FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL HARDWARE
NUMBER: M8-1MR-M005-X

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

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: ASSEMBLY, HINGE	V075-593327

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
EXTERNAL AIRLOCK UPPER HATCH HINGE ASSEMBLY

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 2
TWO

FUNCTION:
THE HINGES DIRECT MOTION OF THE HATCH BETWEEN THE CLOSED POSITION AND THE OPEN/STOWED POSITION WITH THE EXTERNAL AIRLOCK UPPER HATCH OPEN FOR MIR OPERATIONS.

REFERENCE DOCUMENTS: V519-593315
M072-593829

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1MR-M005-01

REVISION# 3 9/15/95

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK
LRU: ASSEMBLY, HINGE
ITEM NAME: ASSEMBLY, HINGE

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS TO ROTATE (OPEN OR CLOSED)

MISSION PHASE:
OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 104 ATLANTIS

CAUSE:
ROLLER BEARING FAILURE DUE TO: CONTAMINATION/FOREIGN OBJECT/DEBRIS, FAILURE/DEFLECTION OF INTERNAL PART, DEFECTIVE PART/MATERIAL, 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 - AT LEAST TWO REMAINING PATHS ARE DETECTABLE IN FLIGHT.

C)

METHOD OF FAULT DETECTION:
FAILURE OF HINGE ASSEMBLY TO ROTATE OPEN OR CLOSED CAN VISUALLY/PHYSICALLY BE DETECTED BY THE FLIGHT CREW.

CORRECTING ACTION: CREW CAN APPLY ADDITIONAL LOAD TO OVERCOME A JAMMED HINGE ON EXTERNAL AIRLOCK UPPER HATCH. HINGE MAY BE DISCONNECTED FROM UPPER HATCH IF REQUIRED TO ALLOW MANUAL POSITIONING OF HATCH PRIOR TO REPRESSURIZING EXTERNAL AIRLOCK FOR REENTRY OF EVA CREWMEMBERS INTO CREW MODULE THROUGH FIFTH HATCH AND CREW CABIN "A" HATCH.

REMARKS/RECOMMENDATIONS:
EVA CAN BE PERFORMED OUT EXTERNAL AIRLOCK UPPER HATCH WHEN ORBITER AND MIR ARE NOT DOCKED. 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 MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL FAILURE MODE
NUMBER: M8-1MR-M005-01

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NO EFFECT UNTIL FAILURE OF REDUNDANT ROLLER BEARINGS. THEN EXTERNAL AIRLOCK UPPER HATCH CANNOT BE PLACED IN ITS OPEN/STOWED POSITION AND/OR ITS CLOSED/LATCHED POSITION IF ITS HATCH HINGE ASSEMBLY FAILS TO ROTATE.

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT FIRST FAILURE. INABILITY TO ROTATE EXTERNAL AIRLOCK UPPER HATCH CLOSED. FOLLOWING SECOND BEARING FAILURE, WOULD EXPOSE INTERFACING SUBSYSTEMS TO VACUUM DURING SEPARATION AND COULD HINDER THE CAPABILITY TO RECOVER FROM AN EVA OUT EXTERNAL AIRLOCK.

(C) MISSION:
NO EFFECT FIRST FAILURE. LOSS OF PRIMARY MISSION OBJECTIVES IF THE EXTERNAL AIRLOCK UPPER HATCH FAILS TO ROTATE OPEN FOLLOWING SECOND ROLLER BEARING FAILURE (LOSS OF ACCESS TO THE MIR STATION).

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT FIRST FAILURE. POSSIBLE LOSS OF CREW AND VEHICLE IF EVA IS PERFORMED OUT EXTERNAL AIRLOCK UPPER HATCH WHEN ORBITER AND MIR ARE NOT DOCKED FOLLOWING SECOND FAILURE.

(E) FUNCTIONAL CRITICALITY EFFECTS:
FIRST BEARING FAILURE - NO EFFECT SINCE HINGE CONTAINS REDUNDANT ROLLER BEARINGS.
SECOND BEARING FAILURE - INABILITY TO ROTATE EXTERNAL AIRLOCK UPPER HATCH CLOSED RESULTING IN LOSS OF NOMINAL HATCH CLOSING. DEGRADED EVA RECOVERY CAPABILITIES. THIS WOULD FIRST REQUIRE A FAILURE TO OPEN TUNNEL ADAPTER "C" HATCH SINCE IT IS PRIMARY FOR PERFORMING AN EVA.

(F SEPARATION FROM MIR IS ACCOMPLISHED, AFTER REMOVING EXTERNAL AIRLOCK UPPER HATCH AND HOLDING IT 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.

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 UPPER HATCH. EXTERNAL AIRLOCK VOLUME CANNOT BE REPRESSURIZED FOLLOWING A PLANNED EVA OUT THE UPPER HATCH WHEN ORBITER AND MIR ARE NOT DOCKED. POSSIBLE LOSS OF EVA CREW MEMBERS IF HABITABLE 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

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1MR-M005-01

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	:
DESIGN ENGINEER	:	T. S. COOK	: