PRINT DATE: 01/24/97

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: M8-1SS-BM031-X
(APPLIES ONLY TO THE PMA 2/3)

SUBSYSTEM NAME: MECHANICAL - EDS

REVISION: 1 JAN. 1997

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	HATCH ASSEMBLY RSC-ENERGIA	33U.4371.016-02 33U.4371.016-02
SRU	:	TIGHTENING ELEMENT RSC-ENERGIA	33U.4973.007 (QTY-8) 33U.4973.007
SRU	:	TIE-ROD ASSEMBLY RSC-ENERGIA	33U.6672.018 (QTY-7) 33U.6672.018
SRU	:	CONNECTING ROD ASSEMBLY RSC-ENERGIA	33U.8321.087 (QTY-1) 33U.8321.087
SRU	:	CONNECTING ROD ASSEMBLY RSC-ENERGIA	33U.8321.088 (QTY-1) 33U.8321.088
SRU	:	SHACKLE ASSEMBLY RSC-ENERGIA	33U.4866.002 (QTY-1) 33U.4866.002
SRU	:	SHACKLE ASSEMBLY RSC-ENERGIA	33U.4866.003 (QTY-1) 33U.4866.003

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
LATCH MECHANISM

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 19 (8; 7; 2; 2)
NINETEEN

FUNCTION:
TIGHTENING ELEMENT IS A WORKING ELEMENT FOR THE HATCH SEALING. TIGHTENING ELEMENTS ARE INTERCONNECTED AND COUPLED WITH A DRIVE USING TIE-ROD AND CONNECTING ROD ASSEMBLIES. WHEN THIS DRIVE ROTATES, THE EIGHT TIGHTENING ELEMENTS MOVE ON THE HATCH SURFACE. WHILE THE DRIVE IS IN AN OPEN POSITION, TIGHTENING ELEMENTS ARE ROLLED OUT FROM UNDER THE LATCH RESTRAININGBRACKETS (8 LATCH RESTRAINING BRACKETS - 33U.8512.145). WHILE THE DRIVE IS IN A CLOSED POSITION, TIGHTENING ELEMENTS ARE RETRACTED UNDER THE LATCH RESTRAINING BRACKETS, THUS PRESSING AGAINST HATCH CLOSURE SEALS, LOCATED ON THE PASSIVE MECHANISM SHELL, TO PROVIDE THE HATCH SEALING.

MAINTAINABILITY

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NUMBER: M8-1SS-BM031-X

REPAIR METHOD - REPLACEMENT (WITH THE AVAILABILITY OF SPARE SET AND WHEN THE OCCASION REQUIRES).

REFERENCE DOCUMENTS: 33U.4371.016
33U.4371.016-02

PRINT DATE: 01/24/97

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: M8-1SS-BM031- 02

REVISION# 1 JAN, 1997

SUBSYSTEM NAME: MECHANICAL - EDS
LRU: HATCH ASSEMBLY
ITEM NAME: LATCH MECHANISM

CRITICALITY OF THIS FAILURE MODE: 2/2

FAILURE MODE:
FAILS TO DISENGAGE

MISSION PHASE:
OO ON-ORBIT

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

CAUSE:
ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, FAILURE/DEFLECTION OF INTERNAL PART, PHYSICAL BINDING/JAMMING

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:
PHYSICAL OBSERVATION - INABILITY TO OPEN HATCH.

REMARKS/RECOMMENDATIONS:
THE HATCH IS CLOSED AND SEALED ON THE GROUND AND OPENED ONLY ONCE DURING THE INITIAL DOCKING (MISSION 2A) AND LEFT UNSEALED FOR SUBSEQUENT MISSIONS.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF CAPABILITY TO OPEN PASSIVE MECHANISM HATCH.

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

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: M8-1SS-BM031-02

(C) MISSION:
LOSS OF PRIMARY MISSION OBJECTIVES DUE TO INABILITY TO ACCESS THE SPACE STATION THROUGH VESTIBULE TUNNEL.

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT ON CREW OR VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:
N/A

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
WORST CASE, THERE IS NO WORKAROUND TO CIRCUMVENT A FAILURE TO DISENGAGE LATCH MECHANISM.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: MINUTES

TIME FROM FAILURE OCCURRENCE TO DETECTION: IMMEDIATE

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: N/A

IS TIME REQUIRED TO IMPLEMENT CORRECTIVE ACTION LESS THAN TIME TO EFFECT?
NO

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
THERE IS NO CORRECTIVE ACTION FOR THE INITIAL ISS FLIGHTS SINCE THERE IS NO ONE OCCUPYING THE SPACE STATION.

