FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL HARDWARE
NUMBER: M5-6MR-B024-X

SUBSYSTEM NAME: ORBITER DOCKING SYSTEM

REVISION: 1 SEPT 1, 1995

		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: 40V53A1A3

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 ± 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.

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: M5-6MR-B024- 82

REVISION# 1 SEPT 1, 1995

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

CRITICALITY OF THIS FAILURE MODE: 2R3

FAILURE MODE:
INADVERTENT ACTIVATION OF ONE OF THREE "RING EXTEND/RETRACT" CONTROL SIGNALS.

MISSION PHASE:
OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 104 ATLANTIS

CAUSE:
INTERNAL COMPONENT FAILURE(S)

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

REDUNDANCY SCREEN
A) ~~FAILS~~ PASS
B) FAILS
C) PASS

PASS/FAIL RATIONALE:
A)
~~FIRST FAILURE MASKED BY SERIES REDUNDANCY~~
B)
SINGLE RELAY FAILURE NOT DETECTABLE.
C)

METHOD OF FAULT DETECTION:
RING WOULD ~~STOP~~ START AFTER SECOND FAILURE. WHILE SYSTEM IS POWERED UP.

MASTER MEAS. LIST NUMBERS: NONE

- FAILURE EFFECTS -

(A) SUBSYSTEM:
DEGRADATION OF REDUNDANCY AGAINST INADVERTENT RING EXTEND OR RETRACT OUTPUT.

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

(C) MISSION:
FIRST FAILURE - NO EFFECT.

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: M5-6MR-B024- 02

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
FIRST FAILURE (INADVERTENT ACTIVATION OF ONE OF THREE INTERNAL CONTROL SIGNALS OF RING DRIVE LOGIC CIRCUIT) - DEGRADED REDUNDANCY AGAINST INADVERTENT RING MOVEMENT.
SECOND FAILURE (INADVERTENT ACTIVATION OF SECOND 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): 2R3

(F) RATIONALE FOR CRITICALITY CATEGORY DOWNGRADE:
N/A ~~(THERE ARE NO WORKAROUNDS TO CIRCUMVENT THIS FAILURE.)~~ e

-DISPOSITION RATIONALE-

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

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

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

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

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

(E) OPERATIONAL USE:
~~NONE~~ e

- APPROVALS -

PRODUCT ASSURANCE ENGR	: M. NIKOLAYEVA	:	
DESIGN ENGINEER	: B. VAKULIN	:	
NASA SS/MA	:	:	9/21/95
NASA SUBSYSTEM MANAGER	:	:	9/22/95
NASA EPD&C SUBSYSTEM MANAGER:			9/21/95

After third failure, crew would 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. However, worst case, crew would abort docking since this workaround requires a great deal of time to perform.