FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL HARDWARE
NUMBER: M8-1SS-BM028-X
(DOESN'T APPLY TO PMA2/3
PASSIVE MECHANISM)

SUBSYSTEM NAME: MECHANICAL - EDS

REVISION: 1 DEC, 1996

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	STRUCTURAL LATCH MECHANISM RSC-ENERGIA	33U.6365.010-07 ("SOFT") 33U.6365.010-08 (PMA1)
SRU	:	SENSOR RSC-ENERGIA	33U.5319.001-01 33U.5319.001-01

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
"READY TO HOOK" SENSOR

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 4
FOUR

FUNCTION:
FOUR SENSORS LOCATED AROUND THE FRAME (STRUCTURAL INTERFACE) OF THE DOCKING MECHANISM CONTAIN RODS THAT SENSE INITIAL CONTACT BETWEEN THE ORBITER/PMA1 AND ISS DOCKING MECHANISMS. EACH SENSOR SENDS REDUNDANT SIGNALS TO THE DSCU TO TURN ON THE STRUCTURAL LATCH ACTUATOR AND TO ILLUMINATE THE "READY TO HOOK" INDICATOR LIGHT ON THE DOCKING CONTROL PANEL WHEN THREE OF THE FOUR SENSORS ARE ACTIVATED. THIS SIGNAL IS ALSO DOWNLINKED FOR GROUND CREW MONITORING.

SERVICE IN BETWEEN FLIGHT AND MAINTENANCE CONTROL:
VISUAL INSPECTION, SERVICEABILITY CONTOL, DOCKING WITH CALIBRATING DOCKING MECHANISM.

MAINTAINABILITY
REPAIR METHOD - REPLACEMENT.

REFERENCE DOCUMENTS: 33U.5319.001-01
33U.6365.010-07 ("SOFT")
33U.6365.010-08 (PMA1)

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1SS-BM028- 03
(DOESN'T APPLY TO PMA2/3
PASSIVE MECHANISM)

REVISION# . 1 DEC, 1996

SUBSYSTEM NAME: MECHANICAL - EDS
LRU: STRUCTURAL LATCH MECHANISM
ITEM NAME: SENSOR, "READY TO HOOK"

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
ONE CONTACT SET SHORTS TO GROUND

MISSION PHASE:
OO ON-ORBIT

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

CAUSE:
CONTAMINATION, PIECE PART STRUCTURAL FAILURE DUE TO MECHANICAL/THERMAL SHOCK, VIBRATION, OR MANUFACTURER/MATERIAL DEFECT

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:
INSTRUMENTATION - FALSE "READY TO HOOK" INDICATION ON DOCKING CONTROL PANEL. VISUAL OBSERVATION - HOOKS WOULD BE CLOSED PREMATURELY.

MASTER MEAS. LIST NUMBERS: V53X0752E

CORRECTING ACTION: IF FIRST FAILURE OCCURS CREW COULD STOP AUTOMATIC SEQUENCE, RE-OPEN THE HOOKS, AND CONTINUE MANUAL DOCKING WITH THE APDS LOGIC BUS POWERED DOWN. IF SECOND FAILURE OCCURS DURING RING ATTENUATION, CREW COULD FIRE RCS JETS TO ENABLE SEPARATION (APPLIES ONLY TO THE ORBITER).

REMARKS/RECOMMENDATIONS:
"READY TO HOOK" SENSORS WORK ON A 3 OF 4 VOTING SCHEME.

- FAILURE EFFECTS -

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE NUMBER: M8-1SS-BM026- 03 (DOESN'T APPLY TO PMA2/3 PASSIVE MECHANISM)

(A) SUBSYSTEM:
INADVERTENT "READY TO HOOK" INDICATION TO DSCU. PREMATURE CLOSING OF STRUCTURAL HOOKS AND A FALSE "READY TO HOOK" INDICATION ON THE DOCKING CONTROL PANEL IF FAILURE OCCURS FOLLOWING CAPTURE.

