PRINT DATE: 17.02.97

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

SUBSYSTEM NAME: E - DOCKING SYSTEM

REVISION: 0 FEBDEC, 1997G

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	CONNECTOR SWITCHING BOX (CSB)	SLIYU.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 STAND-BY. 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 TRANSFERED 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 (F.E. PMA1). IF THE SHUTTLE IS EQUIPPED WITH THE "SOFT" DOCKING ASSEMBLY, THE USE OF THE CONNECTOR SWITCHING BOX IS NOT PLANNED.

PRINT DATE: 17.02.97

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL FAILURE MODE
NUMBER: MS-6SS-B031- 03

REVISION# 0 FEBDEC, 19976

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

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
CONTINUOUS CYCLING BETWEEN CONNECTOR POSITIONS

MISSION PHASE:
OO ON-ORBIT

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

CAUSE:
CONTAMINATED POSITION INDICATION SENSOR, FEEDBACK CIRCUITRY FAILURE

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:
SWITCHING BOX MECHANISM POSITION AND CONNECTOR MATING INDICATION ANOMALY (BOTH ON STANDARD SWITCH PANEL AND IN TELEMETRY DATA).

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) REMOVE POWER TO CYCLING MOTOR;
2) INITIATION OF PYROBOLT SEPARATION;

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: MS-6SS-B031- 03

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

REMARKS/RECOMMENDATIONS:
POSITION SENSOR HAS REDUNDANT CONTACT SETS. NOMINALLY IT TAKES APPROXIMATELY 12 SECONDS TO CYCLE BETWEEN CONNECTOR POSITIONS. PYRO CONTROL IS NOT SWITCHED. FAILURE CANNOT OCCUR UNTIL AFTER NODE (PMA1) IS CONNECTED.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
DOCKING MECHANISM CONTROL IS ALTERNATELY SWITCHED BETWEEN UPPER AND LOWER DOCKING MECHANISMS.

(B) INTERFACING SUBSYSTEM(S):
INABILITY TO CONTROL THE ORBITER ~~EITHER~~ DOCKING MECHANISM USING NOMINAL OPERATIONS TO OPEN THE HOOKS FOR UNDOCKING.

(C) MISSION:
FIRST FAILURE - NO EFFECT, ~~FIRST FAILURE, POSSIBLE LOSS OF MISSION FOLLOWING THIRD FAILURE.~~

(D) CREW, VEHICLE, AND ELEMENT(S):
FIRST FAILURE - NO EFFECT, ~~FIRST FAILURE, FAILURE TO SEPARATE ORBITER FROM ISS FOLLOWING FOURTH FAILURE COULD RESULT IN LOSS OF CREW AND VEHICLE.~~

(E) FUNCTIONAL CRITICALITY EFFECTS:
WORST CASE. SHUTTLE MECHANISM CONTROL: POSSIBLE LOSS OF CREW OR VEHICLE AFTER MULTIPLE ~~THREE~~ FAILURES.
FIRST FAILURE (CONTINUOUSLY CYCLES BETWEEN CONNECTOR POSITIONS IN ONE CIRCUIT) ~~NO EFFECT.~~
SECOND FAILURE - LOSS OF ABILITY TO REMOVE POWER TO CYCLING MOTOR (REQUIRES MULTIPLE FAILURES) AFTER BERTHING/DOCKING - UNABLE TO PERFORM NOMINAL UNDOCKING. ~~(CONTINUOUSLY CYCLES BETWEEN CONNECTOR POSITIONS IN THE SECOND CIRCUIT) - DOCKING MECHANISM CONTROL IS UNOBTAINABLE ON EITHER DOCKING MECHANISM.~~
THIRD FAILURE (FAILURE WITHIN PYRO SUBSYSTEM) - LOSS OF CAPABILITY TO IMPLEMENT PYRO SEPARATION - LOSS OF ALL UNDOCKING 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 THIRD FAILURE, THE CREW WOULD PERFORM EVA TO ~~MANUALLY SWITCH CONNECTORS OR~~ REMOVE 96 BOLTS TO CIRCUMVENT THE WORST CASE "DESIGN CRITICALITY" EFFECT. IF UNABLE TO PERFORM EVA (FOURTH FAILURE), POSSIBLE LOSS OF CREW/VEHICLE DUE TO LOSS OF ALL UNDOCKING CAPABILITY.

PRINT DATE: 15.12.96

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M5-6SS-B031- 03

- 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	:	R. TUKAVIN	:
DESIGN ENGINEER	:	A. DONCHENKO	: