITICALI	TY HDW/FUNC
SUBSYSTEM: MDAC ID:				FLIGHT:	/NA
ITEM: FAILURE MODE		JPPLY VALVE D OPEN			
LEAD ANALYST	: DUFFY,	HUYNH, SAIIDI	SUB	SYS LEAD:	M.J. SAIIDI
BREAKDOWN HI 1) 2) 3) 4) 5) 6) 7) 8) 9)	ERARCHY :				
		CRITICAL	LITIES		
		FLIGHT PHASE PRE-OPS: OPS: POST-OPS:	HDW/F /N. /N.	A	
REDUNDANCY S	CREENS:	A [] H	3[]	с[]
LOCATION: PART NUMBER:					
CAUSES:					
	MODE WAS	5 STUDIED UNDER ARGE CAPABILITY			

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REFERENCES:

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DATE:			HIGHEST CRIT	TICALITY	HDW/FUNC
SUBSYSTEM MDAC ID:			FI	LIGHT:	3/2R
	FSS SU ODE: FAILS				
LEAD ANAL	YST: DUFFY,	HUYNH, SAIIDI	SUBSYS	LEAD: M.J	. SAIIDI
BREAKDOWN 1) MMU 2) FSS 3) PROP 4) 5) 6) 7) 8) 9)	HIERARCHY:	CRITICA FLIGHT PHASE			
		PRE-OPS: OPS: POST-OPS:	3/3		
REDUNDANC	Y SCREENS:	A [2]	B [P]	C [P]	
LOCATION: PART NUMB	ER:				
CAUSES:	CONTAMINATIO	N, CORROSION,	MECHANICAL F.	AILURE	

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.

REFERENCES:

DATE: SUBSYSTEM: MMU	HIGHEST CRITICALITY HDW/FUNC
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)	
CRITICA	LITTES
FLIGHT PHASE	HDW/FUNC
PRE-OPS:	3/3
OPS: POST-OPS:	/NA 2/2
REDUNDANCY SCREENS: A [2]	В[Р] С[Р]
LOCATION: PART NUMBER:	
CAUSES: SHOCK, VIBRATION	
EFFECTS/RATIONALE: A SEVERE EXTERNAL LEAKAGE (IF NOT AN VALVE-DOWNSTREAM SIDE) WILL PREVENT - GAS (GN2) WILL ESCAPE FROM ORBITED WILL BE LOST AFTER THE FIRST MMU ACT	THE MMU FROM BEING RECHARGED R AND MMU TANKS. THUS MMU-OPS

- GAS (GN2) WILL ESCAPE FROM ORBITER AND MMU TANKS. THUS MM WILL BE LOST AFTER THE FIRST MMU ACTIVITY. ONLY ONE MMU REMAINING.

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REFERENCES:

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) 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: 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.

REFERENCES:

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 POST-OPS: 3/2R 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. **REFERENCES:**

REPORT DATE 02/18/88

E-40

HIGHEST CRITICALITY HDW/FUNC DATE: 3/27/87 SUBSYSTEM: MMU FLIGHT: MDAC ID: 2391 3/2RITEM: 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.

REFERENCES:

REPORT DATE 02/18/88

E-41

DATE:			**					HIGH	EST	CRI	FICALI	TY H	DW/FUNC
SUBSY MDAC										F	LIGHT:		3/3
ITEM: FAILU	RE MO	DDE:	FSS INAE	FOOT SILIT	' RES' 'Y TO	TRAIN CAPT	r Jre	BOOT					
LEAD	ANALY	(ST:	DUFFY	, HU	YNH,	SAIII	DI		SUB	SYS	LEAD:	M.J.	SAIIDI
BREAK 1)	FSS												
2) 3) 4) 5) 6) 7) 8)	FOOT	REST	RAINT										
9)													
						CRITI	ICAI	ITIES	5				
				F	LIGH	T PHAS				UNC			
						-OPS:			3/3				
						:			3/3				
					POS	T-OPS:	:		3/3				
REDUN	IDANCY	SCR	EENS:	А	[]	F	3 []		сĺ]	
LOCAT PART			FSS,	RIGH	T OR	LEFT	RES	STRAII	T				
CAUSE	s: V	VEAR,	DAMA	GE T	0 BO	OT OR	FOC	T RES	STRA	INT			
EFFEC IF BO	•			FAIL	, GR	EATER	EFF	ORT I	IN H	OLDI	ING PO	SITIO	N.
REFER	ENCES	5:											

DATE: 9/23/87 SUBSYSTEM: MMU MDAC ID: 4000	HIGHEST CRITICALITY HDW/FUNC 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)	
CRITICA	
FLIGHT PHASE PRE-OPS: OPS: POST-OPS:	3/3 3/3
REDUNDANCY SCREENS: A [2]	B [P] C [P]
LOCATION: PART NUMBER:	
CHICEC. DIRCE DADE FAILURE TANKI	

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.

