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PRINT DATE: 15.12.96

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL HARDWARE
NUMBER: M5-6SS-8027-X**

SUBSYSTEM NAME: E - DOCKING SYSTEM

REVISION: 0 DEC. 1996

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	PACU RECE	MC621-0087-0007 33Y.5212.006

PART DATA

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
LINE REPLACEABLE UNIT (LRU) PRESSURIZATION ACTUATION CONTROL UNIT (PACU) -
HOOKS MOTORS LOGIC AND POWER CONTROL**

**REFERENCE DESIGNATORS: 45V53A2A1
45V53A2A3**

**QUANTITY OF LIKE ITEMS: 2
(TWO)**

FUNCTION:

**PROVIDE HOOKS DRIVE MOTOR CONTROL FOR INTERFACE PRESSURIZATION USING
COMMANDS FROM THE DSCU DURING THE AUTOMATIC SEQUENCE OR IN THE MANUAL
CONTROL MODE.**

OUTPUT FUNCTIONS:

- 1) PACU-1: PROVIDE POWER TO THE HOOKS #1 MOTORS M6 & M7.**
- 2) PACU-1: PROVIDE AUTOMATIC CONTROL FEEDBACK SIGNALS TO DSCU.**
- 3) PACU-1: PROVIDE HOOKS POSITION SIGNAL FOR TELEMETRY AND PANEL
INDICATION.**
- 4) PACU-2: PROVIDE POWER TO THE HOOKS #2 MOTORS M8 & M9.**
- 5) PACU-2: PROVIDE AUTOMATIC CONTROL FEEDBACK SIGNALS TO DSCU.**
- 6) PACU-2: PROVIDE HOOKS POSITION SIGNAL FOR TELEMETRY AND PANEL
INDICATION.**

FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE
NUMBER: M5-6SS-B027-04

REVISION# 0 FEBDEC, 19976

SUBSYSTEM NAME: E - DOCKING SYSTEM
 LRU: MCG21-0087-0007
 ITEM NAME: PACU

CRITICALITY OF THIS
 FAILURE MODE: 1R3

FAILURE MODE:
INADVERTENT ACTIVATION OF ONE OF THREE AUTOMATIC CONTROL SIGNALS TO THE DSCU TO INITIATE AUTOMATIC RING OUT AND CAPTURE LATCHES OPEN.

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:

AFTER THE THIRD FAILURE (AFTER THE SIXTH FAILURE - FOR THE -SOFT- MECHANISM), CREW WOULD PERFORM A PANEL A8A3 POWER CYCLE TO TERMINATE INADVERTENT ACTIVATION AND FIRE RCS JETS AVOID COLLISION BETWEEN THE ORBITER AND ISS.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

DEGRADATION OF REDUNDANCY AGAINST INADVERTENT CONTROL SIGNAL ACTIVATION.

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

NUMBER: MS-655-B027-04

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT.

(C) MISSION:

NO EFFECT.

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

FIRST FAILURE - NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:

WORST CASE, SHUTTLE -HARD- MECHANISM CONTROL: POSSIBLE LOSS OF CREW OR VEHICLE AFTER THREE FAILURES.

1. 2) TWO INTERNAL SWITCHING COMPONENTS FAIL CLOSED, INADVERTENT ACTIVATION OF TWO OF THREE AUTOMATIC CONTROL SIGNALS TO THE DSCU.

3) SINGLE ASSOCIATED HOOKS CLOSED SENSOR FAILS CLOSED RESULTING IN INADVERTENT CAPTURE LATCH RELEASE, POSSIBLE VEHICLE COLLISION DUE TO LATCH RELEASE DURING DYNAMIC OPERATIONS.

WORST CASE, SHUTTLE -SOFT- MECHANISM CONTROL: POSSIBLE LOSS OF CREW OR VEHICLE AFTER SIX FAILURES.

1. 2) TWO INTERNAL SWITCHING COMPONENTS FAIL CLOSED IN PACU1(2), INADVERTENT ACTIVATION OF TWO OF THREE AUTOMATIC CONTROL SIGNALS TO THE DSCU.

3) SINGLE ASSOCIATED HOOKS 1(2) CLOSED SENSOR FAILS CLOSED IN PACU1(2).

4. 5) TWO INTERNAL SWITCHING COMPONENTS FAIL CLOSED IN PACU2(1), INADVERTENT ACTIVATION OF TWO OF THREE AUTOMATIC CONTROL SIGNALS TO THE DSCU.

6) SINGLE ASSOCIATED HOOKS 2(1) CLOSED SENSOR FAILS CLOSED IN PACU2(1).

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 THIRD FAILURE (AFTER THE SIXTH FAILURE - FOR THE -SOFT- MECHANISM), THE CREW WOULD PERFORM A PANEL ABAT POWER CYCLE TO TERMINATE INADVERTENT ACTIVATION. IF A POWER OFF WAS NOT PERFORMED WITHIN 10 SECONDS OF CRITICAL EFFECT, THE CREW WOULD FIRE RCS JETS TO ENABLE THEREBY CIRCUMVENT THE WORST CASE "DESIGN CRITICALITY" EFFECT. IF UNABLE TO PERFORM THE WORKAROUND (FOURTH FAILURE) (SEVENTH FAILURE - FOR THE -SOFT- MECHANISM), POSSIBLE LOSS OF CREW/VEHICLE DUE TO AN INADVERTENT COLLISION BETWEEN THE ORBITER AND ISS.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: MINUTES

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL FAILURE MODE
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TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: HOURS

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

**RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
CREW WOULD HAVE SUFFICIENT TIME TO PERFORM A PANEL A2A3 POWER CYCLE
AND RCS JET FIRING.**

HAZARDS REPORT NUMBER(S) : ORBI 4028

**HAZARD DESCRIPTION:
UNCONTROLLED/NADVERTENT COLLISION BETWEEN ORBITER AND ISS.**

- APPROVALS -

**PRODUCT ASSURANCE ENGR : M. NIKOLAYEVA
DESIGN ENGINEER : B. VAKULIN**

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