HAZARDS REPORT NUMBER(S): NONE

HAZARD(S) DESCRIPTION:
N/A

-DISPOSITION RATIONALE-

(A) DESIGN:
LATCH MECHANISM, BASED ON PROVEN SOYEZ, KRISTALL, DM DESIGN, CONSISTS OF EIGHT TIGHTENING ELEMENTS INTERCONNECTED AND COUPLED WITH A DRIVE USING TIE-ROD AND CONNECTING ROD ASSEMBLIES. WHEN THIS DRIVE ROTATES, THE EIGHT TIGHTENING ELEMENTS MOVE OVER THE HATCH SURFACE. WHILE THE DRIVE IS IN AN OPEN POSITION, TIGHTENING ELEMENTS ARE ROLLED OUT FROM UNDER THE LATCH RESTRAINING BRACKETS. WHILE THE DRIVE IS IN A CLOSED POSITION, TIGHTENING ELEMENTS ARE RETRACTED UNDER THE LATCH RESTRAINING BRACKETS, THUS PRESSING AGAINST HATCH CLOSURE SEALS TO PROVIDE THE HATCH SEALING. LINKAGE ATTACHMENTS HAVE DUAL ROTATING SURFACES. PROTECTIVE COVER MINIMIZES CONTAMINATION. MAXIMUM LATCHING FORCE IS 200KG. POSITIVE MARGINS ON ALL COMPONENTS. LATCH AND LINKAGE CHOSEN FOR HIGH STRENGTH AND LOW WEAR. HATCH WITHSTANDS DIFFERENTIAL PRESSURE IN ONLY ONE DIRECTION (INSIDE

TO OUTSIDE). PROBABILITY OF THIS FAILURE MODE IS EXTREMELY LOW; IT IS MANUALLY OPERATED MECHANICAL DEVICE OF SIMPLE/ RELIABLE CONSTRUCTION.

(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. HATCH FUNCTION TEST
2. HATCH AND APDA BODY COMPONENT PROOF PRESSURE TEST
3. VIBRATION TEST AVT (RANDOM VIBRATION 360SEC (120SEC PER AXIS))

DOCKING MECHANISM QUALIFICATION TESTS:
1. HATCH TEST (ACCORDING TO THE QUAL TEST PROGRAMM)
2. PARTIALLY DISASSEMBLY INSPECTION

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

(C) INSPECTION:
REPEATED INSPECTIONS FOR THE HATCH ELEMENTS WITHIN DOCKING MECHANISM ARE CARRY OUT DURING ASSEMBLY AND ACCEPTANCE TESTS.

RECEIVING INSPECTION
RAW MATERIAL IS VERIFIED BY INSPECTION TO ASSURE COMPLIANCE WITH THEIR SPECIFICATIONS ON A CERTAIN % OF THE BATCH AT THE INPUT CONTROL.

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, AND CHEMICAL PLATING VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
ADJUSTMENTS AND TUNING ACCORDING TO TECHNICAL REQUIREMENTS OF THE DRAWINGS ARE VERIFIED BY INSPECTION. QUALITY CONTROL OF COATINGS AND FABRICATION OF TIGHTENING ELEMENTS, AND TIE-ROD AND CONNECTING ROD ASSEMBLIES ARE VERIFIED BY INSPECTION.

TESTING
ATP/QTP TESTING VERIFIED BY INSPECTION.

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

(D) FAILURE HISTORY:

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FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: M8-1SS-BM031- 02

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:
WHEN ISS IS NON-INHABITED AND PASSIVE MECHANISM HATCH IS CLOSED, NO OPERATIONAL WORKAROUND IS POSSIBLE BECAUSE TIGHTENING ELEMENTS ARE ON THE INSIDE OF HATCH AND ARE INACCESSIBLE TO ORBITER CREW MEMBERS IN EXTERNAL AIRLOCK. WHEN ISS IS HABITED AND HATCH IS CLOSED, SPACE STATION CREW COULD REMOVE EACH OF THE EIGHT LATCH RESTRAINING BRACKETS OVER THE EIGHT TIGHTENING ELEMENTS BY REMOVING THEIR THREE BOLTS.

- APPROVALS -

PRODUCT ASSURANCE ENGR	: M. NIKOLAYEVA	:
DESIGN ENGINEER	: E. BOBROV	:
DESIGN ENGINEER	: L. FROLOV	:
NASA SSMA	:	:
NASA SUBSYSTEM MANAGER	:	:
JSC MOD	:	: