FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER: M8-1MR-M004-X

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK
REVISION: 3 9/15/95

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	ACTUATOR, HATCH LATCH	MC287-0036-0008

PART DATA

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

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 1
ONE

FUNCTION:
MANUALLY DRIVEN REDUCTION GEARBOX - PROVIDES A CONTROLLED OUTPUT FOR DRIVING THE LATCH MECHANISM ON EXTERNAL AIRLOCK AFT HATCH OPEN OR CLOSED. PROVIDES THE FORCE FOR HATCH SEAL COMPRESSION AS IT PULLS THE SEALING SURFACES TOGETHER. TWO HANDLES FOR OPERATION ARE PROVIDED FOR THE HATCH; ONE IS ON EACH SIDE OF THE HATCH. A MECHANICAL LOCK AND A "NO-BACK" ARE PROVIDED FOR RESTRAINT BETWEEN USES. THE KNOB ON THE HANDLE ON THE SPACELAB SIDE (MIR 1) OR PAYLOAD BAY SIDE (MULTI-MIR) OF THE HATCH IS REMOVABLE. THE DESIGN UTILIZES DUAL O-RING SEALS TO PREVENT LEAKAGE OF ODS PRESSURE THROUGH OR PAST THE ACTUATORS.

REFERENCE DOCUMENTS: M072-593628

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1MR-M004-01

REVISION# 3 9/15/95

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK
LRU: ACTUATOR, HATCH LATCH
ITEM NAME: ACTUATOR, HATCH LATCH

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
PHYSICAL BINDING/JAMMING (GEARBOX)

MISSION PHASE:
OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 104 ATLANTIS

CAUSE:
ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, FAILURE/DEFLECTION OF INTERNAL PART

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 - AT LEAST TWO REMAINING PATHS ARE DETECTABLE IN FLIGHT.

C)

METHOD OF FAULT DETECTION:
PHYSICAL BINDING/JAMMING OF THE HATCH LATCH ACTUATOR CAN BE VISUALLY/PHYSICALLY DETECTED BY THE FLIGHT CREW.

CORRECTING ACTION: CREW COULD REMOVE HATCH AND HOLD HATCH IN CLOSED POSITION DURING REPRESSURIZATION OF EXTERNAL AIRLOCK TO ALLOW RE-ENTRY INTO CREW CABIN THROUGH FIFTH HATCH AND "A" HATCH.

REMARKS/RECOMMENDATIONS:
EXTERNAL AIRLOCK AFT HATCH IS OPEN FOR SPACELAB OR OTHER PRESSURIZED PAYLOAD OPERATIONS (MIR 1) OR UTILIZED FOR EVA PURPOSES (MULTI-MIR). 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 -

(A) SUBSYSTEM:
A JAMMED ACTUATOR WOULD PREVENT THE LATCHES FROM OPERATING RESULTING IN THE INABILITY TO OPEN OR CLOSE EXTERNAL AIRLOCK AFT HATCH.

(B) INTERFACING SUBSYSTEM(S):
MIR 1 - INABILITY TO OPEN EXTERNAL AIRLOCK AFT HATCH DUE TO THE INABILITY TO OPEN LATCHES WOULD PREVENT ACCESS TO SPACELAB. INABILITY TO CLOSE LATCHES WOULD PREVENT LATCHING OF EXTERNAL AIRLOCK AFT HATCH FOLLOWING SPACELAB OPERATIONS.
MULTI-MIR - INABILITY TO OPEN EXTERNAL AIRLOCK AFT HATCH WOULD PREVENT CAPABILITY TO PERFORM EVA OUT EXTERNAL AIRLOCK. LOSS OF CAPABILITY TO CLOSE EXTERNAL AIRLOCK AFT HATCH FOLLOWING AN EVA WOULD PREVENT REPRESSURIZATION OF EXTERNAL AIRLOCK VOLUME.

(C) MISSION:
MIR 1 - PARTIAL LOSS OF MISSION OBJECTIVES IF EXTERNAL AIRLOCK AFT HATCH LATCH MECHANISM FAILS TO ROTATE OPEN (LOSS OF ACCESS TO THE SPACELAB). INABILITY TO PERFORM PLANNED EVA OUT EXTERNAL AIRLOCK IF HATCH CANNOT BE OPENED (MULTI-MIR) OR CLOSED (MIR 1).

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT UNTIL EVA IS REQUIRED. THEN POSSIBLE LOSS OF CONTINGENCY EVA PERFORMANCE AND PLANNED EVA RECOVERY CAPABILITIES OUT EXTERNAL AIRLOCK.

IF EXTERNAL AIRLOCK AFT HATCH IS REMOVED AND HELD INTO PLACE WHILE RE-PRESSURIZING ODS VOLUME, 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.

(E) FUNCTIONAL CRITICALITY EFFECTS:
INABILITY TO OPEN EXTERNAL AIRLOCK AFT HATCH:
MIR 1 - LOSS OF MISSION OBJECTIVES ASSOCIATED WITH SPACELAB. - CRIT 2/2 CONDITION.
MULTI-MIR - LOSS OF CAPABILITY TO PERFORM AN EVA OUT EXTERNAL AIRLOCK. POSSIBLE LOSS OF CREW AND VEHICLE IF A CONTINGENCY EVA OUT EXTERNAL AIRLOCK IS REQUIRED. THIS WOULD FIRST REQUIRE A FAILURE TO OPEN TUNNEL ADAPTER "C" HATCH SINCE IT IS PRIMARY FOR PERFORMING AN EVA. - CRIT 1R3 CONDITION.

INABILITY TO CLOSE EXTERNAL AIRLOCK AFT HATCH:
LOSS OF NOMINAL HATCH CLOSING RESULTING IN DEGRADED EVA RECOVERY CAPABILITIES THROUGH AFT HATCH. THIS WOULD FIRST REQUIRE A FAILURE TO OPEN TUNNEL ADAPTER "C" HATCH SINCE IT IS PRIMARY FOR PERFORMING AN EVA.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
THIRD FAILURE (INABILITY TO DISCONNECT HINGE OR HOLD HATCH IN CLOSED POSITION) - INABILITY TO CLOSED AND SEAL EXTERNAL AIRLOCK AFT HATCH. EXTERNAL AIRLOCK VOLUME CANNOT BE REPRESSURIZED FOLLOWING A PLANNED EVA OUT THE AFT HATCH. POSSIBLE LOSS OF EVA CREW MEMBERS IF HABITABLE

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VOLUMES 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 TO HOURS

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 AMPLE TIME TO REMOVE HATCH AND HOLD HATCH IN CLOSED POSITION TO ALLOW REPRESSURIZATION OF EXTERNAL AIRLOCK TO HOLD HATCH IN CLOSED POSITION BEFORE FAILURE BECAME CATASTROPHIC.

HAZARDS REPORT NUMBER(S): DM1OHA06(F)

HAZARD(S) DESCRIPTION:
EVA HAZARD.

- APPROVALS -

PRODUCT ASSURANCE ENGR. : M. W. GUENTHER : M.W. Guenther
DESIGN ENGINEER : T. S. COOK : T S Cook