

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- HARDWARE
NUMBER: M0-AG1-M02 -X**SUBSYSTEM NAME:** REMOTELY OPERATED FLUID UMBILICAL (ROFU)
REVISION: 01/23/03**PART DATA**

PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
: ROFU	V847-544100-001
: XO CENTERING MECHANISM,	V848-544300-001

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:X₀ CENTERING MECHANISM, PAYLOAD DISCONNECT ASSEMBLY
(PDA)**REFERENCE DESIGNATORS:** N/A**QUANTITY OF LIKE ITEMS:** 1
ONE PER PDA, ONE PDA PER UMBILICAL**FUNCTION:**THE MECHANISM PROVIDES FREEDOM OF MOVEMENT FOR THE PAYLOAD MOUNTED CONNECTOR ALONG THE X₀ AXIS AS AN ALIGNMENT ACCOMMODATION DURING MATING WITH THE ORBITER DISCONNECTS AND AS A STRESS RELIEF AFTER MATING IS COMPLETED.

FAILURE MODES EFFECTS ANALYSIS FMEA -- FAILURE MODE

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SUBSYSTEM NAME: REMOTELY OPERATED FLUID UMBILICAL (ROFU)

LRU:

CRITICALITY OF THIS

ITEM NAME: X₀ CENTERING MECHANISM

FAILURE MODE: 2/2

FAILURE MODE:

PHYSICAL BINDING/JAMMING

MISSION PHASE: OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:	102	COLUMBIA
	103	DISCOVERY
	104	ATLANTIS
	105	ENDEAVOUR

CAUSE:

ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, DEFECTIVE PART/MATERIAL OR MANUFACTURING DEFECT, THERMAL DISTORTION, VIBRATION, BROKEN SPRING.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:

A)
N/A

B)
N/A

C)
N/A

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF FREEDOM OF MOVEMENT FOR ALIGNMENT ALONG THE X₀ AXIS.

(B) INTERFACING SUBSYSTEM(S):

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LOSS OF ABILITY TO MATE QD'S. STRESSES ALONG THE X₀ AXIS WOULD NOT BE RELIEVED, IF DISCONNECTS ARE MATED.

(C) MISSION:

LOSS OF MISSION OBJECTIVE. RETRIEVED PAYLOAD COOLANT SYSTEM COULD NOT BE CONNECTED OR DISCONNECTED.

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

NO EFFECT.

SUCCESS PATHS REMAINING AFTER FIRST FAILURE: 0

- TIME TO EFFECT -

REACTION TIME: SECONDS

-DISPOSITION RATIONALE-

(A) DESIGN:

SIMPLE SPRING-LOADED MECHANISM WHICH TRANSLATES ALONG TWO SHAFTS AND GUIDED BY LINEAR BEARINGS IN THE X-AXIS. SAFETY FACTOR IS 1.4 MINIMUM, ALL COMPONENTS SHOW POSITIVE MARGINS BY ANALYSIS.

ALL THE MECHANISM MATERIALS HAVE BEEN CHOSEN FOR HIGH STRENGTH/LOW WEAR CHARACTERISTICS. MECHANISM DESIGNED WITH POSITIVE MARGINS OF SAFETY FOR WORST CASE THERMAL CONDITIONS. ALIGNMENT MECHANISM DESIGNED TO ENSURE PROPER CAPTURE ENVELOPE FOR WORST CASE THERMAL CONDITIONS.

(B) TEST:**QUALIFICATION:**

THE ROFU MECHANISM IS CERTIFIED PER CR 60-44-544100-001-C. SYSTEM QUALIFICATION TESTS INCLUDED:

- * VISUAL EXAMINATION TO VERIFY CONFORMANCE TO DRAWINGS, IDENTIFICATION MARKINGS, AND CLEANLINESS.
- * ENVIRONMENTAL TESTS - VIBRATION FOR 600 SEC/AXIS (STOWED). VIBRATION FOR 1400 SEC/AXIS (MATED) BY THE ROFU QUALIFICATION TEST. FIVE THERMAL / VACUUM CYCLES.
- * OPERATIONAL LIFE TESTS - 500 CYCLES, BY THE ROFU QUALIFICATION TEST, ON ARM AND LATCH MECHANISM.
- * QUALIFICATION ACCEPTANCE TESTS TO CERTIFY MECHANISM FOR FIVE ACCEPTANCE THERMAL AND FIVE ACCEPTANCE VIBRATION TESTS.
- * MAXIMUM DISPLACEMENT TESTS TO VERIFY OPERATIONAL ENVELOPE.
- * LIMIT, LIMIT PLUS LOADS TESTS TO VERIFY STATIC LOADING.
- * ARM AND LATCH STALL LOAD TESTS.

ACCEPTANCE:

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THE LATCH MECHANISMS WERE RIGGED PER CONTROLLED SPECIFICATION ML0308-0187, PLUS:

- * ACCEPTANCE VIBRATION RANDOM SPECTRUM 3 MIN/AXIS.
- * FIVE ACCEPTANCE THERMAL CYCLES.

CERTIFICATION BY ANALYSIS/SIMILARITY:

FACTORS INCLUDE: HUMIDITY, FUNGUS, OZONE, SALTSpray, SAND/DUST, ACCELERATION, FACTORS OF SAFETY, HAIL, LIGHTNING, RAIN, SOLAR RADIATION (THERMAL AND NUCLEAR), STORAGE/OPERATING LIFE, METEOROIDS, ACOUSTICS, AND EXPLOSIVE ATMOSPHERE.

GROUND TURNAROUND:

OMRSD - ANY TURNAROUND TEST CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD

(C) INSPECTION:

RECEIVING INSPECTION

MATERIAL AND PROCESS CERTIFICATIONS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

INSPECTION VERIFIES CLEANLINESS IS MAINTAINED. INSPECTION VERIFIES CORROSION PROTECTION PER MA0608-301.

ASSEMBLY/INSTALLATION

DIMENSIONS OF DETAIL PARTS VERIFIED BY INSPECTION. FASTENER INSTALLATION IS VERIFIED BY INSPECTION. ASSEMBLY AND RIGGING OF CENTERING MECHANISM IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION OF DETAIL PARTS IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

APPLICATION OF LB0140-005 DRY FILM LUBRICANT PER MA0112-302 IS VERIFIED BY INSPECTION. HEAT TREATING IS VERIFIED BY INSPECTION.

TESTING

ACCEPTANCE TESTING OF THE CENTERING MECHANISM ASSEMBLY PRIOR TO DELIVERY IS VERIFIED BY INSPECTION PER APPLICABLE PROCEDURES.

HANDLING/PACKAGING

HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATA BASE.

(E) OPERATIONAL USE:

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NONE

- APPROVALS -

S&R ENGINEER	:A. NGUYEN	:/s/ Anh Nguyen_____
CARGO/INTEG ITM	:J. CAPALENI	:/s/ Bob Dueease for_____
DESIGN ENGINEER	:P. HOE	:/s/ Pham Hoe_____
SSM	:L. J. SALVADOR	:/s/ Pham Hoe_for_____
NASA/DCE	:B. BROWN	:/s/ B. Brown_____
MOD	:K. SMITH	:/s/ K. Smith_____
SR&QA	:H. MALTBY	:/s/ Harry Maltby_____
USA SAM	:R. SMITH	:/S/ R. SMITH_____
USA CARGO/INTG ELEMENT	:S. KUNKEL	:/S/ S. KUNKEL_____
USA ORBITER ELEMENT	:S. LITTLE	:/S/ SUZANNE LITTLE_____