FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL HARDWARE
NUMBER: M8-1MR-BM026-X

SUBSYSTEM NAME: MECHANICAL - EDS

REVISION: 2 9/1/95

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	STRUCTURAL LATCH MECHANISM NPO-ENERGIA	33U.6365.010-05 33U.6365.010-05
SRU	:	SENSOR NPO-ENERGIA	33U.5319.011 33U.5319.011

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 AND MIR 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.5319.011
33U.6365.010-05

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1MR-BM026- 02

REVISION# 1 9/1/95

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 FAILS CLOSED

MISSION PHASE:
OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 104 ATLANTIS

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) 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 FOR FIRST AND SECOND FAILURE. FALSE "READY TO HOOK" INDICATION FOLLOWING SIMILAR FAILURE OF THIRD SENSOR. CREW COULD VISUALLY DETECT PREMATURE HOOK CLOSING AS THE RESULT OF THE THIRD SENSOR FAILURE.

MASTER MEAS. LIST NUMBERS: V53X0752E

CORRECTING ACTION: NONE. SINCE A FAILED CLOSED CONDITION IS REQUIRED ON THREE OF FOUR SENSORS TO INADVERTENTLY ISSUE A COMMAND FROM THE DSCU FOR AUTOMATIC HOOK CLOSING AND TO THE DOCKING CONTROL PANEL FOR ILLUMINATING THE "READY TO HOOK" INDICATOR LIGHT. A FAILURE OF ONE OR TWO SENSORS HAS NO EFFECT.

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

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL FAILURE MODE
NUMBER: M8-1MR-SM026- 02

- FAILURE EFFECTS -

(A) SUBSYSTEM:
INADVERTENT "READY TO HOOK" SIGNAL TO DSCU FROM A SINGLE SENSOR. NO EFFECT FIRST AND SECOND FAILURE. SIMILAR FAILURE OF THIRD SENSOR WILL RESULT IN PREMATURE CLOSING OF STRUCTURAL HOOKS AND A FALSE "READY TO HOOK" INDICATION ON THE DOCKING CONTROL PANEL.

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT ON INTERFACING ORBITER SUBSYSTEMS GIVEN THE FIRST THREE SENSOR FAILURES. HOWEVER, IF THESE FAILURES 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 AND MIR TO COLLIDE RESULTING IN STRUCTURAL DAMAGE TO THE ORBITER.

(C) MISSION:
NO EFFECT FIRST AND SECOND FAILURE. SIMILAR FAILURE OF THIRD SENSOR WILL PRECLUDE DOCKING CAPABILITIES IF HOOKS CLOSE PRIOR TO MATING THE INTERFACE.

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT FIRST THREE SENSOR FAILURES. POTENTIAL LOSS OF CREW AND VEHICLE IF A FAILS CLOSED CONDITION ON A SINGLE CONTACT SET OF ONE "HOOKS CLOSED" SENSOR ACCOMPANIES THESE FAILURES DURING RING ATTENUATION.

(E) FUNCTIONAL CRITICALITY EFFECTS:
FIRST SENSOR FAILURE - INADVERTENT "READY TO HOOK" SIGNAL TO DSCU FROM A SINGLE SENSOR.
SECOND SENSOR FAILURE - INADVERTENT "READY TO HOOK" SIGNAL TO DSCU FROM TWO SENSORS.
THIRD SENSOR FAILURE - PREMATURE "READY TO HOOK" INDICATION ON DOCKING CONTROL PANEL AND INADVERTENT CLOSING OF STRUCTURAL HOOKS. IF THE THIRD FAILURE OCCURS PRIOR TO DOCKING, MATING OF ORBITER AND MIR DOCKING MECHANISMS WOULD BE IMPOSSIBLE RESULTING IN THE INABILITY TO STRUCTURALLY LATCH THE INTERFACE. FAILURE TO LATCH AND SEAL THE INTERFACE WOULD PRECLUDE ORBITER/MIR DOCKING CAPABILITIES RESULTING IN LOSS OF MISSION OBJECTIVES. - CRITICALITY 2R3 CONDITION
FOURTH FAILURE (FAILS CLOSED CONDITION ON A SINGLE CONTACT SET OF ONE "HOOKS CLOSED" SENSOR) ACCOMPANIES FIRST THREE FAILURES DURING RING ATTENUATION - INADVERTENT OPENING OF ALL THREE CAPTURE LATCHES RESULTING IN POTENTIAL COLLISION BETWEEN ORBITER AND MIR.

DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)): 1R3

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
FIFTH FAILURE (INABILITY TO FIRE RCS) - CREW IS UNABLE TO STOP A POTENTIAL COLLISION BETWEEN ORBITER AND MIR. WORST CASE, DAMAGE RESULTING FROM COLLISION COULD RESULT IN LOSS OF CREW AND VEHICLE.

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1MR-BM025- 02

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: MINUTES

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: SECONDS

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 FIRE RCS JETS TO AVOID A POTENTIAL COLLISON BETWEEN ORBITER AND MIR.

HAZARDS REPORT NUMBER(S): ORBI 402A

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

- APPROVALS -

DESIGN ENGINEER	:	M. NIKOLAYEVA	:
DESIGN MANAGER	:	A. SOUBCHEV	: