PRINT DATE: 01/23/91

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE

NUMBER: MO-AB1-302000-01-000-X

SUBSYSTEM NAME: GAMMA RAY OBSERVATORY

REVISION : 1 01/23/91

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ SRU :	PLUG ASSEMBLY, C&D	V784-540006-001
■ SRU :	PLUG ASSEMBLY, POWER	V784-540006-007

PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
DISCONNECT PLUG ASSEMBLY, P/N -001 FOR THE COMMAND AND DATA DISCONNECT (PORT SIDE); P/N -007 FOR THE POWER DISCONNECT (STARBOARD SIDE).

■ QUANTITY OF LIKE ITEMS: 2
TWO: ONE FOR THE COMMAND AND DATA DISCONNECT (PORT SIDE); ONE FOR THE POWER DISCONNECT (STARBOARD SIDE).

■ FUNCTION:
PROVIDES THE CAPABILITY TO DISCONNECT THE ELECTRICAL UMBILICALS BETWEEN THE ORBITER AND PAYLOAD PRIOR TO THE DEPLOYMENT OF THE PAYLOAD. TWO UMBILICAL DISCONNECTS ARE PROVIDED - COMMAND AND DATA DISCONNECT (PORT SIDE) AND POWER DISCONNECT (STARBOARD SIDE). DISCONNECTS ARE MOUNTED ON RETRACTION/RETENTION ARMS TO SWING CLEAR OF THE PAYLOAD AT SEPARATION

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NUMBER: MO-AB1-302000-01-000-01

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SUBSYSTEM: GAMMA RAY OBSERVATORY

ITEM NAME: PLUG ASSEMBLY

CRITICALITY OF THIS FAILURE MODE:2/2

■ FAILURE MODE:
DISCONNECT PLUG FAILS TO DISENGAGE.

MISSION PHASE:
OO ON-ORBIT

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

■ CAUSE:
STRUCTURAL FAILURE, ADVERSE TOLERANCES/WEAR (I.E. SCRATCHES/GROOVES IN LATCH BLADE), CONTAMINATION/FOREIGN OBJECT/DEBRIS, DEFECTIVE PART/MATERIAL (I.E. FAULTY LOCK RING) OR MANUFACTURING DEFECT, THERMAL STRESS, VIBRATION, UMBILICAL SPRING FAILURE, PROCESSING ANOMALY.

■ CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

■ REDUNDANCY SCREEN A) N/A
■ B) N/A
■ C) N/A

PASS/FAIL RATIONALE:
■ A)

■ B)

■ C)

- FAILURE EFFECTS -

■ (A) SUBSYSTEM:
PLUG DOES NOT DISCONNECT AND DEMATE, ARM DOES NOT RETRACT.

■ (B) INTERFACING SUBSYSTEM(S):
NO EFFECT.

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■ (C) MISSION:
LOSS OF GRO MISSION, IF PAYLOAD CANNOT BE DEPLOYED.

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

■ (E) FUNCTIONAL CRITICALITY EFFECTS:
N/A

- DISPOSITION RATIONALE -

■ (A) DESIGN:
THE PLUG ASSEMBLY HAS REDUNDANT SOLENOIDS;EITHER CAN RELEASE THE LATCH BLADE/LOCKRING CONFIGURATION. THE TOLERANCES DESIGNED INTO THE SYSTEM PRECLUDE ANY FAILURE AS A RESULT OF THERMAL DISTORTION AND ADVERSE TOLERANCE/WEAR.

■ (B) TEST:
QUALIFICATION TESTS: QUALIFICATION TESTS INCLUDE QUALIFICATION ACCEPTANCE VIBRATION TESTS (QAVT), SEPARATION CYCLES AT AMBIENT, +200 DEG F, -75 DEG F, AND THERMAL VACUUM.

ACCEPTANCE TESTS: ACCEPTANCE TESTS INCLUDE VISUAL INSPECTION, ELECTRICAL CONTINUITY AND RESISTANCE, SEPARATION AT AMBIENT, +200 DEG F, -75 DEG F, AND ACCEPTANCE VIBRATION TESTING (AVT) 20-80 HZ, +3DB/OCT; 80-350 HZ, 0.067G2/HZ; 350-2000 HZ, -3DB/OCT WITH SEPARATION.

OMRSD: GROUND TURNAROUND INCLUDES STANDARD UMBILICAL RETENTION/ RETRACTION SYSTEM (SURS) DISCONNECT VERIFICATION, VERIFYING POWER TO SURS DISCONNECT SOLENOIDS, AND SURS DISCONNECT VERIFICATION IN ACCORDANCE WITH ML0103-0574 AND VERIFIED BY OMRSD FILE II VOL II ANNEX 9 (PAYLOAD REQUIREMENTS).

