

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE

NUMBER: M8-1SS-BM006-X
 (DOESNT APPLY TO PMA2/3
 PASSIVE MECHANISM)

SUBSYSTEM NAME: MECHANICAL - EDS

REVISION: 1 DEC, 1996

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: GUIDE RING ASSEMBLY RSC-ENERGIA	33U.6271.011-09(SOFT) 33U.6271.011-05 (PMA1)
SRU	: ASSEMBLY, CAPTURE LATCH RSC-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 ISS 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 ISS AND ORBITER (NOMINAL UNDOCKING IS NOT PLANNED TO PMA1 MECHANISM). 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

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CONTROL PANEL AND COMMAND RING TO RETRACT WHEN THE SENSOR ON ALL THREE CAPTURE LATCH ACTUATORS IS CLOSED.

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 CONTROL, DOCKING WITH CALIBRATING DOCKING MECHANISM.**

MAINTAINABILITY

REPAIR METHOD - REPLACEMENT.

**REFERENCE DOCUMENTS: 33U.6322.025
33U.6271.011-09 ("SOFT")
33U.6271.011-05 (PMA1)**

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE

NUMBER: MB-1SS-BM006-02
 (DOESN'T APPLY TO PMA2/3
 PASSIVE MECHANISM)

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

REVISION# 1 DEC, 1996

CRITICALITY OF THIS
 FAILURE MODE: 2/2

FAILURE MODE:
 FAILS TO CLOSE

MISSION PHASE:
 OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

103	DISCOVERY
104	ATLANTIS
105	ENDEAVOUR

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

ACTUATOR FAILS TO EXTEND - CONTAMINATION, MECHANICAL/THERMAL SHOCK,
 MANUFACTURE/MATERIAL DEFECT, MOTOR FAILURE

MANUAL LATCH/UNBLOCKING DEVICE FAILS TO RESET - SPRING FAILURE,
 MECHANICAL/THERMAL SHOCK, MANUFACTURE/MATERIAL DEFECT, CONTAMINATION

CRITICALITY 1R1 DURING INTACT ABORT ONLY? NO

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

REDUNDANCY SCREEN

A)	N/A
B)	N/A
C)	N/A

PASS/FAIL RATIONALE:

A)
 N/A

B)
 N/A

C)
 N/A

METHOD OF FAULT DETECTION:

NO INDICATION IF ROLLER MECHANISM FAILS. HOWEVER AN ACTUATOR FAILING TO
 CLOSE (EXTEND) A LATCH WOULD BE DETECTED BY A LOSS OF "LATCH CLOSED"
 INDICATION ON THE DOCKING CONTROL PANEL. AN OPEN MANUAL LATCH/ UNBLOCKING
 DEVICE WOULD ONLY BE DETECTED THROUGH EVALUATION OF TELEMETRY DATA.

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REMARKS/RECOMMENDATIONS:

CAPTURE LATCHES ARE CLOSED DURING GROUND OPERATIONS PRIOR TO FLIGHT AND THE CAM REMAINS CLOSED THROUGHOUT THE DOCKING RING CAPTURE PROCESS.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

NO EFFECT ON CURRENT DOCKING SINCE CAPTURE LATCHES ARE CLOSED ON THE GROUND AND REMAIN CLOSED DURING CAPTURE. HOWEVER, IF FAILURE OCCURRED PRIOR TO SUBSEQUENT DOCKINGS AFFECTED CAPTURE LATCH ASSEMBLY ON ORBITER/PMA1 DOCKING MECHANISM WILL NOT BE LATCHED TO OPPOSING BODY MOUNTED LATCH ON ISS DOCKING MECHANISM. ALTHOUGH IT MAY BE POSSIBLE TO CAPTURE AND RETRACT THE DOCKING RING WITH ONLY TWO CLOSED CAPTURE LATCHES, MATING OF THE TWO DOCKING MECHANISMS FOR CLOSING STRUCTURAL HOOKS WOULD BE IMPAIRED. WORST CASE WOULD BE THE INABILITY TO MATE AND STRUCTURALLY LATCH INTERFACE.

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT ON INTERFACING SUBSYSTEMS.

(C) MISSION:

NO EFFECT ON CURRENT DOCKING. A FAILURE TO CLOSE CAPTURE LATCHES WOULD ONLY RESULT IN LOSS OF SUBSEQUENT DOCKINGS. INABILITY TO DOCK, WHEN REQUIRED, WOULD RESULT IN LOSS OF MISSION OBJECTIVES.

