FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL HARDWARE
NUMBER:M8-1SS-E006 -X

SUBSYSTEM NAME: ECLSS - ARPCS

REVISION: 2 04/08/97

PART DATA

	PART NAME **VENDOR NAME**	**PART NUMBER** **VENDOR NUMBER**
LRU	:CAP, PRESSURE CARELTON TECHNOLOGIES	MC250-0004-0010 2763-2001-7

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
EXTERNAL AIRLOCK AFT HATCH EQUALIZATION VALVE PRESSURE CAP

QUANTITY OF LIKE ITEMS: 2
TWO

FUNCTION:
CAPS ONTO EQUALIZATION VALVE TO PROVIDE SECONDARY PROTECTION FOR INTERNAL LEAKAGE ACROSS EXTERNAL AIRLOCK AFT HATCH.

REFERENCE DOCUMENTS: M072-593830
V519-331051

PRINT DATE: 01/03/97

FAILURE MODES EFFECTS ANALYSIS FMEA – NON-CIL FAILURE MODE

NUMBER: M8-1SS-E006-03

REVISION#: 2 04/08/97

SUBSYSTEM NAME: ECLSS - ARPCS
LRU: CAP, EQUALIZATION VALVE PRESSURE
ITEM NAME: CAP, EQUALIZATION VALVE PRESSURE

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
INABILITY TO REMOVE

MISSION PHASE: OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

103	DISCOVERY
104	ATLANTIS
105	ENDEAVOUR

CAUSE:
CONTAMINATION, PHYSICAL BINDING/JAMMING, CORROSION, MECHANICAL SHOCK, EXCESSIVE VIBRATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

METHOD OF FAULT DETECTION:
PHYSICAL OBSERVATION - CREW PHYSICALLY UNABLE TO REMOVE CAP FROM EQUALIZATION VALVE.

CORRECTING ACTION: MANUAL

CORRECTING ACTION DESCRIPTION:
CREW COULD UTILIZE REDUNDANT EQUALIZATION VALVE TO EQUALIZE PRESSURE ACROSS HATCH. WHEN NO PRESSURIZED PAYLOAD IS INSTALLED, CREW COULD UTILIZE EXTERNAL AIRLOCK DEPRESSURIZATION VALVE TO EQUALIZE EXTERNAL

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AIRLOCK PRESSURE TO OUTSIDE PRESSURE. WHEN A PRESSURIZED PAYLOAD IS INSTALLED CREW COULD PERFORM THE FOLLOWING WORKAROUND FOLLOWING SIMILAR FAILURE OF SECOND EQUALIZATION VALVE CAP DURING AN EVA: ANOTHER EVA CREWMEMBER WITHIN EXTERNAL AIRLOCK COULD DEPRESSURE EXTERNAL AIRLOCK USING THE DEPRESS VALVING WITHIN THIS AIRLOCK TO ALLOW OPENING OF THE AFT HATCH. ONCE ALL EVA CREWMEMBERS ARE INSIDE THE EXTERNAL AIRLOCK, BOTH THE AIRLOCK AND TUNNEL CAN BE REPRESSURIZED FOR CREW ENTRY INTO CREW CABIN.

REMARKS/RECOMMENDATIONS:
CRITICALITY OF THIS FAILURE MODE IS BASED ON THE WORST CASE EFFECT WHEN THERE IS A PRESSURIZED PAYLOAD INSTALLED AND EXTERNAL AIRLOCK AFT HATCH IS CLOSED DURING AN EVA. RECOMMEND THAT THE EXTERNAL AIRLOCK AFT HATCH BE REMOVED IF A PRESSURIZED PAYLOAD IS INSTALLED.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NO EFFECT WHEN A PRESSURIZED PAYLOAD IS NOT INSTALLED SINCE EXTERNAL AIRLOCK AFT HATCH REMAINS CLOSED DURING NOMINAL MISSION. WHEN A PRESSURIZED PAYLOAD IS INSTALLED, FAILURE TO REMOVE A CAP WILL RESULT IN LOSS OF CAPABILITY TO USE AFFECTED EQUALIZATION VALVE. LOSS OF CAPABILITY TO EQUALIZE PRESSURE ACROSS THE EXTERNAL AIRLOCK AFT HATCH IF UNABLE TO REMOVE CAP ON BOTH EQUALIZATION VALVES.

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT ON ORBITER INTERFACING SUBSYSTEMS.

(C) MISSION:
NO EFFECT FIRST FAILURE. INABILITY TO REMOVE CAP ON REDUNDANT VALVE WOULD PREVENT EQUALIZING PRESSURE ACROSS EXTERNAL AIRLOCK AFT HATCH USING THESE VALVES. LOSING ALL PRESSURE EQUALIZATION CAPABILITIES WOULD PREVENT OPENING OF AFT HATCH RESULTING IN LOSS OF MISSION OBJECTIVES ASSOCIATED WITH: (1) THE INABILITY TO PERFORM A PLANNED EVA; OR (2) THE PRESSURIZED PAYLOAD (WHEN INSTALLED).

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT UNTIL ALL MEANS OF EQUALIZING PRESSURE ACROSS EXTERNAL AIRLOCK AFT HATCH ARE LOST. THEN INABILITY TO OPEN HATCH TO PERFORM A CONTINGENCY EVA OR TO RETURN FROM AN EVA COULD RESULT IN LOSS OF CREW AND/OR VEHICLE.

