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PRINT DATE: 02/18/95

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE**

NUMBER: M8-1MR-M002-X

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK

REVISION: 3 8/15/95

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: MECHANISM. LATCH	V519-593302

**PART DATA**

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**  
EXTERNAL AIRLOCK AFT HATCH LATCH MECHANISM

**REFERENCE DESIGNATORS:**

**QUANTITY OF LIKE ITEMS: 1**  
ONE

**FUNCTION:**

THIS MECHANISM IS MOUNTED ON THE SPACELAB SIDE (MIR 1) OR PAYLOAD BAY SIDE (MULTI-MIR) OF EXTERNAL AIRLOCK AFT HATCH TO SECURE IT IN THE CLOSED AND SEALED POSITION. THIS ASSEMBLY CONSISTS OF SEVENTEEN (17) HATCH-TYPE LATCHES WHICH ARE JOINED BY RODS AND LINKS. THE RODS AND LINKS MOVE CIRCUMFERENTIALLY, CAUSING THE LATCHES TO MOVE AXIALLY TO SECURE THE LATCHES IN A CLOSED AND SEALED POSITION. TWO "KICKER" LATCHES INCORPORATE PROVISION FOR "BREAKING FREE" THE HATCH SEALS AGAINST ANY SMALL RESIDUAL DELTA PRESSURE. WHEN OPENING THE HATCH, THE LATCHES ARE DRIVEN BY A MANUALLY OPERATED REDUCTION GEARBOX (ACTUATOR).

**REFERENCE DOCUMENTS: M072-593829**

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE**  
**NUMBER: M8-1MR-M002-01**

**REVISION# 3 9/15/95**  
**SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK**  
**LRU: MECHANISM, LATCH**  
**ITEM NAME: MECHANISM, LATCH**  
**CRITICALITY OF THIS FAILURE MODE: 1R3**

**FAILURE MODE:**  
**FAILS TO ENGAGE**

**MISSION PHASE:**  
**OO ON-ORBIT**

**VEHICLE/PAYLOAD/KIT EFFECTIVITY: 104 ATLANTIS**

**CAUSE:**  
**ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, FAILURE/**  
**DEFLECTION OF INTERNAL PART, PHYSICAL BINDING/JAMMING.**

**CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO**

**CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? N/A**

**REDUNDANCY SCREEN**  
**A) PASS**  
**B) N/A**  
**C) PASS**

**PASS/FAIL RATIONALE:**  
**A)**  
**B)**  
**N/A - MECHANICAL LINKAGE**  
**C)**

**METHOD OF FAULT DETECTION:**  
**LATCH MECHANISM FAILING TO LATCH/ENGAGE CAN VISUALLY/PHYSICALLY BE**  
**DETECTED BY THE FLIGHT CREW.**

**CORRECTING ACTION: MIR 1 - SPACELAB WOULD HAVE TO BE DEPRESSURIZED --**  
**BEFORE EXTERNAL AIRLOCK UPPER HATCH CAN BE OPENED FOR PERFORMING AN**  
**EVA OUT UPPER HATCH WHEN ORBITER AND MIR ARE NOT DOCKED. FOLLOWING THIS**  
**EVA, EXTERNAL AIRLOCK AFT HATCH WOULD HAVE TO BE HELD IN PLACE TO ALLOW**  
**REPRESSURIZING EXTERNAL AIRLOCK FOR CREW RE-ENTRY INTO CREW MODULE**  
**THROUGH FIFTH HATCH AND CREW MODULE HATCH 'A' SINCE CONSUMABLES ARE**  
**NOT AVAILABLE TO REPRESSURIZE SPACELAB VOLUME.**  
**MULTI-MIR - EVA CREWMEMBER CAN MANUALLY HOLD EXTERNAL AIRLOCK AFT HATCH**  
**IN THE CLOSED POSITION DURING REPRESSURIZATION OF THE AIRLOCK UNTIL THE**  
**PRESSURE DIFFERENTIAL (OF 3.2 PSI MINIMUM) IS SUFFICIENT TO HOLD AND SEAL THE**  
**HATCH IN POSITION AND THEN ALLOW FOR RE-ENTRY INTO THE CABIN THROUGH**  
**FIFTH HATCH AND CREW MODULE HATCH 'A'.**

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**REMARKS/RECOMMENDATIONS:**

EXTERNAL AIRLOCK AFT HATCH LATCH MECHANISM CONTAINS SEVENTEEN LATCHES. HATCH CAN WITHSTAND PRESSURE IN BOTH DIRECTIONS. PROBABILITY OF THIS FAILURE MODE IS EXTREMELY LOW; IT IS MANUALLY OPERATED MECHANICAL DEVICE OF SIMPLE/RELIABLE CONSTRUCTION. EFFECTS ON EVA RECOVERY ARE MINIMIZED SINCE TUNNEL ADAPTER 'C' HATCH IS THE PRIMARY HATCH FOR PERFORMING AN EVA AND AN ADDED FIFTH HATCH WILL ISOLATE TUNNEL ADAPTER AND EXTERNAL AIRLOCK VOLUMES.

**• FAILURE EFFECTS •**

**(A) SUBSYSTEM:**

LATCHES THAT FAIL TO ENGAGE WILL CAUSE THE LOSS OF THE ABILITY TO (MECHANICALLY) KEEP EXTERNAL AIRLOCK AFT HATCH CLOSED AND SEALED. INABILITY TO ISOLATE EXTERNAL AIRLOCK AND SPACELAB VOLUMES (MIR 1) OR INABILITY TO ISOLATE EXTERNAL AIRLOCK AND PAYLOAD BAY ENVIRONMENT (MULTI-MIR).

