FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL HARDWARE
NUMBER:M5-6SS-0800 -X

SUBSYSTEM NAME: ISSA DOCKING SYSTEM

REVISION: 0 02/27/98

PART DATA

	PART NAME / **VENDOR NAME**	**PART NUMBER** / **VENDOR NUMBER**
LRU	:ML86B PANEL	V070-730382
SRU	:CIRCUIT BREAKER	MC454-0026-2030

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
CIRCUIT BREAKER, 3 AMP - EXTERNAL AIRLOCK WATER SHUTOFF VALVE CIRCUIT.

REFERENCE DESIGNATORS: 60V73A130CB106

QUANTITY OF LIKE ITEMS: 1
(ONE)

FUNCTION:
PROVIDE OVERLOAD PROTECTION AND ISOLATION FROM THE MAIN B BUS FOR THE POTABLE WATER VALVE CONTROL CIRCUIT.

REFERENCE DOCUMENTS: 1) VS70-640109, SCHEMATIC DIAGRAM - AIRLOCK ENVIRONMENTAL CONTROL SUBSYSTEM

FAILURE MODES EFFECTS ANALYSIS FMEA -- NON-CIL FAILURE MODE
NUMBER: M5-6SS-0800-01

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SUBSYSTEM NAME: ISS DOCKING SYSTEM
LRU: ML86B PANEL
ITEM NAME: CIRCUIT BREAKER

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS OPEN, FAILS TO CONDUCT, FAILS TO CLOSE

MISSION PHASE: OO ON-ORBIT

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

CAUSE:
A) STRUCTURAL FAILURE, B) CONTAMINATION, C) VIBRATION, D) MECHANICAL SHOCK, E) PROCESSING ANOMALY, F) THERMAL STRESS

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? NO

REDUNDANCY SCREEN
A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF CAPABILITY TO OPEN OR CLOSE POTABLE WATER SHUT OFF VALVE.

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(B) INTERFACING SUBSYSTEM(S):
LOSS OF CAPABILITY TO CONTROL POTABLE WATER SHUTOFF VALVE.
LOSS OF ABILITY TO OPEN POTABLE WATER SUPPLY VALVE COULD RESULT IN LOSS OF EVA CAPABILITIES SUBSEQUENT TO FIRST EVA SINCE WATER IS NOT AVAILABLE TO COOL BOTH EMU'S.
LOSS OF ABILITY TO CLOSE POTABLE WATER SUPPLY VALVE COULD OCCUR AFTER TWO ADDITIONAL FAILURES RESULTING IN WATER IN THE EXTERNAL AIRLOCK.

(C) MISSION:
FIRST FAILURE - NO EFFECT.

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT - FIRST FAILURE.

(E) FUNCTIONAL CRITICALITY EFFECTS:
CASE 1:
CIRCUIT BREAKER FAILS OPEN WHEN THE WATER SHUTOFF VALVE IS IN THE CLOSED POSITION.
POSSIBLE LOSS OF CREW/VEHICLE AFTER TWO FAILURES:
1) CIRCUIT BREAKER FAILS OPEN - LOSS OF POTABLE WATER SUPPLY. WORST CASE IF FAILURE OCCURS FOLLOWING AN INITIAL EVA. THEN LOSS OF WATER SUPPLY FOR COOLING ALL EMU'S WOULD PRECLUDE SUBSEQUENT EVA CAPABILITIES. POTENTIAL LOSS OF CONTINGENCY EVA OPERATIONS.
2) A FAILURE REQUIRING AN EVA TO PREVENT A POTENTIAL CATASTROPHIC SITUATION - INABILITY TO PERFORM A CONTINGENCY EVA TO CORRECT A CRIT 1 CONDITION COULD RESULT IN A LOSS OF CREW/VEHICLE - CRITICALITY 1R2 CONDITION.

