

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE

NUMBER: M5-6SS-B024-X

SUBSYSTEM NAME: E - DOCKING SYSTEM

REVISION: 0 DEC. 1996

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: DMCU RSC-E	MC621-0087-0005 33Y.5212.011

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

LINE REPLACEABLE UNIT (LRU) DOCKING MECHANISM CONTROL UNIT (DMCU) -
DOCKING RING MOTORS (M4/M5) LOGIC AND POWER CONTROL

REFERENCE DESIGNATORS: 45V53A1A4

QUANTITY OF LIKE ITEMS: 1

(ONE)

FUNCTION:

THE DMCU IS DESIGNED TO RECEIVE COMMANDS FROM THE DOCKING SYSTEM CONTROL UNIT (DSCU.) IT IMPLEMENTS DOCKING RING CONTROL DURING THE AUTOMATIC AND THE PANEL CONTROLLED OPERATIONAL MODES. THE UNIT CONTROLS THE TWO DOCKING MECHANISM (RING) ELECTROMOTORS. THE UNIT RECEIVES THE FOLLOWING COMMANDS FROM THE CONTROL PANEL THROUGH THE DSCU: 1) RING RETRACT, 2) STOP RING RETRACTION, 3) RING EXTEND, AND 4) STOP RING EXTENSION. THE UNIT PROVIDES ONE TELEMETRY SIGNAL TO THE DATA COLLECTION UNITS (DCUs) FOR MONITORING THE RING MOTOR ACTUATION.

OUTPUT FUNCTIONS:

- 1) MOTOR CONTROL \pm 27 V RING DEPLOY/RETRACT POWER FOR M4/M5 MOTORS (TWO POSITIVE AND TWO NEGATIVE POWER OUTPUTS PER MOTOR.)
- 2) TELEMETRY INFORMATION (ONE DISCRETE) TO THE DCU-1.

PAGE: 2

PRINT DATE: 14.12.96

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: MS-6SS-B024-01**

REVISION# 0 DEC, 1996

**SUBSYSTEM NAME: E - DOCKING SYSTEM
LRU: MC621-0087-0005
ITEM NAME: DMCU**

**CRITICALITY OF THIS
FAILURE MODE: 2R3**

**FAILURE MODE:
LOSS OF M4/M5 MOTOR CONTROL SIGNAL (ONE OF THREE) FOR RING EXTENSION OR
RETRACT.**

**MISSION PHASE:
OO ON-ORBIT**

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

**CAUSE:
INTERNAL COMPONENT FAILURE(S)**

CRITICALITY 1R1 DURING INTACT ABORT ONLY? NO

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

**REDUNDANCY SCREEN A) PASS
B) N/A
C) FAIL**

**PASS/FAIL RATIONALE:
A)**

**B)
N/A - AT LEAST ONE REMAINING PATH IS DETECTABLE IN FLIGHT.**

**C)
REDUNDANT FUNCTIONS ROUTED THROUGH THE SAME CONNECTOR.**

**METHOD OF FAULT DETECTION:
RING WOULD STOP AFTER SECOND FAILURE.**

MASTER MEAS. LIST NUMBERS: NONE

- FAILURE EFFECTS -

**(A) SUBSYSTEM:
DEGRADATION OF REDUNDANCY FOR CONTROLLING RING DRIVE MOTORS.**

**(B) INTERFACING SUBSYSTEM(S):
NO EFFECT.**

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: M5-GSSMR-B024-01**

(C) MISSION:
FIRST FAILURE - NO EFFECT.

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:
SHUTTLE OR PMA1 MECHANISM CONTROL: POSSIBLE LOSS OF MISSION AFTER TWO FAILURES.
FIRST FAILURE (LOSS OF ONE OF THREE INTERNAL CONTROL SIGNALS OF RING DRIVE LOGIC CIRCUIT) - DEGRADED RING DRIVE CONTROL REDUNDANCY.
SECOND FAILURE (LOSS OF SECOND ASSOCIATED INTERNAL CONTROL SIGNAL) - LOSS OF ALL RING CONTROL RESULTING IN LOSS OF CAPABILITY TO PERFORM DOCKING. LOSS OF MISSION OBJECTIVES WITH INABILITY TO PERFORM DOCKING.

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 SECOND FAILURE, CREW COULD PERFORM AN IN-FLIGHT MAINTENANCE TO DRIVE THE RING MOTORS DIRECTLY FROM THE FEED-THROUGH CONNECTORS IN THE EXTERNAL AIRLOCK, USING THE ORBITER BREAKOUT BOX. IF UNABLE TO PERFORM IFM (THIRD FAILURE), LOSS OF MISSION OBJECTIVES DUE TO INABILITY TO PERFORM DOCKING.

-DISPOSITION RATIONALE-

(A) DESIGN:
REFER TO APPENDIX X3, ENERGIA HARDWARE.

(B) TEST:
REFER TO APPENDIX X3, ENERGIA HARDWARE.

RING DEPLOYMENT CONTROL OPERATION IS VERIFIED DURING GROUND CHECKOUT. ANY TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

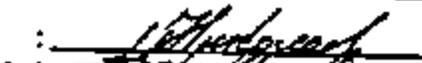
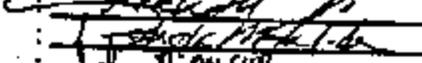
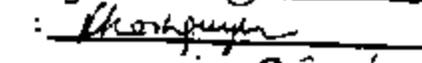
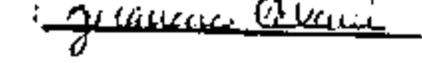
(C) INSPECTION:
REFER TO APPENDIX X3, ENERGIA HARDWARE.

(D) FAILURE HISTORY:
REFER TO APPENDIX X3, ENERGIA HARDWARE.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE
NUMBER: M5-6SSMR-8024-01

(E) OPERATIONAL USE:
AFTER SECOND FAILURE, CREW COULD PERFORM AN IN-FLIGHT MAINTENANCE 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 SSMA	:		:	
NASA SUBSYSTEM MANAGER	:		:	
JSC MOD	:		:	
NASA EPDC SSMA	:		:	
NASA EPDC SUBSYSTEM MANAGER	:		:	