

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

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

**CRITICALITY OF THIS
FAILURE MODE: 2/2**

**FAILURE MODE:
JAMMED ROLLER IN EXTENDED POSITION**

**MISSION PHASE:
OO ON-ORBIT**

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

**CAUSE:
CONTAMINATION, STRUCTURAL FAILURE DUE TO MANUFACTURE/MATERIAL DEFECT**

CRITICALITY 1/1 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:

**VISUAL OBSERVATION - THE INABILITY OR DIFFICULTY TO CAPTURE MAY INDICATE A
CAPTURE LATCH JAMMED ROLLER CONDITION.**

REMARKS/RECOMMENDATIONS:

A JAMMED ROLLER ON A CAPTURE LATCH IS CONSIDERED VERY REMOTE.

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(A) SUBSYSTEM:

FAILURE OF CAPTURE LATCH ROLLER TO MOVE ASIDE WHEN IN CONTACT WITH ITS OPPOSING BODY MOUNTED LATCH ON THE ISS DOCKING MECHANISM. CAPTURE BETWEEN ORBITER/PMA1 DOCKING MECHANISM RING AND ISS DOCKING MECHANISM MAY NOT BE POSSIBLE.

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT ON INTERFACING SUBSYSTEMS.

(C) MISSION:

WORST CASE, INABILITY TO CAPTURE FOLLOWING FIRST FAILURE RESULTING IN LOSS OF DOCKING AND SUBSEQUENT LOSS OF MISSION OBJECTIVES.

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

REPEATED ATTEMPTS AT CAPTURE, WITH A JAMMED ROLLER, COULD CAUSE SLIGHT DAMAGE TO BOTH ORBITER/PMA1 AND ISS DOCKING MECHANISMS.

(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: MINUTES TO HOURS

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 MISSION.

HAZARDS REPORT NUMBER(S): NONE

HAZARD(S) DESCRIPTION:

N/A

-DISPOSITION RATIONALE-

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(A) DESIGN:

A JAMMED CAPTURE LATCH ROLLER IS CONSIDERED VERY REMOTE. THE CAPTURE LATCH ROLLER ASSEMBLY IS DESIGNED TO ALLOW EASE OF MOVEMENT WHEN CONTACTING THE OPPOSING BODY MOUNTED LATCH. THE CAPTURE LATCH ASSEMBLY IS COMPLETELY ENCASED TO PREVENT INTRODUCING CONTAMINATION LARGE ENOUGH TO CAUSE A JAMMING.

(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. AXIAL STIFFNESS IN INITIAL POSITION LOAD TEST
2. RETRACTION FORCE LOAD TEST
3. RESTRAINING FORCE LOAD TEST
4. BODY LATCH LOAD TEST
5. CAPTURE LATCH FORCE LOAD TEST
6. VIBRATION TEST
7. THERMAL VACUUM TEST

DOCKING MECHANISM QUALIFICATION TESTS:

1. TRANSPORTABILITY STRENGTH TEST
2. VIBRATION TEST
3. SHOCK-BASIC DESIGN TEST
4. THERMAL VACUUM TEST
5. SIX-DEGREE-OF-FREEDOM TEST
6. SERVICE LIFE TEST
7. 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

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.

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**TESTING
ATP/QTP 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 :		:

Handwritten signatures and initials are present over the approval lines, including a large signature at the top, a signature in the middle, and initials at the bottom.