**(B) INTERFACING SUBSYSTEM(S):**

MIR 1 - DEGRADED CAPABILITY TO USE EXTERNAL AIRLOCK UPPER HATCH AS AN EVA HATCH IF EXTERNAL AIRLOCK AFT HATCH CANNOT BE CLOSED AND (MECHANICALLY) LATCHED AS THERE ARE NOT ENOUGH CONSUMABLES AVAILABLE TO REPRESSURIZE EXTERNAL AIRLOCK AND SPACELAB. AN EVA CREWMEMBER WOULD HAVE TO FIRST PUSH ON EXTERNAL AIRLOCK AFT HATCH TO MAKE THE INITIAL SEAL DURING THE PRESSURE BUILDUP AFTER AN EVA OUT EXTERNAL AIRLOCK PRIOR TO RE-ENTERING THE CREW CABIN.

MULTI-MIR - DEGRADED CAPABILITY TO RE-PRESSURIZE THE AIRLOCK (POST-EVA OUT EXTERNAL AIRLOCK), IF A CREWMEMBER HAS TO FIRST PUSH ON EXTERNAL AIRLOCK AFT HATCH TO MAKE THE INITIAL SEAL DURING THE PRESSURE BUILDUP.

**(C) MISSION:**

INABILITY TO PERFORM PLANNED EVA OUT EXTERNAL AIRLOCK. NO EFFECT ON IVA MISSION OPERATIONS.

**(D) CREW, VEHICLE, AND ELEMENT(S):**

MIR 1 - NO EFFECT UNTIL EVA IS REQUIRED OUT EXTERNAL AIRLOCK. THEN INABILITY TO PERFORM CONTINGENCY EVA COULD RESULT IN LOSS OF CREW AND VEHICLE.  
MULTI-MIR - POTENTIAL LOSS OF EVA CREW MEMBERS IF EVA IS PERFORMED OUT THE EXTERNAL AIRLOCK UPPER HATCH AND HATCH CANNOT BE CLOSED AND SEALED FOR REPRESSURIZING EXTERNAL AIRLOCK.

MINOR DAMAGE MIGHT OCCUR TO THE INSIDE OF EXTERNAL AIRLOCK IF EXTERNAL AIRLOCK AFT HATCH CANNOT BE CLOSED/LATCHED AND IS LEFT OPEN DURING THE DESCENT/LANDING PHASE. ONCE PRESSURE ACROSS THIS HATCH HAS EQUALIZED THE UNATTACHED HATCH IS ALLOWED TO MOVE FREELY.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

FIRST FAILURE (INABILITY TO OPEN TUNNEL ADAPTER 'C' HATCH) - CREW IS UNABLE TO PERFORM AN EVA OUT TUNNEL ADAPTER.

SECOND FAILURE (INABILITY TO CLOSE EXTERNAL AIRLOCK AFT HATCH) -

MIR 1 - INABILITY TO MECHANICALLY CLOSE EXTERNAL AIRLOCK AFT HATCH WOULD RESULT IN LOSS OF CAPABILITY TO DEPRESSURIZE EXTERNAL AIRLOCK FOR PERFORMING CONTINGENCY EVA WHEN REQUIRED. (INSUFFICIENT CONSUMABLES

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AVAILABLE TO REPRESSURE EXTERNAL AIRLOCK AND SPACELAB TOGETHER.) LOSS OF CONTINGENCY EVA TO CORRECT A CRIT 1 CONDITION COULD RESULT IN LOSS OF CREW AND VEHICLE.

MULTI-MIR - INABILITY TO LATCH AFT HATCH CLOSED FOR REPRESSURIZATION OF EXTERNAL AIRLOCK FOLLOWING A PLANNED EVA OUT EXTERNAL AIRLOCK AFT HATCH.

DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)): 1R2

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

THIRD FAILURE (INABILITY TO HOLD HATCH IN CLOSED POSITION WHILE REPRESSURIZING EXTERNAL AIRLOCK) - LOSS OF ALL CAPABILITIES TO CLOSE AND SEAL UPPER HATCH. POSSIBLE LOSS OF EVA CREW MEMBERS IF EVA IS PERFORMED OUT EXTERNAL AIRLOCK UPPER HATCH AND EXTERNAL AIRLOCK CANNOT BE REPRESSURIZED FOR CREW RETURN TO CABIN (EVA CREW MEMBERS MUST REMAIN IN AIRLOCK UNTIL LANDING).

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: HOURS TO DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: MINUTES

IS TIME REQUIRED TO IMPLEMENT CORRECTIVE ACTION LESS THAN TIME TO EFFECT?  
YES

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:

CREW WOULD HAVE ENOUGH TIME TO REMOVE HATCH AND HOLD IT IN THE CLOSED POSITION WHILE REPRESSURIZING EXTERNAL AIRLOCK BEFORE THE PROBLEM BECAME CATASTROPHIC.

HAZARDS REPORT NUMBER(S): DM10HA08(F)

HAZARD(S) DESCRIPTION:  
EVA HAZARD.

- APPROVALS -

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DESIGN ENGINEER : T. S. COOK

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