

PAGE: 1

PRINT DATE: 10/23/95

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

NUMBER: M8-1MR-M011-X

SUBSYSTEM NAME: MECHANICAL - EXTERNAL AIRLOCK

REVISION: 3 9/15/95

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: SEAL, HATCH PRESSURE	V070-332504

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
EXTERNAL AIRLOCK UPPER HATCH PRESSURE SEAL

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 2
TWO

FUNCTION:

THE PERIMETER OF EXTERNAL AIRLOCK UPPER HATCH IS SEALED WITH TWO (DUAL/REDUNDANT) CONCENTRIC ANNULAR O-RING SEALS IN DOVETAIL GROOVES. AN INNER SEAL IS ON THE HATCH AND AN OUTER SEAL IS MOUNTED ON THE TOP FLANGE OF THE EXTERNAL AIRLOCK.

REFERENCE DOCUMENTS: V070-332504
M072-593829

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

NUMBER: M8-1MR-M011-01

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

FAILURE MODE:
 LEAKAGE (O-RING SEALS)

MISSION PHASE:
 OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 104 ATLANTIS

CAUSE:
 AGING/OXIDATION/SUBLIMATION, CONTAMINATION/FOREIGN OBJECT/DEBRIS,
 DEFECTIVE PART MATERIAL OR MANUFACTURING DEFECT, INADEQUATE/EXCESSIVE/
 UNEVEN SEAL COMPRESSION LOADS, MISHANDLING, THERMAL DISTORTION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

CRITICALITY 1R3 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:
 NONE FOR FIRST FAILURE. FAILURE OF REDUNDANT O-RING SEAL CAN BE DETECTED
 THROUGH INSTRUMENTATION & PHYSICAL OBSERVATION - LOSS OF EXTERNAL
 AIRLOCK PRESSURE WHEN ORBITER AND MIR ARE NOT DOCKED.

CORRECTING ACTION: NONE FOR FIRST FAILURE. CREW COULD CLOSE APPROPRIATE
 HATCH(S) TO ISOLATE LEAKAGE GIVEN FAILURE OF REDUNDANT O-RING.

REMARKS/RECOMMENDATIONS:
 THIS FAILURE MODE APPLIES TO THE EXTERNAL AIRLOCK UPPER HATCH WHILE IT IS
 CLOSED AND THE ORBITER/MIR ARE NOT DOCKED.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE
NUMBER: M8-1MR-M011-01**

- FAILURE EFFECTS -

(A) SUBSYSTEM:

NO EFFECT FIRST FAILURE. SECOND O-RING FAILURE WILL RESULT IN THE INABILITY TO ISOLATE THE VESTIBULE TUNNEL FROM EXTERNAL AIRLOCK ENVIRONMENT. NO EFFECT DURING IVA SINCE EXTERNAL AIRLOCK UPPER HATCH IS OPEN.

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT FIRST FAILURE. LOSS OF PRESSURE TO OUTSIDE ATMOSPHERE AND INCREASED USE OF O2/N2 CONSUMABLES GIVEN A SIMILAR FAILURE OF SECOND O-RING WHEN ORBITER AND MIR ARE NOT DOCKED. INABILITY TO DEPRESSURIZE VESTIBULE TUNNEL FOR SEPARATION WITHOUT EFFECTING EXTERNAL AIRLOCK VOLUME.

(C) MISSION:

NO EFFECT FIRST FAILURE. EXCESSIVE LEAKAGE FOLLOWING FAILURE OF REDUNDANT SEAL COULD RESULT IN POSSIBLE EARLY MISSION TERMINATION IF SECOND FAILURE OCCURS PRIOR TO MATING WITH THE MIR. NO EFFECT DURING MIR OPERATIONS SINCE EXTERNAL AIRLOCK UPPER HATCH IS OPEN.

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

NO EFFECT FIRST FAILURE UNTIL LOSS OF REDUNDANT SEAL AND AN ADDITIONAL SEAL FAILURE WITHIN HABITABLE VOLUME OCCURS.

(E) FUNCTIONAL CRITICALITY EFFECTS:

FIRST O-RING FAILURE - NO EFFECT. LOSS OF REDUNDANCY ONLY.

SECOND O-RING FAILURE - POSSIBLE EARLY MISSION TERMINATION DUE TO LEAKAGE TO OUTSIDE ATMOSPHERE WHEN ORBITER/MIR ARE NOT DOCKED RESULTING IN AN INCREASED USE OF CONSUMABLES.

THIRD FAILURE (ADDITIONAL SINGLE SEAL FAILURE WITHIN HABITABLE VOLUME) - (1) IF THIRD FAILURE OCCURS DURING IVA (CAMERA PREPARATION FOR DOCKING OR SPACELAB OPERATIONS) EXCESSIVE LOSS OF CONSUMABLES CAN JEOPARDIZE CREW SAFETY; (2) IF THIRD FAILURE OCCURS DURING EVA OUT EXTERNAL AIRLOCK, POSSIBLE LOSS OF EVA CREWMEMBERS IF EXTERNAL AIRLOCK VOLUME CANNOT BE REPRESSURIZED FOR RETURN TO CREW CABIN. (EVA CREWMEMBERS MUST REMAIN IN AIRLOCK UNTIL LANDING). THIS WOULD FIRST REQUIRE A FAILURE TO OPEN TUNNEL ADAPTER "C" HATCH SINCE IT IS PRIMARY FOR PERFORMING AN EVA.

IF SECOND FAILURE OCCURS WHEN ORBITER/MIR ARE DOCKED, POSSIBLE LOSS OF PRESSURE IN MIR IF ISOLATION BETWEEN EXTERNAL AIRLOCK AND MIR IS LOST WHEN EXTERNAL AIRLOCK IS DEPRESSURIZED FOR EVA.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

NONE. UTILIZING WORKAROUND TO CLOSE HATCHES TO ISOLATE LEAKAGE HAS NO EFFECT ON THE CRITICALITY OF THIS FAILURE MODE. CRITICALITY REMAINS A 1R3 FOR MULTI-MIR.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE
NUMBER: M8-1MR-M011-01

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: HOURS TO DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: MINUTES

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: SECONDS TO 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 SUFFICIENT TIME TO CLOSE APPROPRIATE HATCH(S) TO ISOLATE
LEAKAGE FROM THE CREW CABIN VOLUME BEFORE EXCESSIVE LEAKAGE BECAME
CATASTROPHIC.

HAZARDS REPORT NUMBER(S): ORBI 511

HAZARD(S) DESCRIPTION:
LOSS OF HABITABLE PRESSURE WHEN ORBITER AND MIR ARE NOT DOCKED.

- 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>