FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: M7-3-M68-X

SUBSYSTEM NAME: TUNNEL ADAPTER
REVISION : 1 03/20/91

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	WINDOW ASSEMBLY	V075-332650
SRU	:	HATCH WINDOW SEALS	MB3248/1-349
SRU	:	HATCH WINDOW SEALS	MB3248/1-356

PART DATA

- EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
  WINDOW ASSEMBLY, HATCHES "C" & "D"

- QUANTITY OF LIKE ITEMS: 2
  ONE WINDOW ASSEMBLY PER HATCH "C"
  ONE WINDOW ASSEMBLY PER HATCH "D"

- FUNCTION:
  THE WINDOW ASSEMBLY IS A 4-INCH DIAMETER CIRCULAR VIEWING PORT WHICH IS MOUNTED IN THE CENTER OF THE TUNNEL ADAPTER HATCHES. THE ASSEMBLY IS MADE OF TWO PANES OF POLYCARBONATE AND IS MOUNTED UTILIZING DUAL (REDUNDANT) O-RING SEALS.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: M7-3-M6B-01

REVISION# 1 03/20/91 R

SUBSYSTEM: TUNNEL ADAPTER
LRU :WINDOW ASSEMBLY
ITEM NAME: HATCH WINDOW SEALS

CRITICALITY OF THIS FAILURE MODE:1R3

■ FAILURE MODE:
LEAKAGE (O-RING SEALS)

MISSION PHASE:
OO ON-ORBIT

■ VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
: 103 DISCOVERY
: 104 ATLANTIS
: 105 ENDEAVOUR

■ CAUSE:
CRACKS, LOW TEMPERATURE, MATERIAL DEGRADATION

■ CRITICALITY 1/1 OURING INTACT ABORT ONLY? NO

■ REDUNDANCY SCREEN A) FAIL
■ B) FAIL
■ C) PASS

PASS/FAIL RATIONALE:
■ A)
SEAL FAILS SCREEN "A" BECAUSE A LEAK TEST OF EACH (INDIVIDUAL) SEAL IS NOT FEASIBLE.

■ B)
SEAL FAILS SCREEN "B" BECAUSE A LEAK TEST OF EACH (INDIVIDUAL) SEAL IS NOT FEASIBLE.

■ C)
PASSES SCREEN "C" SINCE THE FAILURE OF ANY ONE SEAL CANNOT CAUSE THE FAILURE OF THE OTHER REDUNDANT SEAL.

- FAILURE EFFECTS -

■ (A) SUBSYSTEM:
NO EFFECT IF A SINGLE O-RING SEAL FAILS. LEAKAGE OF CREW MODULE

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: M7-3-M6B-01

ATMOSPHERE OVERBOARD AND INCREASED USE OF O2/N2 CONSUMABLES IF BOTH SEALS FAIL.

■ (B) INTERFACING SUBSYSTEM(S):
SAME AS (A).

■ (C) MISSION:
NO EFFECT IF A SINGLE SEAL FAILS. POSSIBLE EARLY TERMINATION OF MISSION IF BOTH SEALS FAIL.

■ (D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT IF A SINGLE SEAL FAILS. POSSIBLE LOSS OF CREW/VEHICLE IF LEAK RATE FROM DUAL SEAL FAILURE AND AN ADDITIONAL SEAL FAILURE WITHIN THE CREW MODULE EXCEEDS THE ARPCS MAKEUP CAPABILITY.

■ (E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

■ (A) DESIGN:
DUAL O-RING FACE SEALS ARE INSTALLED BETWEEN WINDOW SURFACE AND HATCH BASE WHICH IS A RIGID STRUCTURE. DIFFERENTIAL PRESSURE ACROSS WINDOW INCREASES SEAL COMPRESSION. SEAL MATERIAL IS FLUOROCARBON ELASTOMER (VITON).