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT ON INTERFACING ORBITER/PMA1 SUBSYSTEMS GIVEN THE FIRST FAILURE. HOWEVER, IF THIS FAILURE WERE TO OCCUR ALONG WITH A FAILS CLOSED CONDITION ON A SINGLE CONTACT SET OF ONE "HOOKS CLOSED" SENSOR, ALL THREE CAPTURE LATCHES WOULD INADVERTENTLY OPEN. AN INADVERTENT OPENING OF THE CAPTURE LATCHES DURING RING ATTENUATION COULD POTENTIALLY CAUSE ORBITER/PMA1 AND ISS TO COLLIDE RESULTING IN STRUCTURAL DAMAGE TO THE ORBITER/PMA1.

(C) MISSION:
LOSS OF DOCKING CAPABILITIES IF HOOKS ARE CLOSED PRIOR TO MATING THE INTERFACE.

(D) CREW, VEHICLE, AND ELEMENT(S):
POTENTIAL LOSS OF CREW AND VEHICLE IF A "FAILS CLOSED" CONDITION ON A SINGLE CONTACT SET OF ONE "HOOKS CLOSED" SENSOR ACCOMPANIES THIS FAILURE DURING RING ATTENUATION.

(E) FUNCTIONAL CRITICALITY EFFECTS:
FIRST FAILURE (ONE "READY TO HOOK" SENSOR CONTACT SET SHORTS TO GROUND) OCCURS AFTER CAPTURE - PREMATURE "READY TO HOOK" INDICATION ON DOCKING CONTROL PANEL AND INADVERTENT CLOSING OF STRUCTURAL HOOKS. IF THIS FAILURE OCCURS PRIOR TO THE RING REACHING THE PROPER "READY TO HOOK" POSITION, MATING OF ORBITER/PMA1 AND ISS (PMA2/FGB) DOCKING MECHANISMS WOULD BE IMPOSSIBLE RESULTING IN THE INABILITY TO STRUCTURALLY LATCH THE INTERFACE.
SECOND (SAFETY CRITICAL RELATED) FAILURE (FAILS CLOSED CONDITION ON A SINGLE CONTACT SET OF ONE "HOOKS CLOSED" SENSOR) ACCOMPANIES FIRST FAILURE DURING RING ATTENUATION - INADVERTENT OPENING OF ALL THREE CAPTURE LATCHES WOULD OCCUR 10 SECONDS FOLLOWING SECOND FAILURE, RESULTING IN POTENTIAL COLLISION BETWEEN ORBITER/PMA1 AND ISS.

DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)): 1R2

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
SECOND (MISSION CRITICAL RELATED) FAILURE (INABILITY TO DROP BUS OR MANUALLY CONTROL HOOKS) - INABILITY TO LATCH AND SEAL INTERFACE RESULTING IN LOSS OF DOCKING AND SUBSEQUENT LOSS OF MISSION OBJECTIVES.
THIRD (SAFETY CRITICAL RELATED) FAILURE - INABILITY TO FIRE RCS (APPLIES ONLY TO THE ORBITER) - CREW IS UNABLE TO STOP A POTENTIAL COLLISION BETWEEN ORBITER/PMA1 AND ISS. WORST CASE, DAMAGE RESULTING FROM COLLISION COULD RESULT IN LOSS OF CREW AND VEHICLE.

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1SS-BM026- 03
(DOESN'T APPLY TO PMA2/3
PASSIVE MECHANISM)

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: MINUTES TO HOURS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION:
SECONDS TO MINUTES

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

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
CREW HAS AMPLE TIME TO DROP APPROPRIATE BUS(S) AND MANUALLY CONTROL HOOKS TO CONTINUE DOCKING FOLLOWING FIRST FAILURE. CREW HAS AMPLE TIME TO FIRE RCS JETS (APPLIES ONLY TO THE ORBITER) TO AVOID A POTENTIAL COLLISON BETWEEN ORBITER/PMA1 AND ISS FOLLOWING SECOND FAILURE.

HAZARDS REPORT NUMBER(S): ORBI 402B

HAZARD(S) DESCRIPTION:
UNCONTROLLED/INADVERTENT COLLISON BETWEEN ORBITER/PMA1 AND ISS.

- APPROVALS -

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DESIGN ENGINEER	:	E. BOBROV	: