FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER: M8-1MR-BM006-X

SUBSYSTEM NAME: MECHANICAL - EDS
REVISION: 2 9/1/95

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	GUIDE RING ASSEMBLY NPO-ENERGIA	33U.6271.011-05 33U.6271.011-05
SRU	:	ASSEMBLY, CAPTURE LATCH NPO-ENERGIA	33U.6322.025 33U.6322.025

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
CAPTURE LATCH ASSEMBLY

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 3
THREE (ONE PER GUIDE PEDAL)

FUNCTION:
THREE ACTIVE (CAPTURE) LATCHES, ONE ON EACH GUIDE PEDAL OF THE ORBITER DOCKING RING, PROVIDES POSITIVE CAPTURE TO THREE PASSIVE (BODY MOUNTED) LATCHES LOCATED ON THE MIR DOCKING MECHANISM. CAPTURE LATCH ROLLER MECHANISMS MOVE ASIDE DURING CLOSING CONTACT WITH THEIR OPPOSING BODY MOUNTED LATCHES AND ARE SPRING DRIVEN TO LOCK AFTER PASSING THE THREE PASSIVE BODY LATCHES (LUGS). TWO ROLLER MECHANISMS LOCATED ON EACH CAPTURE LATCH ASSEMBLY PROVIDE A REDUNDANT MEANS OF CAPTURE.

UPON RECEIPT OF A "CLOSE CAPTURE LATCH" COMMAND, POWER IS APPLIED THROUGH REDUNDANT "LATCH MOTOR OPEN" SENSOR CONTACT SETS TO A SINGLE ACTUATOR MOTOR TO EXTEND BOTH ROLLERS OF ONE CAPTURE LATCH ASSEMBLY. A "LATCH INDICATION CLOSED" SENSOR ON EACH ACTUATOR SENSES THE CLOSED POSITION OF THE LATCH AND SENDS REDUNDANT SIGNALS TO THE DOCKING CONTROL PANEL VIA THE DSCU TO ILLUMINATE THE "LATCHES CLOSED" LIGHT WHEN ALL THREE CAPTURE LATCHES ARE CLOSED.

UPON RECEIPT OF AN "OPEN CAPTURE LATCH" COMMAND (FOLLOWING COMPLETION OF THE DOCKING PROCESS), POWER IS APPLIED THROUGH REDUNDANT "LATCH MOTOR CLOSED" SENSOR CONTACT SETS TO A SINGLE ACTUATOR MOTOR TO RETRACT BOTH ROLLERS OF THE CAPTURE LATCH ASSEMBLY FOR UNDOCKING OF THE MIR AND ORBITER. A "LATCH INDICATION OPEN" SENSOR LOCATED ON EACH CAPTURE LATCH ACTUATOR SENSES THE OPEN POSITION OF THE LATCH AND SENDS REDUNDANT SIGNALS TO THE DSCU TO ILLUMINATE THE "LATCHES OPEN" INDICATOR LIGHT ON THE DOCKING CONTROL PANEL AND COMMAND RING TO RETRACT WHEN THE SENSOR ON ALL THREE CAPTURE LATCH ACTUATORS IS CLOSED.

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THE THIRD CONTACT SET OF EACH "LATCH INDICATION OPEN" AND "LATCH INDICATION CLOSED" SENSOR IS UTILIZED FOR GROUND MONITORING OF CAPTURE LATCH POSITION. CAPTURE LATCH "INITIAL POSITION" IS ALSO DOWNLINKED FOR GROUND MONITORING.

IN THE EVENT A CAPTURE LATCH FAILS TO OPEN, THE MANUAL LATCH/UNBLOCKING DEVICE CONTAINED BEHIND THE CAPTURE LATCH ASSEMBLY WILL PROVIDE MANUAL RELEASE OF THE LATCH. A BUTTON ON EACH SIDE OF THE DEVICE, WHEN DEPRESSED SIMULTANEOUSLY, WILL RELEASE LATCH CONTROL BY THE LATCH ACTUATOR, THUS ALLOWING BOTH CAPTURE LATCH ROLLERS TO RETRACT TO THEIR OPEN POSITION.

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

MAINTAINABILITY
REPAIR METHOD - REPLACEMENT.

REFERENCE DOCUMENTS: 33U.6322.025
33U.6271.011-05

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1MR-BM006-01

REVISION# 2 9/1/95

SUBSYSTEM NAME: MECHANICAL - EDS
LRU: GUIDE RING ASSEMBLY
ITEM NAME: ASSEMBLY, CAPTURE LATCH

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS TO OPEN

MISSION PHASE:
OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 104 ATLANTIS

CAUSE:
CAPTURE LATCH FAILURE - CONTAMINATION, MECHANICAL/THERMAL SHOCK, MANUFACTURE/MATERIAL DEFECT

ACTUATOR FAILS TO RETRACT - CONTAMINATION, MECHANICAL/THERMAL SHOCK, MANUFACTURE/MATERIAL DEFECT, MOTOR FAILURE
MANUAL LATCH/UNBLOCK DEVICE FAILS TO RELEASE CLOSED LATCH - CONTAMINATION, MECHANICAL/THERMAL SHOCK, MANUFACTURE/MATERIAL DEFECT

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? N/A

REDUNDANCY SCREEN
A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

METHOD OF FAULT DETECTION:
LOSS OF "LATCH OPEN" INDICATION ON THE DOCKING CONTROL PANEL. VISUAL OBSERVATION THROUGH ORBITER/MIR SEPARATION WOULD INDICATE A FAILURE OF ONE OR MORE CAPTURE LATCHES TO OPEN.

