FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER: M8-1SS-BM019-X

SUBSYSTEM NAME: MECHANICAL - EDS

REVISION: 1 DEC, 1996

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	STRUCTURAL LATCH MECHANISM RSC-ENERGIA	33U.6365.010-07 ("SOFT") 33U.6365.010-08 (PMA1) 33U.6365.010-04 (PMA2/3)
SRU	:	PUSHER, SPRING RSC-ENERGIA	33U.6411.004 33U.6411.004

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
SPRING PUSHER

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 2
TWO

FUNCTION:
TWO SPRING PUSHERS ARE LOCATED ON OPPOSITE SIDES OF EACH DOCKING FRAME (ISS AND ORBITER). WHEN MATED FOUR SPRING PUSHERS ARE LOCATED EQUALLY AROUND THE MATED SURFACE. TOGETHER THEY PROVIDE THE FORCE NECESSARY TO OVERCOME THE CONNECTION BETWEEN THE ORBITER AND ISS OR PMA1 AND ISS DOCKING MECHANISMS RESULTING FROM THE MECHANICAL INTERFACE CONNECTORS AND SEAL ADHESION. ALL SPRING PUSHERS TOGETHER PROVIDE ABOUT 4 KG-M OF INITIAL SEPARATION ENERGY (NOMINAL SEPARATION IS NOT PLANNED TO PMA1 ASSEMBLY). THE VELOCITY CREATED BY THIS SEPARATION IS ABOUT 14 MM/SEC.

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

MAINTAINABILITY
REPAIR METHOD - REPLACEMENT.

REFERENCE DOCUMENTS: 33U.6411.004
33U.6365.010-07 ("SOFT")
33U.6365.010-08 (PMA1)
33U.6365.010-04 (PMA2/3)

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: M8-1SS-BM019- 02

REVISION# 1 DEC, 1996

SUBSYSTEM NAME: MECHANICAL - EDS
LRU: STRUCTURAL LATCH MECHANISM
ITEM NAME: PUSHER, SPRING

CRITICALITY OF THIS FAILURE MODE: 2R3

FAILURE MODE:
FAILS TO COMPRESS

MISSION PHASE:
OO ON-ORBIT

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

CAUSE:
STUCK IN EXTENDED POSITION DUE TO: A COCKED PLUNGER; CONTAMINATION BETWEEN PLUNGER AND RETAINER WALL OR BETWEEN SPRING COILS

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

REDUNDANCY SCREEN
A) FAIL
B) FAIL
C) PASS

PASS/FAIL RATIONALE:
A)
FAILS SCREEN A SINCE FIRST SURFACE FAILURE IS NOT DETECTABLE ON GROUND.

B)
FAILS SCREEN B SINCE FIRST SURFACE FAILURE IS NOT DETECTABLE IN FLIGHT.

C)

METHOD OF FAULT DETECTION:
NONE FOR FIRST FAILURE. SECOND FAILURE CAN BE DETECTED THROUGH VISUAL OBSERVATION - LITTLE OR NO SEPARATION BETWEEN BOTH VEHICLES (NOMINAL SEPARATION IS NOT PLANNED TO PMA1 ASSEMBLY).

REMARKS/RECOMMENDATIONS:
SEPARATION CAN BE ACCOMPLISHED WITH ONLY ONE SPRING PUSHER.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
AFFECTED SPRING PUSHER FAILS TO COMPRESS FOLLOWING SECOND SURFACE FAILURE. POSSIBLE LOSS OF CAPABILITY TO MATE ORBITER/PMA1 DOCKING MECHANISM WITH ISS (PMA2/FGB) DOCKING MECHANISM FOR STRUCTURAL LATCHING.

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

(C) MISSION:
NO EFFECT FIRST FAILURE. POTENTIAL LOSS OF DOCKING FOLLOWING SECOND FAILURE RESULTING IN LOSS OF ORBITER(PMA1)/ISS MISSION OBJECTIVES.

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
FIRST FAILURE (FAILURE OF FIRST SLIDING SURFACE) - NO EFFECT
SECOND FAILURE (FAILURE OF REDUNDANT SLIDING SURFACE - WORST CASE, INABILITY TO MATE AND STRUCTURALLY LATCH THE INTERFACE RESULTING IN LOSS OF DOCKING CAPABILITIES. LOSS OF DOCKING WILL RESULT IN LOSS OF MISSION OBJECTIVES.

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

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 RECOVER FROM A SPRING PUSHER THAT IS STUCK IN THE EXTENDED POSITION.

HAZARDS REPORT NUMBER(S): NONE

HAZARD(S) DESCRIPTION:
N/A

-DISPOSITION RATIONALE-

(A) DESIGN:
A SPRING PUSHER FAILING TO COMPRESS IS CONSIDERED TO BE VERY REMOTE. THE CLEARANCE BETWEEN THE PLUNGER AND RETAINER IS VERY MINIMAL. THE POSSIBILITY THAT CONTAMINATION CAN PENETRATE INTO THIS AREA OR MIGRATE BETWEEN THE SPRING COILS (OF SUFFICENT SIZE TO CAUSE IT TO JAM) IS CONSIDERED VERY REMOTE. BECAUSE OF THIS MINIMAL CLEARANCE THE POSSIBILITY THAT THE PLUNGER CAN COCK AND JAM IS ALSO CONSIDERED TO BE VERY REMOTE. SINCE THERE IS VERY LITTLE CLEARANCE BETWEEN THE SPRING AND RETAINER WALL, FRACTURED SPRING COILS WOULD REMAIN IN PLACE. SLIGHT FRICTION BUILT UP

BETWEEN THE PLUNGER AND RETAINER WALL WOULD PROBABLY BE OVERCOME BY THE MATING FORCE OF THE TWO MECHANISMS.

(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. VIBRATION TEST
2. 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. STRUCTURAL HOOK SIMULTANEOUS LOADS TEST
8. STRUCTURAL HOOK COMPONENT LOADS TEST
9. DISASSEMBLY INSPECTION

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

(C) INSPECTION:
RECEIVING INSPECTION
SPRING PUSHERS 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 AND HEAT TREATING VERIFIED BY INSPECTION.

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

TESTING
ATP/OTP/OMRSD TESTING VERIFIED BY INSPECTION.

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

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(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 IF SPRING PUSHER CANNOT BE COMPRESSED. HOWEVER, SLIGHT FRICTION BUILT UP BETWEEN THE PLUNGER AND RETAINER WALL WOULD MOST LIKELY BE OVERCOME BY THE MATING FORCE OF THE TWO DOCKING MECHANISMS.

- APPROVALS -

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