REFERENCES:

DATE: 3/23/87 SUBSYSTEM: MMU	HIGHEST CRITICALITY HDW/FUNC					
MDAC ID: 4001	FLIGHT: 3/3					
ITEM: ARM STRAPS FAILURE MODE: FAILS UNLATCHED						
LEAD ANALYST: DUFFY, HUYNH, SAIIDI	SUBSYS LEAD: M.J. SAIIDI					
BREAKDOWN HIERARCHY: 1) MMU 2) ARM ASSEMBLY 3) 4) 5) 6) 7) 8) 9)						
CRITICA						
FLIGHT PHASE PRE-OPS:	HDW/FUNC 3/3					
OPS:	/*					
POST-OPS:	3/3					
REDUNDANCY SCREENS: A []	B[] C[]					
LOCATION: PART NUMBER:						
CAUSES:						
EFFECTS/RATIONALE: *SEE MDAC-201. THIS PRIMARY LATCH HOLDS THE ARM IN	PLACE.					
REFERENCES:						

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HIGHEST CRITICALITY HDW/FUNC DATE: SUBSYSTEM: MMU FLIGHT: 3/2R MDAC ID: 4002 MMU BATTERY RECHARGE CABLE ITEM: 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 3/2R PRE-OPS: OPS: /NA POST-OPS: 3/2R REDUNDANCY SCREENS: A [2] B [P] C [P] ORBITER AIRLOCK LOCATION: 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.

REFERENCES:

DATE: SUBSYSTEM: MMU MDAC ID: 4003	HIGHEST CRITICALITY HDW/FUNC FLIGHT: 3/2R
ITEM: MMU BATTERY RECHARGE FAILURE MODE: FAILURE TO PROVIDE A	CABLE
LEAD ANALYST: DUFFY, HUYNH, SAIIDI	SUBSYS LEAD: M.J. SAIIDI
BREAKDOWN HIERARCHY: 1) MMU 2) FSS 3) 4) 5) 6) 7) 8) 9)	
CRITICA	
FLIGHT PHASE PRE-OPS:	· · · · · · · · · · · · · · · · · · ·
OPS: POST-OPS:	3/3 3/3
REDUNDANCY SCREENS: A [2]	В[Р] С[Р]
LOCATION: ORBITER AIRLOCK PART NUMBER:	
CAUSES: SHORT DUE TO CONTAMINATION	, FRAYED CONNECTOR
EFFECTS/RATIONALE: EXCESSIVE CURRENT DRAW FROM ORBITER AIRLOCK RPC AUTOMATICALLY OPENING.	WHICH WILL LIKELY RESULT IN
REFERENCES:	

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HIGHEST CRITICALITY HDW/FUNC DATE: SUBSYSTEM: MMU FLIGHT: 3/2R MDAC ID: 4004 TRUNNION PIN ATTACHMENT DEVICE ITEM: 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 3/2R PRE-OPS: 3/2R OPS: 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.

REFERENCES:

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.

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REFERENCES:

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HIGHEST CRITICALITY HDW/FUNC DATE: SUBSYSTEM: MMU FLIGHT: 3/2R 4006 MDAC ID: BATTERY TETHER STRAP ITEM: FAILURE MODE: FAILS TO RETAIN BATTERY LEAD ANALYST: DUFFY, HUYNH, SAIIDI SUBSYS LEAD: M.J. SAIIDI BREAKDOWN HIERARCHY: 1) MMU STRUCTURE AND MECHANISM 2) 3) 4) 5) 6) 7) 8) 9) CRITICALITIES FLIGHT PHASE HDW/FUNC PRE-OPS: 3/2R /NA OPS: /NA POST-OPS: 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. **REFERENCES:**

DATE: HIGHEST CRITICALITY HDW/FUNC SUBSYSTEM: MMU MDAC ID: 4007 FLIGHT: 2/2 ITEM: CONTINGENCY TOOL FAILURE MODE: FAILS TO RELEASE FLEX HOSE FROM OD 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.

REFERENCES:

HIGHEST CRITICALITY HDW/FUNC DATE: SUBSYSTEM: MMU MDAC ID: 4008 FLIGHT: 3/2R CONTINGENCY TOOL ITEM: 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 /NA OPS: POST-OPS: /NA REDUNDANCY SCREENS: A [2] B [P] C [P] ANCILLARY EQUIPMENT LOCATION: PART NUMBER: CAUSES: BINDING, MATERIAL FAILURE EFFECTS/RATIONALE: INABILITY TO RELEASE ARM WOULD RESULT IN MISSION IMPACT IF POWER TOOL HAS ALSO FAILED. **REFERENCES:**

DATE: SUBSYSTEM: MMU	HIGHEST CRITICALITY HDW/FUNC				
MDAC ID: 4009	FLIGHT: 3/2R				
ITEM: 5/16" THIN WALL SOCK FAILURE MODE: FAILS TO INTERFACE	ŒT				
LEAD ANALYST: DUFFY, HUYNH, SAIIDI	SUBSYS LEAD: M.J. SAIIDI				
BREAKDOWN HIERARCHY: 1) MMU 2) FSS 3) 4) 5) 6) 7) 8) 9)					
CRITICA FLIGHT PHASE					
PRE-OPS:	3/2R				
OPS: POST-OPS:	/NA 3/2R				
REDUNDANCY SCREENS: A [2]	В[Р] С[Р]				
LOCATION: ANCILLARY EQUIPMENT PART NUMBER:					
CAUSES: MATERIAL FAILURE, SOCKET STRIPPED OR BENT					
EFFECTS/RATIONALE: INABILITY TO EMPLOY SOCKET ON LAUNC BOLTS. IF CONTINGENCY TOOL ALSO FA FROM INABILITY TO RELEASE MMU.					
REFERENCES:					

