

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL HARDWARE  
NUMBER:M5-6SS-0104 -X**

**SUBSYSTEM NAME: ISS DOCKING SYSTEM**

**REVISION: 0                      02/27/98**

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**PART DATA**

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	<b>PART NAME VENDOR NAME</b>	<b>PART NUMBER VENDOR NUMBER</b>
LRU	:MID PCA-1	VO70-764400
LRU	:MID PCA-2	VO70-764430
SRU	:GENERAL PURPOSE CONTACTOR	MC455-0134-0003

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**  
CONTACTOR, GENERAL PURPOSE, LATCHING, 125 AMP - SYSTEM 1 POWER MAIN A, AND SYSTEM 2 POWER MAIN B CONTROL.

**REFERENCE DESIGNATORS:**    40V76A25K5  
                                          40V76A26K5

**QUANTITY OF LIKE ITEMS:**    2  
TWO

**FUNCTION:**  
THE CONTACTORS PROVIDE POWER DISTRIBUTION TO THE CIRCUIT PROTECTED PANEL MAIN A AND MAIN B BUSES, MAIN A AND MAIN B LOGIC BUSES AND PORT AND STARBOARD VESTIBULE DOCKING LIGHT 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-0104-01

REVISION#: 0 02/27/98

SUBSYSTEM NAME: ISS DOCKING SYSTEM

LRU: MID PCA 1, 2

ITEM NAME: GENERAL PURPOSE CONTACTOR

CRITICALITY OF THIS

FAILURE MODE: 1R3

**FAILURE MODE:**

OPEN, FAILS TO CONDUCT, INADVERTENTLY OPENS, FAILS TO TRANSFER, SHORT TO STRUCTURE (GROUND)

MISSION PHASE: OO ON-ORBIT

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

**CAUSE:**

A) PIECE PART 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 REDUNDANT ISS DOCKING MECHANISM LOGIC POWER BUS SOURCES REMAIN OPERATIONAL.

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**- FAILURE EFFECTS -**

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**(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 A5A3 MAIN A POWER.

ISS DOCKING FUNCTIONS LOST DUE TO PANEL MAIN A (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 A5A2

CASE 2: LOSS OF PANEL A5A3 MAIN B POWER.

ISS DOCKING FUNCTIONS LOST DUE TO PANEL MAIN B (SYSTEM 2 POWER CONTROL CIRCUIT) FAILURE INCLUDE: VESTIBULE DE-PRESSURIZATION VALVE FUNCTIONAL CAPABILITY (MAIN "B" BRANCH); TRUSS AFT DOCKING LIGHT ENABLE; VESTIBULE STARBOARD DOCKING LIGHT ENABLE; PANEL "B" BUS (PARTIAL) ENABLE FOR THE ISS DOCKING MECHANISM PANEL A5A2.

**(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 CONTACTOR FAILS OPEN - DEGRADATION OF PANEL BUS REDUNDANCY. TWO REDUNDANT ISS DOCKING MECHANISM LOGIC POWER BUS SOURCES REMAIN OPERATIONAL.
- 2) REDUNDANT CONTACTOR INADVERTENTLY OPENS AFTER DOCKING - LOSS OF PANEL BUSES. ONE ISS DOCKING MECHANISM LOGIC BUS POWER SOURCE REMAINS OPERATIONAL.

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- 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 FUNCTION. 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.

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**- TIME FRAME -**

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**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 -

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SS&PAE  
DESIGN ENGINEERING

: T. K. KIMURA  
: C. J. ARROYO

*T. Kimura 4-13-98*  
