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PRINT DATE: 13.02.87

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE  
NUMBER: M5-6SS-B025-X

SUBSYSTEM NAME: E - DOCKING SYSTEM

REVISION: 0 FEBDEC, 19976

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: POWER SWITCHING UNIT (PSU) RSC-E	MC621-0087-1003 33Y.5114.007

**PART DATA**

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**  
LINE REPLACEABLE UNIT (LRU) PSU - APDS LOGIC AND POWER CONTROL,  
DISTRIBUTION, AND PROTECTION.

REFERENCE DESIGNATORS: 45V53A2A4

QUANTITY OF LIKE ITEMS: 1  
(ONE)

**FUNCTION:**

THE PSU CONTROLS AND DISTRIBUTES THE APDS LOGIC BUSES. IT PROTECTS AND DISTRIBUTES THE APDS POWER BUSES. LOGIC AND MAIN POWER IS RECEIVED FROM THE ORBITER THROUGH CONNECTOR X3 AND RETURNED THROUGH CONNECTOR X4. THE LOGIC POWER BUSES ARE +WIA +WIB +WIB AND THE POWER BUSES ARE +CIW1 AND +CIW2. THE PSU PROVIDES THE FOLLOWING OUTPUTS:

**OUTPUT FUNCTIONS:**

- 1) POWER BUS +CIW1: RING MOTOR M4, PACU MOTORS M6 & M6, FIXERS 1 & 2, AND HI-ENERGY (AND LOW-ENERGY FOR THE "SOFT" DOCKING MECHANISM) DAMPERS 1 & 2.
- 2) POWER BUS +CIW2: RING MOTOR M5, PACU MOTORS M7 & M9, FIXERS 3, 4, & 5, AND HI-ENERGY (AND LOW-ENERGY FOR THE "SOFT" DOCKING MECHANISM) DAMPER 3.
- 3) LOGIC POWER BUSES +WIA +WIB +WIB ARE PROTECTED BY PANEL A8A3 CIRCUIT BREAKERS AND PROVIDE POWER PROVIDED UNFUSED TO THE LACU, PACU-1, PACU-2, DSCU, AND THE DMCU.

## FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE

NUMBER: M5-6SS-B025-01

REVISION# 0 FEBDEC, 19976

SUBSYSTEM NAME: E - DOCKING SYSTEM

LRU: MC621-0087-1003

ITEM NAME: POWER SWITCHING UNIT

CRITICALITY OF THIS

FAILURE MODE: 1R3

## FAILURE MODE:

LOSS OF ONE OF TWO POWER BUSES (+CU1) OR (+CU2) TO SINGLE AVIONICS LRU.

## MISSION PHASE:

OO ON-ORBIT

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

## CAUSE:

INTERNAL FUSES FAIL OPEN.

CRITICALITY 1R1 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:  
 LOSS OF TELEMETRY INDICATION.

MASTER MEAS. LIST NUMBERS: V53X0779E  
 V53X0780E

## CORRECTING ACTION:

1) ~~IN-FLIGHT MAINTENANCE IFM~~ PROCEDURES DEVELOPED TO DRIVE THE HOOKS  
 MOTORS DIRECTLY FROM THE FEED-THROUGH CONNECTORS IN THE EXTERNAL  
 AIRLOCK USING THE ORBITER BREAKOUT BOX;

2) INITIATION OF PYROBOLT SEPARATION IS AVAILABLE;

3) 96 BOLT EVA OPTION IS AVAILABLE TO SEPARATE THE ORBITER FROM ISS.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE**

**NUMBER: M5-6SS-8025-01**

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**- FAILURE EFFECTS -**

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**(A) SUBSYSTEM:**

LOSS OF ONE OF TWO POWER FEEDS TO PACU.

**(B) INTERFACING SUBSYSTEM(S):**

LOSS OF ONE OF TWO REDUNDANT HOOKS MOTORS RESULTING IN INCREASED MOTOR RUN TIME.

**(C) MISSION:**

NO EFFECT.

**(D) CREW, VEHICLE, AND ELEMENT(S):**

FIRST FAILURE - NO EFFECT.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

WORST CASE. SHUTTLE MECHANISM CONTROL: POSSIBLE LOSS OF CREW OR VEHICLE AFTER THREE FAILURES.

1) LOSS OF ONE OF TWO POWER BUSES RESULTING IN LOSS OF ONE HOOKS MOTOR IN BOTH SETS. 2) LOSS OF ASSOCIATED POWER BUS RESULTING IN LOSS OF ASSOCIATED HOOKS MOTOR IN BOTH SETS. LOSS OF NOMINAL VEHICLE SEPARATION CAPABILITY. 3) ONE PYROBOLT FAILS TO INITIATE. LOSS OF CAPABILITY TO IMPLEMENT PYROTECHNIC SEPARATION.

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

**(F) RATIONALE FOR CRITICALITY CATEGORY DOWNGRADE:**

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

AFTER THE SECOND FAILURE, THE CREW WOULD PERFORM IFM TO DRIVE THE HOOKS OPEN. IF UNABLE TO PERFORM THE IFM (THIRD FAILURE) THEN IMPLEMENT THE PYROTECHNIC SEPARATION. IF UNABLE TO PERFORM THE PYROTECHNIC SEPARATION (FOURTH FAILURE) THEN PERFORM EVA TO REMOVE 96 BOLTS 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: HOURS

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: HOURS

TIME REQUIRED TO IMPLEMENT CORRECTIVE ACTION LESS THAN TIME TO EFFECT?

YES

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PRINT DATE: 15.12.96

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL FAILURE MODE  
NUMBER: M5-6SS-8025-01

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:  
CREW WOULD HAVE SUFFICIENT TIME TO PERFORM IFM OR EVA TO REMOVE 96 BOLTS.

HAZARDS REPORT NUMBER(S) : ORBI 401A

HAZARD DESCRIPTION:  
INABILITY TO SEPARATE ORBITER AND ISS.

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- APPROVALS -

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PRODUCT ASSURANCE ENGR  
DESIGN ENGINEER

: M. NIKOLAYEVA  
: B. VAKULIN