(D) CREW, VEHICLE, AND ELEMENT(S):

NO EFFECT ON CREW OR VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:

N/A

DESIGN CRITICALITY (PRIOR TO OPERATIONAL DOWNGRADE, DESCRIBED IN F): N/A

(F) RATIONALE FOR CRITICALITY CATEGORY DOWNGRADE:

N/A (THERE ARE NO WORKAROUNDS TO CIRCUMVENT THIS FAILURE.)

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: HOURS TO DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS TO MINUTES

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: N/A

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

N/A

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:

THERE IS NO CORRECTIVE ACTION TO THIS FAILURE OTHER THAN TO ABORT A SECOND DOCKING ATTEMPT.

HAZARDS REPORT NUMBER(S): NONE

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PASSIVE MECHANISM)****HAZARD(S) DESCRIPTION:**

N/A

-DISPOSITION RATIONALE-

(A) DESIGN:

CAPTURE LATCH ASSEMBLY IS EFFECTIVELY ENCASED TO PREVENT INTRODUCING CONTAMINATION THAT COULD CAUSE THE LATCH OR ACTUATOR TO JAM IN THE OPEN POSITION.

(B) TEST:

REFER TO "APPENDIX B" FOR DETAILS OF THE FOLLOWING ACCEPTANCE AND QUALIFICATION TESTS OF THE DOCKING MECHANISMS RELATIVE TO THIS FAILURE MODE.

DOCKING MECHANISM ACCEPTANCE TESTS:

1. ELECTRICAL CIRCUIT VERIFICATION TEST
2. INSULATION ELECTRICAL RESISTANCE TEST
3. CAPTURE LATCH FUNCTIONAL PERFORMANCE TEST
4. AXIAL STIFFNESS IN INITIAL POSITION LOAD TEST
5. CAPTURE LATCH FORCE LOAD TEST
6. VIBRATION TEST
7. THERMAL VACUUM TEST

DOCKING MECHANISM QUALIFICATION TESTS:

1. ELECTRICAL CIRCUIT VERIFICATION TEST
2. INSULATION ELECTRICAL RESISTANCE TEST
3. TRANSPORTABILITY STRENGTH TEST
4. VIBRATION TEST
5. SHOCK-BASIC DESIGN TEST
6. THERMAL VACUUM TEST
7. SIX-DEGREE-OF-FREEDOM TEST
8. SERVICE LIFE TEST
9. EXTEND/RETRACT MECHANISM LIMIT LOAD TEST
10. EXTEND/RETRACT MECHANISM ULTIMATE LOAD TEST
11. CAPTURE AND BODY LATCH ULTIMATE LOAD TEST
12. DISASSEMBLY INSPECTION

OMRSD - TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

RECEIVING INSPECTION

COMPONENTS ARE SUBJECTED TO A 100% RECEIVING INSPECTION PRIOR TO INSTALLATION.

CONTAMINATION CONTROL

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CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL VERIFIED BY INSPECTION. CHECK OF ROOM CLEANLINESS; PARTS WASHING AND OTHER OPERATIONS OF THE TECHNOLOGICAL PROCESS WHICH PROVIDES CLEANLINESS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES
 ANODIZING, HEAT TREATING, SOLDERING, CHEMICAL PLATING, AND CURING VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
 TORQUE, ADJUSTMENTS AND TOLERANCES ACCORDING TO TECHNICAL REQUIREMENTS OF THE DRAWINGS ARE VERIFIED BY INSPECTION.

TESTING
 ATP/QTP/OMRSD TESTING VERIFIED BY INSPECTION.

HANDLING/PACKAGING
 HANDLING/PACKAGING PROCEDURES AND REQUIREMENT FOR SHIPMENT VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
 DATA ON TEST FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING OF ODS DOCKING MECHANISMS CAN BE FOUND IN PRACA DATA BASE.

(E) OPERATIONAL USE:
 NONE

- APPROVALS -

PRODUCT ASSURANCE ENGR.	:	M. NIKOLAYEVA	:	
DESIGN ENGINEER	:	E. BOBROV	:	
NASA SS/MA	:		:	
NASA SUBSYSTEM MANAGER	:		:	
JSC MOD	:		:	