CORRECTING ACTION: IN THE EVENT A CAPTURE LATCH FAILS TO OPEN PRIOR TO SEPARATION, MANUAL RETRACTION OF THE LATCH IS POSSIBLE BY THE MANUAL LATCH/UNBLOCKING DEVICE. SEPARATION CAN BE POSSIBLE WITH A SINGLE CLOSED CAPTURE LATCH BY EXTENDING THE DOCKING RING. ALL CAPTURE LATCHES MUST BE OPEN TO ENSURE SEPARATION WHEN THE DOCKING RING IS IN IT'S FULLY RETRACTED POSITION. A FAILURE TO OPEN TWO OR MORE CAPTURE LATCHES WOULD REQUIRE CREW TO STRUCTURAL LATCH BOTH MECHANISMS AND PERFORM EVA TO REMOVE THE 96 BOLTS HOLDING THE DOCKING BASE TO THE EXTERNAL AIRLOCK. THIS WILL ALLOW ORBITER AND MIR TO SEPARATE.

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REMARKS/RECOMMENDATIONS:
ALL THREE CAPTURE LATCHES ARE OPENED (RETRACTED) PRIOR TO RETRACTING DOCKING RING TO IT'S FULLY RETRACTED POSITION FOLLOWING STRUCTURAL SEALING OF THE INTERFACE BETWEEN BOTH DOCKING MECHANISMS. FOLLOWING DEMATING OF BOTH MECHANISMS ALL THREE CAPTURE LATCHES MUST BE OPENED TO ACCOMPLISH SAFE SEPARATION WHEN RING IS IN ITS FULLY RETRACTED POSITION.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
BOTH ROLLERS ON ONE CAPTURE LATCH WILL NOT BE RETRACTED. NORMAL CAPTURE LATCH OPENING OPERATIONS ARE LOST WITH THIS FAILURE. NO EFFECT UNTIL MANUAL LATCH/UNBLOCKING DEVICE FAILS TO RELEASE CLOSED CAPTURE LATCH - FOLLOWING MATING OF BOTH DOCKING MECHANISMS A SINGLE CLOSED CAPTURE LATCH WILL PREVENT FULL RETRACTION OF THE DOCKING RING. PRIOR TO SEPARATION, WITH THE RING FULLY RETRACTED, A SINGLE CLOSED CAPTURE LATCH WILL PREVENT ORBITER/MIR SEPARATION.

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT ON INTERFACING ORBITER SUBSYSTEMS.

(C) MISSION:
NO EFFECT ON DOCKED MISSION OBJECTIVES SINCE OPENING OF CAPTURE LATCHES IS NOT REQUIRED UNTIL MISSION OBJECTIVES ARE MET AND ORBITER/MIR SEPARATION IS REQUIRED.

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT FIRST FAILURE. INABILITY TO OPEN CAPTURE LATCH FOLLOWING SECOND FAILURE WOULD RESULT IN ORBITER AND MIR REMAINING LATCHED.

(E) FUNCTIONAL CRITICALITY EFFECTS:
FIRST FAILURE (CAPTURE LATCH FAILS TO OPEN) - NO EFFECT.
SECOND FAILURE (MANUAL LATCH/UNBLOCKING DEVICE FAILS TO RETRACT AFFECTED CLOSED CAPTURE LATCH) - INABILITY OF ORBITER TO NOMINALLY SEPARATE FROM MIR WHILE DOCKING RING IS FULLY RETRACTED. ATTEMPTED SEPARATION WITH ONE OR MORE CAPTURE LATCHES CLOSED COULD DAMAGE TO ORBITER AND/OR MIR DOCKING HARDWARE.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
THIRD FAILURE (INABILITY TO EXTEND DOCKING RING) - UNABLE TO ENABLE SEPARATION WITH A SINGLE CLOSED CAPTURE LATCH.
FOURTH FAILURE (INABILITY TO EVA TO REMOVE 96 BOLTS) - WORST CASE, INABILITY TO SEPARATE ORBITER FROM MIR RESULTING IN LOSS OF CREW/VEHICLE.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: HOURS TO DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
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TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: MINUTES TO HOURS

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 EXTEND DOCKING RING TO ENABLE SEPARATION WITH A SINGLE CLOSED CAPTURE LATCH OR PERFORM AN EVA TO REMOVE THE 96 BOLTS HOLDING THE DOCKING BASE TO THE EXTERNAL AIRLOCK BEFORE CREW/VEHICLE ARE LOST.

HAZARDS REPORT NUMBER(S): ORBI 401A

HAZARD(S) DESCRIPTION:
INABILITY TO SEPARATE ORBITER AND MIR.

- APPROVALS -

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