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**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE**

NUMBER: M5-6SS-B026-X

**SUBSYSTEM NAME: E - DOCKING SYSTEM**

REVISION: 0 FEBDEC. 19976

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	<b>PART NAME VENDOR NAME</b>	<b>PART NUMBER VENDOR NUMBER</b>
LRU	: DSCU RSC-E	MC621-0087-1002 33Y.5212.005

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**PART DATA**

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

LINE REPLACEABLE UNIT (LRU) DSCU - DOCKING SYSTEM CONTROL UNIT.

REFERENCE DESIGNATORS: 45V53A2A2

QUANTITY OF LIKE ITEMS: 1

(ONE)

**FUNCTION:**

THE DSCU IS USED TO IMPLEMENT THE AUTOMATED DOCKING SEQUENCE AND TO RECEIVE AND PROCESS THE COMMANDS FROM THE APDS CONTROL PANEL. THE UNIT PROVIDES TELEMETRY TO THE DCU<sub>s</sub> AND STATUS INDICATION TO THE APDS CONTROL PANEL.

**OUTPUT FUNCTIONS:**

1. PROVIDES HI-ENERGY DAMPERS POWER AND CONTROL FOR THE -HARD-DOCKING MECHANISM.
2. PROVIDES HI-ENERGY AND LOW-ENERGY DAMPERS POWER AND CONTROL (FOR THE "SOFT" DOCKING MECHANISM).
3. PROVIDES CONTROL FOR DOCKING RING EXTENSION AND RETRACTION.
4. PROVIDES FIXERS POWER AND CONTROL.
5. PROVIDES HOOKS OPENING AND CLOSING CONTROL.
6. PROVIDES CAPTURE LATCHES OPENING AND CLOSING CONTROL.
7. PROVIDES TELEMETRY TO THE DCU<sub>s</sub> AND STATUS INDICATION TO THE APDS PANEL.
8. PROVIDES LOW LEVEL AXIAL SLIP CLUTCH LOCKING DEVICE POWER AND CONTROL (FOR THE "SOFT" DOCKING MECHANISM).

FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE  
NUMBER: M5-6SS-8028-07

REVISION# 0 FEBDEC, 19976

SUBSYSTEM NAME: E - DOCKING SYSTEM  
LRU: MC621-0087-1002  
ITEM NAME: DSCU

CRITICALITY OF THIS  
FAILURE MODE: 1R3

FAILURE MODE:  
LOSS OF HOOKS OPEN ACTIVATION SIGNAL (ONE OF THREE)

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) PASS

PASS/FAIL RATIONALE:  
A)

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

C)

METHOD OF FAULT DETECTION:  
NONE.

MASTER MEAS. LIST NUMBERS: NONE

CORRECTING ACTION:  
WORKAROUNDS ARE AVAILABLE TO SEPARATE THE ORBITER FROM ISS:  
1) IFM TO DRIVE HOOKS OPEN;  
2) INITIATION OF PYROBOLT SEPARATION;  
3) PERFORM EVA TO REMOVE 96 BOLTS FROM THE DOCKING BASE.

- FAILURE EFFECTS -

(A) SUBSYSTEM:  
DEGRADATION OF REDUNDANCY FOR HOOKS OPEN ACTIVATION COMMAND.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE  
NUMBER: M5-6SS-802B-07**

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

LOSS OF ONE OF THREE HOOKS OPEN CONTROL SIGNALS TO THE PACU.

**(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 CONTROL SIGNAL FOR THE HOOKS. DEGRADED CONTROL SIGNAL REDUNDANCY. 2) LOSS OF ONE OF TWO REMAINING ASSOCIATED SIGNALS. LOSS OF NOMINAL 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: MINUTES**

**TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: HOURS**

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

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

FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE  
NUMBER: M5-6SS-B026-07

HAZARDS REPORT NUMBER(S) : ORBI 401A

HAZARD DESCRIPTION:  
INABILITY TO SEPARATE ORBITER AND ISS.

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- APPROVALS -

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