

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

NUMBER: M8-1MR-M001-X

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK

REVISION: 3 9/15/95

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

## PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
EXTERNAL AIRLOCK UPPER HATCH LATCH MECHANISM (VESTIBULE ENTRY)

## REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 1  
ONE

## FUNCTION:

THIS MECHANISM IS MOUNTED ON THE AIRLOCK SIDE OF THE EXTERNAL AIRLOCK UPPER HATCH TO SECURE IT IN THE CLOSED AND SEALED POSITION. THIS ASSEMBLY CONSISTS OF SIX (6) 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. THREE "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: M072-593828

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PRINT DATE: 10/19/95

FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE

NUMBER: M8-1MR-M001-01

REVISION# 3 9/15/95

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK

LRU: MECHANISM, LATCH

CRITICALITY OF THIS

ITEM NAME: MECHANISM, LATCH

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:  
PHYSICAL OBSERVATION - INABILITY TO MECHANICALLY CLOSE UPPER HATCH.

CORRECTING ACTION: WORKAROUND FOR FAILURE TO CLOSE EXTERNAL AIRLOCK  
UPPER HATCH FOLLOWING EVA, IS FOR EVA CREWMEMBER TO REMOVE HATCH AND  
HOLD HATCH IN CLOSED POSITION DURING REPRESSURIZATION OF EXTERNAL  
AIRLOCK TO ALLOW RE-ENTRY INTO CREW MODULE THROUGH FIFTH HATCH AND  
CREW CABIN HATCH "A".

REMARKS/RECOMMENDATIONS:  
EXTERNAL AIRLOCK UPPER HATCH LATCH MECHANISM CONTAINS ONLY SIX LATCHES.  
HATCH CAN ONLY WITHSTAND PRESSURE IN ONE DIRECTION (INSIDE TO OUTSIDE).  
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.

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**- FAILURE EFFECTS -**

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**(A) SUBSYSTEM:**

LATCHES THAT FAIL TO ENGAGE WILL CAUSE THE INABILITY TO (MECHANICALLY) KEEP EXTERNAL AIRLOCK UPPER HATCH CLOSED AND SEALED. INABILITY TO ISOLATE EXTERNAL AIRLOCK AND VESTIBULE TUNNEL VOLUMES.

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

INABILITY TO CLOSE EXTERNAL AIRLOCK UPPER HATCH WOULD EXPOSE INTERFACING SUBSYSTEMS TO VACUUM DURING SEPARATION AND PREVENT THE CAPABILITY TO RECOVER FROM AN EVA WHEN ORBITER AND MIR ARE NOT DOCKED IF AN EVA IS PERFORMED OUT EXTERNAL AIRLOCK.

**(C) MISSION:**

INABILITY TO PERFORM A PLANNED EVA OUT EXTERNAL AIRLOCK WHILE ORBITER AND MIR ARE NOT DOCKED. NO EFFECT ON IVA MISSION OPERATIONS.

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

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.

IF EXTERNAL AIRLOCK UPPER HATCH IS REMOVED AND HELD INTO PLACE WHILE RE-PRESSURIZING EXTERNAL AIRLOCK, THE POTENTIAL EXISTS FOR DAMAGE TO THE EXTERNAL AIRLOCK DURING DESCENT. ONCE PRESSURE ACROSS THIS HATCH HAS EQUALIZED THE UNATTACHED HATCH IS ALLOWED TO MOVE FREELY. NO EFFECT UNTIL EVA IS REQUIRED.

**(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 UPPER HATCH) - INABILITY TO LATCH UPPER HATCH CLOSED FOR REPRESSURIZATION OF EXTERNAL AIRLOCK FOLLOWING A PLANNED EVA OUT UPPER HATCH WHEN ORBITER AND MIR ARE NOT DOCKED.

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

**(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).

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**- TIME FRAME -**

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TIME FROM FAILURE TO CRITICAL EFFECT: HOURS TO DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: MINUTES

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**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):** DM10HA06(F)

**HAZARD(S) DESCRIPTION:**  
EVA HAZARD.

**- APPROVALS -**

PRODUCT ASSURANCE ENGR . :	M. W. GUENTHER	:	<u><i>M.W. Guenther</i></u>
DESIGN ENGINEER :	T. S. COOK	:	<u><i>T.S. Cook</i></u>