■ (B) TEST:
ACCEPTANCE TESTS: STRUCTURAL LEAK TEST OF TUNNEL ADAPTER TO 14.7 PSID IS PERFORMED.

QUALIFICATION TESTS: NO QUALIFICATION TESTS WERE PERFORMED. CERTIFICATION IS BASED ON ACCEPTANCE TESTS AND SEAL MATERIALS DATA.

OMRSD: EACH TIME TUNNEL ADAPTER IS INSTALLED, LEAK TEST OF CREW MODULE/AIRLOCK/TUNNEL ADAPTER IS PERFORMED AT 3.2 PSIG WITH HATCH "A" OPEN AND HATCHES "C" AND "D" CLOSED.

REF. OMRSD V60AB0.015

■ (C) INSPECTION:
RECEIVING INSPECTION
RECEIVING INSPECTORS INSPECT FOR DAMAGE AND WORKMANSHIP AND VERIFY THAT SEAL IS OF SINGLE PIECE MOLDED CONSTRUCTION. RECEIVING INSPECTORS ALSO CHECK IDENTIFICATION AND WALL CROSS-SECTIONAL DIAMETER ON A S-3 SAMPLING BASIS AND THAT SUPPLIER SUBMITTED REQUIRED REPORTS.

CONTAMINATION CONTROL

PRINT DATE: 03/20/91

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: M7-3-M6B-01

RECEIVING INSPECTORS VISUALLY INSPECT SEAL FOR CLEANLINESS. INSPECTORS VERIFY, BEFORE INSTALLATION, THAT THE SEALING SURFACE AND VITON SEAL ARE CLEAN.

ASSEMBLY/INSTALLATION
THE SEALS ARE INSTALLED PER MA0106-328. PRIOR TO INSTALLATION AN INSPECTION IS PERFORMED TO VERIFY THAT THE SEALING SURFACE IS NOT DAMAGED.

TESTING
THE TUNNEL ADAPTER STRUCTURAL LEAK TEST TO 14.7 PSID IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
THE RECEIVING INSPECTORS VERIFY THAT THE SEAL IS INDIVIDUALLY PACKAGED WITH PART NUMBER, MANUFACTURER NAME, COMPOUND NUMBER AND CURE DATE. RECEIVING INSPECTORS ALSO VERIFY THAT THE SEAL IS PACKAGED IN A WAY THAT WILL PROTECT IT DURING STORAGE.

■ (D) FAILURE HISTORY:
SIMILAR FLUOROCARBON ELASTOMER SEALS USED IN SPACE AND COMMERCIAL APPLICATIONS HAVE NO HISTORY OF LEAKAGE FAILURES. SIMILAR SEALS EXHIBITED NO FLIGHT FAILURES DURING APOLLO CSM PROGRAM.

■ (E) OPERATIONAL USE:
IF BOTH SEALS FAIL ON WINDOW ASSEMBLY OF TUNNEL ADAPTER HATCH "C", CREW MODULE/SPACELAB CONSUMABLES CAN BE MONITORED AND ASSESSED FOR FEASIBILITY OF CONTINUING THE MISSION PER CABIN LEAK PROCEDURES AND FLIGHT RULES. IF BOTH SEALS FAIL ON WINDOW ASSEMBLY OF TUNNEL ADAPTER HATCH "D", LOSS OF CONSUMABLES WOULD ONLY OCCUR DURING AN EMERGENCY EVA WHILE HATCH "C" IS OPEN.

- APPROVALS -

RELIABILITY ENGINEERING: D. M. MAYNE : D.M. Mayne
DESIGN ENGINEERING : E. L. SALLEE : E. Sallee
QUALITY ENGINEERING : M. SAVALA : [signature] 3/24/91

NASA RELIABILITY : Brenda S. Shaw 4/12/91
NASA SUBSYSTEM MANAGER : [signature] 4/1/91
NASA QUALITY ASSURANCE : [signature] 4/1/91