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DATE: SUBSYSTEM: MDAC ID:			HIGHEST	CRITICALITY FLIGHT:	•
ITEM: FAILURE MODE	5/16" E: FAILS	THIN WALL SOCKI TO INTERFACE	ET		
LEAD ANALYSI	C: DUFFY,	HUYNH, SAIIDI	SUE	BSYS LEAD: M.	J. SAIIDI
BREAKDOWN HI 1) MMU 2) FSS 3) 4) 5) 6) 7) 8) 9)	ERARCHY:				
		CRITICAL	LITIES		
		FLIGHT PHASE PRE-OPS:			
		OPS:	1		
		POST-OPS:	3/2	:R	
REDUNDANCY S	CREENS:	A [2] H	З[Р]	С[Р]	
LOCATION: PART NUMBER:		RY EQUIPMENT			
CAUSES: MAI	ERIAL FAI	LURE, SOCKET ST	TRIPPED C	DR BENT	
	DEMPLOY S CONTINGENC	OCKET ON LAUNCH Y TOOL ALSO FAI EASE MMU.			
REFERENCES :					

REPORT DATE 02/18/88 E-53

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DATE: Subsystem: MMU	HIGHEST CRITICALITY HDW/FUNC
MDAC ID: 4011	FLIGHT: 3/3
ITEM: SUBWAY STRAPS FAILURE MODE: SEPARATES FROM DONNI	NG STATION
LEAD ANALYST: DUFFY, HUYNH, SAIIDI	SUBSYS LEAD: M.J. SAIIDI
BREAKDOWN HIERARCHY: 1) MMU 2) FSS 3) 4) 5) 6) 7) 8) 9)	
CRITICA	LITIES
FLIGHT PHASE	
PRE-OPS:	3/3
OPS:	/NA
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

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REFERENCES:

PROCESSES.

HIGHEST CRITICALITY HDW/FUNC DATE: SUBSYSTEM: MMU FLIGHT: 3/3 MDAC ID: 4012 THRUSTER CUE LIGHT EXTENDER ITEM: 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) 8) 9) CRITICALITIES FLIGHT PHASE HDW/FUNC PRE-OPS: 3/3 3/3 OPS: POST-OPS: 3/3 REDUNDANCY SCREENS: A [2] B [] C [] ANCILLARY EQUIPMENT LOCATION: PART NUMBER: CAUSES: FRACTURED, MATERIAL FAILURE, SEPARATED FROM MMU EFFECTS/RATIONALE: CREW INCONVENIENCE, OTHERWISE NO MAJOR IMPACT. **REFERENCES:**

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)	
CRITICA	
FLIGHT PHASE PRE-OPS:	HDW/FUNC 3/3
OPS: POST-OPS:	/NA /NA
REDUNDANCY SCREENS: A []	B[] C[]
LOCATION: ANCILLARY EQUIPMENT PART NUMBER:	
CAUSES: MATERIAL FAILURE	
EFFECTS/RATIONALE: INABILITY TO ATTACH CAMERA. THE CA CRITICAL COMPONENT FOR MISSION SUCC OPERATION.	
REFERENCES:	

REPORT DATE 02/18/88 E-56

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DATE:	1001		HIGHEST	CRITICALI	TY HDW/FUNC
SUBSYSTEM: MDAC ID:				FLIGHT:	/NA
ITEM: FAILURE MOD	SUNSHIEL E: LOSS OF	D THERMAL PROTI	ECTION		
LEAD ANALYS	T: DUFFY, HU	YNH, SAIIDI	SUB	SYS LEAD:	M.J. SAIIDI
BREAKDOWN H 1) MMU 2) STRUCT 3) 4) 5) 6) 7) 8) 9)	IERARCHY: URES AND MEC	HANISM			
		CRITICAL	LITIES		
		LIGHT PHASE PRE-OPS: OPS: POST-OPS:	/N	A A	
REDUNDANCY	SCREENS: A	[]]	в[]	c[]
LOCATION: PART NUMBER	:				
CAUSES: MA	TERIAL FAILU	RE			
	NT IS CONSID	ERED IN THE S			E ORBITER

REFERENCES:

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

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

ORIGINAL PAGE IS OF POOR QUALITY

APPENDIX F

IDENTIFIERS			N	ł	1	IOA RECOMMENDATIONS *										
NASA FMEA NUMBER	ICA ASSEBSMENT NUMBER			E	SCREEN				: SC : A) OTHER 1 (SEE LEGEND CODE)	i issue			
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	1 MMU-110		1	1		ţ	ł	2/18	i P	٩	۴	4. 4	; X			
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NASA FMEA TO IDA WORKSHEET CROSS REFERENCE / RECOMMENDATIONS

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