■ (C) INSPECTION:
RECEIVING INSPECTION
MATERIAL AND PROCESS CERTIFICATION ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CONTAMINATION CONTROL AND CORROSION PROTECTION ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
DETAIL PARTS, WIRE/CABLE HARNESSES MANUFACTURED PER DRAWING ON MANUFACTURING ORDERS VERIFIED BY INSPECTION. ELECTRICAL HARNESSES AND COAXIAL CABLES INSTALLED TO ARM ASSEMBLY PER DRAWING AND VERIFIED BY

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INSPECTION ON MANUFACTURING ORDERS. ASSEMBLY OF UMBILICAL ARM ASSEMBLY PER DRAWING VERIFIED BY INSPECTION. INSTALLATION OF THREADED FASTENERS AND TORQUE REQUIREMENTS ARE VERIFIED BY INSPECTION.

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ATTACHMENT -
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NONDESTRUCTIVE EVALUATION
DYE-PENETRANT INSPECTION IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
ELECTRICAL BOND AND TEST PER APPLICABLE SPECIFICATION AND VERIFIED BY INSPECTION.

TESTING
ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

■ (D) FAILURE HISTORY:
CAR NO. AC4666 : IN PRE-QUALIFICATION ACCEPTANCE VIBRATION TEST OF UMBILICAL DISCONNECT AND RETRACTION/RETENTION ARM, DISCONNECT FAILED TO SEPARATE WHEN SOLENOID "A" WAS ENERGIZED; FAILURES OF THE DISCONNECT TO SEPARATE WERE ATTRIBUTED TO FAILURE OF THE LOCKRING TO COLLAPSE INTO THE GROOVE IN THE RECEPTACLE WHEN ONE OF THE TWO LATCH BLADES WAS RETRACTED AND THE FAILURE OF THE SOLENOID TO RETRACT THE LATCH BLADE AT LOW TEMPERATURE (-75 DEG F); THE DISCONNECT PLUG WAS REDESIGNED TO REPLACE THE DUAL LATCH BLADES WITH A SINGLE WIDE BLADE TO ENSURE COLLAPSE OF THE LOCKRING WHEN THE BLADE IS RETRACTED, AND THE LINKAGE BETWEEN SOLENOIDS WAS ALSO REDESIGNED.

CAR NO. AC7404 ; IN ACCEPTANCE THERMAL TEST, THE DISCONNECT UMBILICAL RETRACTION/RETENTION ARM FAILED TO SEPARATE AT -75 DEG F WHEN SOLENOID "B" WAS ENERGIZED; LOW TEMPERATURE EFFECTS AND IMPROPER FINISHES OF INTERFACE SURFACES BETWEEN LATCH BLADE AND LOCKRING RESULTED IN FAILURE TO RELEASE THE LOCKRING;AN ADDITIONAL REQUIREMENT WAS IMPOSED ON THE PREFLIGHT MATING PROCEDURE OF THE UMBILICAL DISCONNECT TO INSTALL A NEW LOCKRING FOR EACH FLIGHT, AND TO VISUALLY INSPECT THE PAYLOAD RECEPT-ACLE LOCKRING FOR BURRS, CHIPS, AND SURFACE FINISH PRIOR TO FINAL MATE.

CAR NO. AC7462 ; DURING ACCEPTANCE VIBRATION TESTING, THE DISCONNECT UMBILICAL RETRACTION/RETENTION ARM FAILED TO SEPARATE AFTER Y-AXIS VIBRATION WHEN SOLENOID "B" WAS ENERGIZED;FAILURES OF PLUG AND RECEPTACLE TO SEPARATE AFTER VIBRATION TESTS WERE CAUSED BY FAILURE TO RELEASE THE LOCKRING HOLDING THEM TOGETHER AND IMPROPER SURFACE FINISHING ON CONTACTING AREAS OF THE LATCH BLADE AND LOCKRING; AN ADDITIONAL REQUIREMENT WAS IMPOSED ON THE PREFLIGHT MATING PROCEDURE OF THE UMBILICAL DISCONNECT TO INSTALL A NEW LOCKRING FOR EACH FLIGHT AND TO VISUALLY INSPECT THE PAYLOAD RECEPTACLE LOCKRING FOR BURRS, CHIPS,

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AND SURFACE FINISH PRIOR TO FINAL MATE.

■ (E) OPERATIONAL USE:
AN EVA PROCEDURE IS AVAILABLE TO DISENGAGE THE CONNECTOR AND RETRACT THE SURS, IN THE EVENT THIS FAILURE MODE OCCURS.

- APPROVALS -

RELIABILITY ENGINEERING	M. P. RAGUSA	:
DESIGN ENGINEERING	R. DIVINSKI	:
DESIGN ENGINEERING	M. GUTIERREZ	:
QUALITY ENGINEERING	M. F. MERGEN	:
NASA RELIABILITY	C.C	:
NASA SUBSYSTEM MANAGER		:
NASA QUALITY ASSURANCE		: