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PRINT DATE: 03.12.96

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

NUMBER: M5-6SS-8002-X

SUBSYSTEM NAME: E - DOCKING SYSTEM

REVISION: 0 DEC. 1996

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	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: ENERGIA POWER PANEL RSC-E	MC621-0087-0009 SLYU.4683 12.001
SRU	: PUSH BUTTON SWITCH	PKZ-8 (AGO.360.212.TU)

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**PART DATA**

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**  
PUSH-BUTTON SWITCHES (TWO DOUBLE POLE SWITCHES UNDER A SINGLE COVER CAP.) TWO POLE, MOMENTARY - APDS "POWER-ON" COMMAND.

REFERENCE DESIGNATORS: 36V73ABA3SB1-81  
36V73ABA3SB1-82

QUANTITY OF LIKE ITEMS: 2  
(TWO)

**FUNCTION:**  
PROVIDE THE "TURN-ON" COMMAND TO THE POWER SWITCHING UNIT (PSU.) THE PSU PROVIDES THE LOGIC BUSES TO THE DSCU, DMCU, FACU, AND THE LACU. THESE LOGIC BUSES ARE REQUIRED TO IMPLEMENT ALL DOCKING AND UNDOCKING OPERATIONS.

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

NUMBER: M5-6SS-8002-01

REVISION# 0 FEBDEC, 19976

SUBSYSTEM NAME: E - DOCKING SYSTEM

LRU: MC621-0087-0009

ITEM NAME: PUSH BUTTON SWITCH

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:

FAILS OPEN (MULTIPLE CONTACTS WITHIN ONE SWITCH)

MISSION PHASE:

OO ON-ORBIT

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

CAUSE:

A) PIECE PART STRUCTURAL FAILURE, B) CONTAMINATION, C) VIBRATION, D) MECHANICAL SHOCK, E) PROCESSING ANOMALY, F) THERMAL STRESS

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.

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- FAILURE EFFECTS -

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(A) SUBSYSTEM:  
PARTIAL LOSS OF SWITCH CONTROL CAPABILITY FOR THE APDS "POWER-ON"  
COMMAND.

(B) INTERFACING SUBSYSTEM(S):  
FIRST FAILURE - NO EFFECT. LOSS OF COMMAND REDUNDANCY.

(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) ONE OF TWO ASSOCIATED SWITCHES FAILS OPEN. DISABLES ONE OF THREE PANEL  
COMMAND SIGNALS. NO EFFECT. 2) FAILURE OF ASSOCIATED SWITCH DISABLES  
REMAINING TWO PANEL COMMAND CHANNEL INPUTS TO THE PSU. LOSS OF NOMINAL  
UNDOCKING CAPABILITY. 3) ONE PYROBOLT FAILS TO INITIATE RESULTING IN LOSS OF  
CAPABILITY TO IMPLEMENT PYROTECHNIC SEPARATION. LOSS OF NOMINAL AND  
PYROTECHNIC SEPARATION CAPABILITY.

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 86 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?  
YES

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FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE  
NUMBER: M5-6SS-B002-01

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:  
CREW WOULD HAVE SUFFICIENT TIME TO USE OR PERFORM EVA.

HAZARDS REPORT NUMBER(S) : ORBI 401A

HAZARD DESCRIPTION:  
INABILITY TO SEPARATE ORBITER AND ISS.


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- APPROVALS -

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PRODUCT ASSURANCE ENGR  
DESIGN ENGINEER

: M. NIKOLAYEVA  
: B. VAKULIN

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