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	MC621-0067-1003 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 +LIIA +LII5 +LII8 AND THE POWER BUSES ARE +CIII1 AND +CIII2. THE PSU PROVIDES THE FOLLOWING OUTPUTS:

OUTPUT FUNCTIONS:

1) POWER BUS +CIII1: RING MOTOR M4, PACU MOTORS M6 & M8, FIXERS 1 & 2, AND HI-ENERGY (AND LOW-ENERGY FOR THE "SOFT" DOCKING MECHANISM) DAMPERS 1 & 2.
2) POWER BUS +CIII2: 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 +LIIA +LII5 +LII8 ARE PROTECTED BY PANEL A8A3 CIRCUIT BREAKERS AND PROVIDE POWER ~~PROVIDED UNFUSED~~ TO THE LACU, PACU-1, PACU-2, DSCU, AND THE DMCU.

PRINT DATE: 13.02.97

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: M5-6SS-B025- 02

REVISION# 0 FEBDEC, 1997

SUBSYSTEM NAME: E - DOCKING SYSTEM
LRU: MC621-0067-1003
ITEM NAME: POWER SWITCHING UNIT

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
LOSS OF ONE OF THREE LOGIC BUSES: +LUA +LUB +LUB

MISSION PHASE:
OO .ON-ORBIT

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

CAUSE:
MULTIPLE INTERNAL COMPONENT FAILURES

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

REDUNDANCY SCREEN
A) PASS
B) N/A
C) FAILS

PASS/FAIL RATIONALE:
A)

B)
N/A - AT LEAST TWO REMAINING PATHS ARE DETECTABLE IN FLIGHT.

C)
REDUNDANT FUNCTIONS ROUTED THROUGH THE SAME CONNECTOR.

METHOD OF FAULT DETECTION:
NONE

MASTER MEAS. LIST NUMBERS: NONE

- FAILURE EFFECTS -

(A) SUBSYSTEM:
DEGRADATION OF CAPABILITY TO PROVIDE LOGIC BUS POWER TO AVIONICS LRUs.

(B) INTERFACING SUBSYSTEM(S):
LOSS OF CAPABILITY TO OPEN ONE OF THREE CAPTURE LATCHES. DEGRADED LOGIC BUS REDUNDANCY.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: M5-6SS-B025- 02

(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 TWO FAILURES.
FIRST FAILURE (LOSS OF ONE OF THREE LOGIC BUSES) - NO EFFECT.
SECOND FAILURE (LOSS OF ONE OF TWO ASSOCIATED BUSES) - DISABLES CAPABILITY TO RETRACT THE RING AND OPEN THE CAPTURE LATCHES.

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

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

AFTER THE SECOND FAILURE, THE CREW WOULD PERFORM IFM TO DRIVE THE CAPTURE LATCHES OPEN. IF UNABLE TO PERFORM THE IFM (THIRD FAILURE) THEN CREW WOULD PERFORM THE IFM TO RETRACT RING SO THAT THEY CAN MANUALLY OPEN THE CAPTURE LATCHES. IF UNABLE TO RETRACT THE DOCKING RING (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.

-DISPOSITION RATIONALE-

(A) DESIGN:
REFER TO APPENDIX X4, ENERGIA HARDWARE.

(B) TEST:
REFER TO APPENDIX X4, ENERGIA HARDWARE.

PSU BUS CIRCUIT OPERATION IS VERIFIED DURING GROUND CHECKOUT. ANY TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:
REFER TO APPENDIX X4, ENERGIA HARDWARE.

(D) FAILURE HISTORY:
REFER TO APPENDIX X4, ENERGIA HARDWARE.

(E) OPERATIONAL USE:
AFTER SECOND FAILURE, IN-FLIGHT MAINTENANCE PROCEDURES DEVELOPED TO DRIVE THE CAPTURE LATCH MOTORS DIRECTLY FROM THE FEED-THROUGH CONNECTORS IN THE EXTERNAL AIRLOCK, USING THE ORBITER BREAKOUT BOX.

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FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: M5-6SS-B025- 02

AFTER THIRD FAILURE, IN-FLIGHT MAINTENANCE PROCEDURES DEVELOPED TO DRIVE THE RING MOTORS DIRECTLY FROM THE FEED-THROUGH CONNECTORS IN THE EXTERNAL AIRLOCK, USING THE ORBITER BREAKOUT BOX.

- APPROVALS -

PRODUCT ASSURANCE ENGR	:	M. NIKOLAYEVA	:
DESIGN ENGINEER	:	B. VAKULIN	:
NASA SS/MA	:		:
NASA SUBSYSTEM MANAGER	:		:
JSC MOD			:
NASA EPDC SSMA	:		:
NASA EPDC SUBSYSTEM MANAGER	:		: