

FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL HARDWARE
NUMBER: M5-6SS-B031-X

SUBSYSTEM NAME: E - DOCKING SYSTEM

REVISION: 0 FEBDEC, 1987

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: CONNECTOR SWITCHING BOX (CSB)	SLYU.642522.001

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
CONNECTOR SWITCHING BOX (CSB) - ELECTROMECHANICAL INSTRUMENT

REFERENCE DESIGNATORS: 40V53A4

QUANTITY OF LIKE ITEMS: 1
ONE

FUNCTION:

THE CONNECTOR SWITCHING BOX IS AN ELECTROMECHANICAL INSTRUMENT WHICH:
 1) - SWITCHES TWO PAIRS OF KLEN-TYPE CONNECTORS VIA AN ELECTRIC OR MANUAL DRIVE. THE ELECTRIC DRIVE HAS TWO ELECTRIC MOTORS ONE OF WHICH IS STANDBY. ONE SWITCHING UNIT PROVIDES OPERATION OF ONE OF TWO ELECTRIC MOTORS;
 2) - PASSES THROUGH ITSELF CONTROL CIRCUITS (AS PASSIVE ELEMENT)

INPUT/OUTPUT FUNCTIONS:

ONE INPUT (8 CONNECTORS)
 TWO OUTPUTS (8 CONNECTORS FOR EACH OUTPUT EVERYONE)
 SWITCHING OF 254 CIRCUITS, OF WHICH: 86 CIRCUITS - TM, 168
 CIRCUITS ARE FUNCTIONAL
 THE TM DATA ENTERS "SHUTTLE" PANEL

ALL DOCKING MECHANISM FUNCTIONS EXCEPT FOR PYRO SEPARATION ARE TRANSFERRED BY THE CONNECTOR SWITCHING BOX.

NOTE: CSB FMEA IS ONLY APPLICABLE FOR MISSIONS REQUIRING TRANSFER OF ELECTRICAL FUNCTIONS BETWEEN THE ODS DOCKING MECHANISM AND SOME OTHER MECHANISM (I.E. PMA1). IF THE SHUTTLE IS EQUIPPED WITH THE "SOFT" DOCKING ASSEMBLY, THE USE OF THE CONNECTOR SWITCHING BOX IS NOT PLANNED.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-OIL FAILURE MODE
NUMBER: M5-6SS-B031-01

REVISION# 0 FEBDEC, 1997c

SUBSYSTEM NAME: E - DOCKING SYSTEM
LRU: CONNECTOR SWITCHING BOX
ITEM NAME: CONNECTOR SWITCHING BOX

CRITICALITY OF THIS
FAILURE MODE: 1R3

FAILURE MODE:
LOSS OF ONE MOTOR OF THE SWITCHING MECHANISM

MISSION PHASE:
OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR (APPLIES ONLY WHEN THE
CSE IS INSTALLED)

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) PASS
 C) PASS

PASS/FAIL RATIONALE:
A)
B)
C)

METHOD OF FAULT DETECTION:
INFORMATION ABOUT INITIAL AND FINAL POSITION OF THE SWITCHING BOX MECHANISM IS GOING TO THE "SHUTTLE" TM AND TO THE "SHUTTLE" PANEL; INFORMATION ABOUT MATING OF THE CONNECTORS IS GOING TO THE "SHUTTLE" TM.

MASTER MEAS. LIST NUMBERS: P27X9001Y - CONNECTOR MATE XP1 IND
 P27X9002Y - CONNECTOR MATE XP2 IND
 P27X9003Y - CONNECTOR MATE XP3 IND
 P27X9004Y - CONNECTOR MATE XP4 IND
 P27X9005Y - ODM POSITION
 P27X9006Y - PMA1 POSITION

CORRECTING ACTION:
1) PERFORM EVA TO MANUALLY SWITCH CONNECTORS;
2) INITIATION OF PYROBOLT SEPARATION;

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~~AFTER THIRD FAILURE, CREW WOULD PERFORM EVA TO MANUALLY SWITCH CONNECTORS OR REMOVE 96 BOLTS FROM THE DOCKING BASE TO SEPARATE THE RBITER FROM ISS.~~

REMARKS/RECOMMENDATIONS:

NO REDUNDANT MOTORS ARE PROVIDED TO CONTROL SWITCHING OF CONNECTORS. ONLY ONE MOTOR IS ACTIVATED AT A TIME. THE OTHER MOTOR IS IN STANDBY REDUNDANCY. PYRO CONTROL IS NOT SWITCHED.

- FAILURE EFFECTS -

) SUBSYSTEM:

) EFFECT - LOSS OF MOTOR REDUNDANCY ONLY.

) INTERFACING SUBSYSTEM(S):

) GRADED CONNECTOR SWITCHING BOX CAPABILITY.

) MISSION:

) EFFECT ON MISSION.

) CREW, VEHICLE, AND ELEMENT(S):

) EFFECT FIRST FAILURE.

) FUNCTIONAL CRITICALITY EFFECTS:

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

FIRST FAILURE (ONE MOTOR FAILS TO FUNCTION) - NO EFFECT, LOSS OF REDUNDANCY ONLY.

SECOND FAILURE (SECOND MOTOR FAILS TO FUNCTION) - LOSS OF SWITCHING CAPABILITY RESULTING IN LOSS OF NOMINAL UNDOCKING CAPABILITY.

THIRD FAILURE (FAILURE WITHIN PYRO SUBSYSTEM) - LOSS OF CAPABILITY TO PREVENT PYRO-SEPARATION.

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

RATIONALE FOR CRITICALITY CATEGORY DOWNGRADE:

ALTHOUGH THE CRITICALITY REMAINS UNCHANGED AFTER WORKAROUNDS CONSIDERATION (ALLOWED PER CR 5050107W), THEY ARE PROVIDING ADDITIONAL MT TOLERANCE TO THE SYSTEM.

AFTER THE SECOND/THIRD FAILURE, THE CREW WOULD PERFORM EVA TO MANUALLY SWITCH CONNECTORS. IF UNABLE TO PERFORM THIS EVA (THIRD FAILURE), THEN LATE PYROBOLT SEPARATION, AFTER THE FOURTH FAILURE (FAILURE WITHIN PYRO SYSTEM), CREW WOULD PERFORM EVA TO OR REMOVE 96 BOLTS TO CIRCUMVENT WORST CASE "DESIGN CRITICALITY" EFFECT. IF UNABLE TO PERFORM EVA (FIFTH/FIFTH FAILURE), POSSIBLE LOSS OF CREW/VEHICLE DUE TO LOSS OF ALL UNDOCKING CAPABILITY.

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- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

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 EVA.

HAZARDS REPORT NUMBER(S) : ORBI 401A

HAZARD DESCRIPTION:
INABILITY TO SEPARATE ORBITER AND ISS.

- APPROVALS -

PRODUCT ASSURANCE ENGR.	:	M. NIKOLAYEVA	:	
DESIGN ENGINEER	:	P. TUKAVIN	:	
DESIGN ENGINEER	:	A. DONCHENKO	:	