CASE 2:
CIRCUIT BREAKER FAILS OPEN WHEN THE WATER SHUTOFF VALVE IS IN THE OPEN POSITION.
POSSIBLE LOSS OF CREW/VEHICLE AFTER THREE FAILURES:
1) CIRCUIT BREAKER FAILS OPEN - LOSS OF ABILITY TO CLOSE POTABLE WATER SUPPLY VALVE.
2) EXTERNAL LEAKAGE OF POTABLE WATER DOWNSTREAM OF SHUTOFF VALVE.
3) POTABLE WATER TANK OUTLET VALVE FAILS OPEN. LOSS OF ABILITY TO SHUT OFF WATER SUPPLY - RESULTS IN WATER IN EXTERNAL AIRLOCK. WATER MIGRATION TO KEEL AREA COULD RENDER RUSSIAN AVIONICS INOPERATIVE, RESULTING IN LOSS OF NOMINAL AND PROTECHNIC UNDOCKING CAPABILITY - CRITICALITY 1R3 CONDITION.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
CASE 1:
CRITICALITY DOWNGRADED FROM 1R2 TO 1R3 DUE TO ADDITIONAL FAULT TOLERANCE PROVIDED BY WORKAROUND(S) ALLOWED PER CR S050107W.

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AFTER THE SECOND FAILURE (FAILURE NECESSITATING AN EVA TO PREVENT A POTENTIAL CATASTROPHIC SITUATION) - INABILITY TO PERFORM CONTINGENCY EVA (THIRD FAILURE) TO CORRECT A CRIT 1 CONDITION COULD RESULT IN LOSS OF CREW AND VEHICLE.

CASE 2:
ALTHOUGH THE CRITICALITY REMAINS UNCHANGED AFTER WORKAROUNDS CONSIDERATION (ALLOWED PER CR S050107W), THEY ARE PROVIDING ADDITIONAL FAULT TOLERANCE TO THE SYSTEM.

AFTER THE THIRD FAILURE, THE CREW CAN DISCONNECT THE QD LOCATED AT THE MICROBIAL CHECK VALVE TO STOP THE LEAK. IF UNABLE TO PERFORM WORKAROUND TO DISCONNECT QD (FOURTH FAILURE) AND WATER MIGRATES TO THE EXTERNAL AIRLOCK KEEL AREA AND RENDERS THE RUSSIAN AVIONICS INOPERATIVE, THE CREW WOULD PERFORM EVA TO REMOVE 96 BOLTS FROM THE DOCKING BASE TO CIRCUMVENT THE WORST CASE "DESIGN CRITICALITY" EFFECT. IF UNABLE TO PERFORM EVA (FIFTH FAILURE), POSSIBLE LOSS OF CREW.VEHICLE DUE TO LOSS OF ALL UNDOCKING CAPABILITY.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

TIME FROM DETECTION TO COMPLETED CORRECTING ACTION: MINUTES

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

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
CASE 1: SINCE EMU POTABLE WATER TANKS ARE FILLED PRIOR TO LAUNCH, CREW COULD UTILIZE AN EMU THAT CONTAINS WATER TO PERFORM AN EVA. TO REDUCE THE USE OF EMU POTABLE WATER, CREW COULD MANEUVER ORBITER/ISS SUCH THAT EVA CREW MEMBERS ARE NOT EXPOSED TO THE SUN DURING AN EVA.

CASE 2: LOSS OF ABILITY CLOSE POTABLE WATER SUPPLY VALVE WILL NOT CAUSE A PROBLEM. IT WILL REQUIRE A SECOND FAILURE (PLUMBING LEAK) FOR WATER TO ESCAPE INTO THE EXTERNAL AIRLOCK.

HAZARD REPORT NUMBER(S): ORBI 401

HAZARD(S) DESCRIPTION:
INABILITY TO SAFELY SEPARATE THE ORBITER FROM A MATED ELEMENT.

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- APPROVALS -

SS&PAE	: T. K. KIMURA	: T. Kimura 4-13-98
DESIGN ENGINEERING	: C. J. ARROYO	: