FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL HARDWARE
NUMBER:M5-6SS-0101 -X

SUBSYSTEM NAME: ISS DOCKING SYSTEM
REVISION: 0 02/27/98

PART DATA

	PART NAME / **VENDOR NAME**	**PART NUMBER** / **VENDOR NUMBER**
LRU	:PANEL A6A3	V828-730150
SRU	:TOGGLE SWITCH	MC452-0102-7605

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
SWITCHES, TOGGLE, 1 POLE, 2 POSITION, MOMENTARY - SYSTEM 1 POWER MAIN A, AND SYSTEM 2 POWER MAIN B CONTROL.

REFERENCE DESIGNATORS: 36V73A7A3S1
36V73A7A3S2

QUANTITY OF LIKE ITEMS: 2
TWO

FUNCTION:
THE SWITCHES PROVIDE MANUAL ACTIVATION OF THE PANEL MAIN A AND THE PANEL MAIN B ISS DOCKING SYSTEM POWER CIRCUITS.

REFERENCE DOCUMENTS: 1) VS70-953103, INTEGRATED SCHEMATIC - 53A, MAIN A/MAIN B SYSTEM POWER AND APDS LOGIC BUSES

FAILURE MODES EFFECTS ANALYSIS FMEA -- NON-CIL FAILURE MODE
NUMBER: M5-6SS-0101-01

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SUBSYSTEM NAME: ISS DOCKING SYSTEM
LRU: PANEL A6A3
ITEM NAME: TOGGLE SWITCH

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS OPEN IN THE "ON" POSITION, FAILS CLOSED IN THE "OFF" POSITION, POLE-TO-POLE SHORT, SHORT TO CASE (GROUND)

MISSION PHASE: OO ON-ORBIT

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

CAUSE:
A) PIECE PART 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)

METHOD OF FAULT DETECTION:
VISUAL CUE FROM DS1 AND DS2. VISUAL INSPECTION OF VESTIBULE DOCKING LIGHTS AND TRUSS DOCKING LIGHTS AVAILABLE. VESTIBULE DE-PRESSURIZATION VALVE FUNCTIONAL STATUS AVAILABLE.

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CORRECTING ACTION: NONE

CORRECTING ACTION DESCRIPTION:
DESIGN FAULT TOLERANCE: TWO OF THREE REDUNDANT ISS DOCKING MECHANISM LOGIC POWER BUS SOURCES REMAIN TO PROVIDE POWER TO THE DOCKING SYSTEM CIRCUITS.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF CAPABILITY TO ACTIVATE ONE OF THE TWO ISS DOCKING SYSTEM POWER CIRCUITS.

(B) INTERFACING SUBSYSTEM(S):
CASE 1: LOSS OF PANEL A6A3 MAIN A POWER.
ISS DOCKING FUNCTIONS LOST DUE TO SWITCH S1 (SYSTEM 1 POWER CONTROL CIRCUIT) FAILURE INCLUDE: VESTIBULE DE-PRESSURIZATION VALVE FUNCTIONAL CAPABILITY (MAIN "A" BRANCH); TRUSS FORWARD DOCKING LIGHT ENABLE; VESTIBULE PORT DOCKING LIGHT ENABLE; PANEL "A" BUS (PARTIAL) ENABLE FOR THE ISS DOCKING MECHANISM PANEL A6A2

CASE 2: LOSS OF PANEL A6A3 MAIN B POWER.
ISS DOCKING FUNCTIONS LOST DUE TO SWITCH S2 (SYSTEM 2 POWER CONTROL CIRCUIT) FAILURE INCLUDE: VESTIBULE DE-PRESSURIZATION VALVE FUNCTIONAL CAPABILITY (MAIN "B" BRANCH); TRUSS FORWARD DOCKING LIGHT ENABLE; VESTIBULE STARBOARD DOCKING LIGHT ENABLE; PANEL "B" BUS (PARTIAL) ENABLE FOR THE ISS DOCKING MECHANISM PANEL A6A2.

(C) MISSION:
FIRST FAILURE - NO EFFECT. DEGRADATION OF PANEL BUS REDUNDANCY. DEGRADED DOCKING LIGHTS REDUNDANCY.

(D) CREW, VEHICLE, AND ELEMENT(S):
FIRST FAILURE - NO EFFECT. DEGRADATION OF ISS DOCKING MECHANISM LOGIC BUS REDUNDANCY.

(E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS CREW/VEHICLE AFTER THREE FAILURES:
1) ONE OF TWO SWITCHES FAILS OPEN - DEGRADATION OF PANEL BUS REDUNDANCY. TWO REDUNDANT ISS DOCKING MECHANISM LOGIC POWER BUS SOURCES REMAIN OPERATIONAL.

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2) CONTACTOR OF REDUNDANT CIRCUIT INADVERTENTLY OPENS AFTER DOCKING - LOSS OF PANEL BUSES. ONE ISS DOCKING MECHANISM LOGIC BUS POWER SOURCE REMAINS OPERATIONAL.
3) ONE OF TWO MAIN C - LOGIC 2 AND 3 BUSES CIRCUIT BREAKERS OR DIODES FAILS OPEN - LOSS OF ALL UNDOCKING CAPABILITY. LOSS OF TWO OF THREE ISS DOCKING MECHANISM LOGIC BUSES DISABLES NOMINAL AND PYROTECHNIC SEPARATION SYSTEMS CONTROL.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
ALTHOUGH THE CRITICALITY REMAINS UNCHANGED AFTER WORKAROUNDS CONSIDERATION (ALLOWED PER CR S050107W), ADDITIONAL FAULT TOLERANCE IS PROVIDED TO THE SYSTEM.

AFTER THE THIRD FAILURE, THE CREW WOULD PERFORM IFM TO COMPLETE ALL REQUIRED APDS MOTOR DRIVE FUNCTIONS. IF UNABLE TO PERFORM THE IFM (FOURTH FAILURE) THEN 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: MINUTES

TIME FROM DETECTION TO COMPLETED CORRECTING ACTION: HOURS

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

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
DESIGN FAULT TOLERANCE: TWO OF THREE REDUNDANT ISS DOCKING MECHANISM LOGIC POWER BUS SOURCES REMAIN OPERATIONAL AFTER THE FIRST FAILURE TO PROVIDE POWER TO THE DOCKING SYSTEM CIRCUITS. AFTER THE THIRD FAILURE, THE CREW WOULD BE ABLE TO PERFORM IFM TO COMPLETE ALL REQUIRED APDS MOTOR DRIVE FUNCTIONS.

HAZARD REPORT NUMBER(S): ORBI 401

HAZARD(S) DESCRIPTION:
INABILITY TO SAFELY SEPARATE 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	: