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PRINT DATE: 13.02.97

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE  
NUMBER: M5-6SS-B026-X

SUBSYSTEM NAME: E - DOCKING SYSTEM

REVISION: 0 FEBDEC. 19976

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	DSCU RSC-E	MC621-0087-1002 33Y.5212.005

**PART DATA**

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) - CIL FAILURE MODE

NUMBER: M5-6SS-B028-24A

REVISION# 0 FEBDEC, 19976

SUBSYSTEM NAME: E - DOCKING SYSTEM

LRU: MC621-0087-1002

ITEM NAME: DSCU

CRITICALITY OF THIS

FAILURE MODE: 2R3

## FAILURE MODE:

~~LOSS INADVERTENT ACTIVATION OF ONE OF THREE CONTROL SIGNALS FOR ACTIVATION OF LOW LEVEL THE SLIP CLUTCH LOCKING DEVICE TO THE -HARD- POSITION.~~

## MISSION PHASE:

OO ON-ORBIT

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

## CAUSE:

MULTIPLE INTERNAL COMPONENT FAILURES

CRITICALITY 1R1 DURING INTACT ABORT ONLY? NO

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

## REDUNDANCY SCREEN

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

## PASS/FAIL RATIONALE:

A)

B)

~~N/A - AT LEAST ONE REMAINING PATH IS DETECTABLE IN FLIGHT INADVERTENT ACTIVATION OF ONE LOCKING DEVICE COMMAND SIGNAL IS "MASKED" BY REDUNDANT SIGNALS.~~

C)

REDUNDANT FUNCTIONS ROUTED THROUGH THE SAME CONNECTOR.

## METHOD OF FAULT DETECTION:

NONE.

MASTER MEAS. LIST NUMBERS: NONE

## CORRECTING ACTION:

NONE

## REMARKS/RECOMMENDATIONS:

~~LOCKING DEVICE DE-ACTIVATES THE LOW LEVEL SLIP CLUTCH DURING MATING AND CLOSING OF THE HOOKS. THE LOW LEVEL CLUTCH WILL SLIP WHEN COMPRESSION~~

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

NUMBER: M5-6SS-B028-24A

~~LOADS ARE GREATER THEN 300 +/- 50 KG, THE LOCKING DEVICE ACTIVATES THE LOW LEVEL SLIP CLUTCH FOR THE -SOFT- DOCKING.~~

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- FAILURE EFFECTS -

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## A) SUBSYSTEM:

DEGRADATION OF REDUNDANCY WHICH ACTIVATES THE FOR LOCKING DEVICE, ACTIVATION.

## B) INTERFACING SUBSYSTEM(S):

FIRST FAILURE - NO EFFECT.

## C) MISSION:

FIRST FAILURE - NO EFFECT.

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

NO EFFECT.

## E) FUNCTIONAL CRITICALITY EFFECTS:

APPLIES TO SHUTTLE "SOFT" MECHANISM: POSSIBLE LOSS OF MISSION AFTER TWO FAILURES.

1) LOSS -INADVERTENT ACTIVATION OF ONE OF THREE CONTROL SIGNALS FOR DOCKING DEVICE TO THE -HARD- POSITION. DEGRADED REDUNDANCY. 2) LOSS -INADVERTENT ACTIVATION ONE OF TWO REMAINING ASSOCIATED CONTROL SIGNALS, RESULTING IN ACTIVATION LOCKING DEVICE- SLIP CLUTCH CANNOT BE ACTIVATED. THE LOW LEVEL SLIP CLUTCH IS DESIGNED TO SLIP WHEN COMPRESSION LOADS ARE GREATER THEN 300 +/- 50KG, LOCKED INTO MECHANISM CHAIN. COMPRESSION LOADS DURING MATING ARE LIMITED TO 300 +/- 50 KG. WORST CASE, UNABLE TO CLOSE HOOKS TO SEAL THE INTERFACE.

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

## G) RATIONALE FOR CRITICALITY CATEGORY DOWNGRADE:

1A) ALTHOUGH THE CRITICALITY REMAINS UNCHANGED AFTER WORKAROUNDS CONSIDERATION (ALLOWED PER CR S050107W). THEY ARE PROVIDING ADDITIONAL ULT TOLERANCE TO THE SYSTEM.

AFTER THE SECOND FAILURE, CREW COULD PERFORM AN IN-FLIGHT MAINTENANCE TO MOVE THE SLIP CLUTCH MOTORS (TO THE -HARD- POSITION) DIRECTLY FROM THE BRED-THROUGH CONNECTORS IN THE EXTERNAL AIRLOCK USING THE ORBITER BREAKOUT BOX. IF UNABLE TO PERFORM THE IFM (THIRD FAILURE), LOSS OF ABILITY TO CLOSE HOOKS TO SEAL INTERFACE RESULTS IN LOSS OF MISSION OBJECTIVES.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE  
 NUMBER: M5-6SS-8028-24A

-DISPOSITION RATIONALE-

(A) DESIGN:  
 REFER TO APPENDIX X7, ENERGIA HARDWARE.

(B) TEST:  
 REFER TO APPENDIX X7, ENERGIA HARDWARE.

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

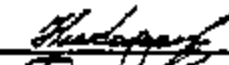



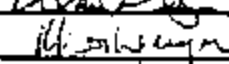
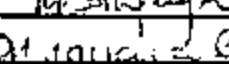
(C) INSPECTION:  
 REFER TO APPENDIX X7, ENERGIA HARDWARE.

(D) FAILURE HISTORY:  
 REFER TO APPENDIX X7, ENERGIA HARDWARE.

(E) OPERATIONAL USE:  
 NONE

AFTER SECOND FAILURE, CREW COULD PERFORM AN IN-FLIGHT MAINTENANCE TO DRIVE THE SLIP CLUTCH MOTORS (TO THE -HARD- POSITION) 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 SSMA	:		:	
NASA SUBSYSTEM MANAGER	:		:	
JSC MOD	:		:	
NASA EPDC SSMA	:		:	
NASA EPDC SUBSYSTEM MANAGER	:		:	