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(E) FUNCTIONAL CRITICALITY EFFECTS:
IF A PRESSURIZED PAYLOAD IS NOT INSTALLED:
FIRST FAILURE (INABILITY TO REMOVE PRESSURE CAP FROM FIRST EQUALIZATION VALVE) - LOSS OF AFFECTED EQUALIZATION VALVE.
SECOND FAILURE (INABILITY TO REMOVE PRESSURE CAP FROM SECOND EQUALIZATION VALVE) - INABILITY TO EQUALIZE PRESSURE ACROSS EXTERNAL AIRLOCK AFT HATCH USING EITHER EQUALIZATION VALVE.
THIRD FAILURE (EXTERNAL AIRLOCK MANUAL DEPRESSURIZATION VALVE FAILS TO OPEN) - LOSS OF CAPABILITY TO EQUALIZE PRESSURE BETWEEN EXTERNAL AIRLOCK AND OUTSIDE ATMOSPHERE. FAILURE TO EQUALIZE PRESSURE WILL PRECLUDE OPENING OF EXTERNAL AIRLOCK AFT HATCH RESULTING IN THE INABILITY TO PERFORM AN EVA. - CRITICALITY 2R3 CONDITION.
FOURTH FAILURE (FAILURE REQUIRING A CONTINGENCY EVA) - POSSIBLE LOSS OF CREW AND VEHICLE IF CONTIGENCY EVA IS REQUIRED TO CORRECT A CRIT 1 CONDITION. - CRITICALITY 1R3 CONDITION.

IF A PRESSURIZED PAYLOAD IS INSTALLED:
FIRST FAILURE (INABILITY TO REMOVE PRESSURE CAP FROM FIRST EQUALIZATION VALVE) - LOSS OF AFFECTED EQUALIZATION VALVE.
SECOND FAILURE (INABILITY TO REMOVE PRESSURE CAP FROM SECOND EQUALIZATION VALVE) - INABILITY TO EQUALIZE PRESSURE ACROSS EXTERNAL AIRLOCK AFT HATCH WOULD LOSE CAPABILITY TO OPEN HATCH. IF SECOND FAILURE OCCURS:
PRIOR TO AN EVA - LOSS MISSION OBJECTIVES ASSOCIATED WITH A PLANNED EVA OR WITH A PRESSURIZED PAYLOAD. - CRITCALITY 2R3 CONDITION)
THIRD FAILURE (FAILURE REQUIRING A CONTINGENCY EVA) - POSSIBLE LOSS OF CREW AND VEHICLE IF CONTIGENCY EVA IS REQUIRED TO CORRECT A CRIT 1 CONDITION. - CRITICALITY 1R3 CONDITION.
DURING AN EVA - POSSIBLE LOSS OF EVA CREWMEMBERS IF HATCH CANNOT BE OPENED FOR CREW'S RETURN TO CREW CABIN. - CRITICALITY 1R2 CONDITION.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
FOR THE FOLLOWING TWO CASES: (1) WHEN A PRESSURIZED PAYLOAD IS NOT INSTALLED; AND (2) WHEN A PRESSURIZED PAYLOAD IS INSTALLED PRIOR TO AN EVA; ALL WORKAROUNDS HAVE ALREADY BEEN CONSIDERED WHEN DETERMINING CRITICALITY. FOR THE CASE WHEN A PRESSURIZED PAYLOAD IS INSTALLED AND THE CAP FROM BOTH EQUALIZATION VALVES CANNOT BE REMOVED, FOLLOWING AN EVA, FAILURE TO PERFORM THE WORKAROUND TO EQUALIZE PRESSURE ACROSS THE HATCH (THIRD FAILURE) COULD RESULT IN LOSS OF EVA CREWMEMBERS IF HATCH CANNOT BE OPENED FOR CREW'S RETURN INTO CREW CABIN. (EVA CREWMEMBERS MUST REMAIN IN TUNNEL ADAPTER UNTIL LANDING.) - CRITICALITY 1R3 CONDITION.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: HOURS

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TIME FROM FAILURE OCCURRENCE TO DETECTION: IMMEDIATE

TIME FROM DETECTION TO COMPLETED CORRECTING ACTION: SECONDS

IS TIME REQUIRED TO IMPLEMENT CORRECTING ACTION LESS THAN TIME TO EFFECT?
YES

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
CREW WOULD HAVE ENOUGH TIME TO OPEN REDUNDANT EQUALIZATION VALVE OR OPEN EXTERNAL AIRLOCK MANUAL DEPRESS VALVE (WHEN A PRESSURIZED PAYLOAD IS NOT INSTALLED) OR PERFORM WORKAROUND TO EQUALIZE PRESSURE ACROSS AFT HATCH BEFORE THE NEED FOR PERFORMING A CONTINGENCY EVA OR FOR THE EVA CREWMEMBER'S RETURN TO CREW CABIN BECAME CATASTROPHIC.

HAZARD REPORT NUMBER(S): ORBI 162, FF-09

HAZARD(S) DESCRIPTION:
INABILITY TO RETURN FROM EVA DUE TO AIRLOCK HATCH FAILURES AND / OR REPRESSURIZATION OF THE AIRLOCK (ORBI 162). INABILITY TO SAFELY PERFORM EVA (FF-09).

- APPROVALS -

SS & PAE	:	M. W. GUENTHER	:
DESIGN ENGINEER	:	K. J. KELLY	: