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ATTACHMENT
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FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: 02-4H-R101-X

SUBSYSTEM NAME: KU-BAND DEPLOY MECHANISM

REVISION : 2 10/01/90

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
SRU :	DEPLOYMENT MECHANISM ASSEMBLY	V070-544902

PART DATA

QUANTITY OF LIKE ITEMS: 1

FUNCTION:
REDUNDANT MOTORS ACT THROUGH A DIFFERENTIAL AND GEARBOX TO DRIVE THE KU-BAND DRIVE CAM. THE DRIVE CAM ROTATES THE KU-BAND ANTENNA TO STOW AND DEPLOY POSITIONS AND IS RETAINED BY ROLLER/DETENT LOCK MECHANISMS.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 02-4H-R101-01

REVISION# 2 10/01/90 R

SUBSYSTEM: KU-BAND DEPLOY MECHANISM

CRITICALITY OF THIS
FAILURE MODE:1R2

ITEM NAME: DEPLOYMENT MECHANISM ASSEMBLY

FAILURE MODE:
PHYSICAL BINDING/JAMMING

MISSION PHASE:

OO ON-ORBIT
DO DE-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, TEMPERATURE, VIBRATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:

- A)
- B)
- C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

FAILURE WILL RESULT IN A LOSS OF ABILITY TO DRIVE THE KU-BAND STOWED OR
DEPLOYED.

(B) INTERFACING SUBSYSTEM(S):

FAILURE WILL CAUSE MOTOR STALL AND RESULT IN AN INABILITY TO EITHER USE
KU-BAND SYSTEM OR CLOSE PAYLOAD BAY DOOR. PROCEDURALLY, DRIVE COMMAND
WILL BE REMOVED BEFORE MOTOR BURNOUT CAN OCCUR.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 02-4H-R101-01**(C) MISSION:**

FAILURE WILL RESULT IN A POSSIBLE LOSS OF MISSION DUE TO INABILITY TO USE KU-BAND SYSTEM.

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

FAILURE WILL REQUIRE JETTISON OF KU-BAND TO ALLOW PAYLOAD BAY DOOR CLOSURE. LOSS OF ALL REDUNDANCY RESULTS IN POSSIBLE LOSS OF CREW/VEHICLE DUE TO AN INABILITY TO CLOSE PAYLOAD BAY DOORS.

(E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

(A) DESIGN:

DESIGN INCLUDES CONTROLLED DIMENSIONS WITH DYNAMIC, TEMPERATURE, AND PRESSURE ALLOWABLES ON INTERACTING SURFACES TO PREVENT ADVERSE TOLERANCE ACCUMULATION EFFECTS. COMPONENTS ARE FABRICATED OF MATERIALS SUCH AS A-286 CRES, 440C CRES, BERYLLIUM COPPER AND INCONEL 718 AND ARE SUPPORTED BY BALL BEARINGS TO LIMIT WEAR AND PARTICLE GENERATION. SEALS PROTECT INTERNAL MOVING PARTS FROM FOREIGN CONTAMINATION. THE ASSEMBLY CONTAINS RECYCLE PROVISIONS. THE ULTIMATE FACTOR OF SAFETY IS 1.4 MINIMUM.

(B) TEST:

RIGGING TESTS: VERIFY ANTENNA INTERFACE PLATE IS LOCKED, DEPLOYED AND STOWED, WITH 1,200 INCH-LB TORQUE APPLIED. VERIFY ROTATIONAL POSITION ACCURACY. APPLY 24,000 INCH-LB TORQUE IN BOTH DIRECTIONS, THEN DISASSEMBLE, INSPECT, CLEAN, AND REASSEMBLE. REVERIFY POSITIONAL ACCURACY WITH TORQUE APPLIED. VERIFY SWITCH ASSEMBLY FUNCTION. VERIFY POSITIONAL ACCURACY IN THE FULL DEPLOY, INTERMEDIATE DEPLOY, AND STOW POSITIONS WITH THE MATCHED SET GEARBOX.

QUALIFICATION TESTS: THE FOLLOWING IS A SUMMARY OF TESTS CONDUCTED PER CR 44-544901-001 TO INCLUDE BOTH NATURAL AND INDUCED ENVIRONMENTAL EFFECTS TO THE KU-BAND DEPLOYMENT MECHANISM ASSEMBLY. FUNCTIONAL TESTS WERE CONDUCTED DURING AND FOLLOWING EACH PHASE OF TESTING TO DETERMINE EFFECTS. ENVIRONMENTS AND REQUIREMENTS ACCEPTED BY ANALYSIS INCLUDE FUNGUS, OZONE, SALT SPRAY, ACCELERATION, SOLAR RADIATION (THERMAL AND NUCLEAR), METEORIODS, SAND AND DUST, STORAGE, AND FACTOR OF SAFETY. FLIGHT VIBRATION LEVEL - 20 TO 2,000 HZ WITH MAXIMUM LEVEL OF 0.017 gZ/HZ AT 100 TO 250 HZ ALL AXES, WITH AND WITHOUT SIMULATED ANTENNA. THERMAL - STABILIZED RANGE FROM -100 DEG F TO +300 DEG F. FUNCTIONAL TESTS CONDUCTED AT -100 DEG F, +70 DEG F, AND +160 DEG F. LOAD - TESTS COMBINED AXIS LOADING TO 140% LIMIT LOAD. LIFE CYCLE TESTS - 1,000 CYCLES IN ADDITION TO CYCLES CONDUCTED DURING VARIOUS QUALIFICATION

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TESTING AT 24 VARIOUS LOAD AND MOTOR CONDITIONS. SEPARATION TESTS -
BREECH AND RELEASE NUT ACTUATED IN SIMULATED ZERO-G ENVIRONMENT.

OMRSD: DEPLOY MOTORS' PERFORMANCE IS VERIFIED DURING NORMAL IN-FLIGHT
OPERATIONS. GROUND TESTING WOULD BE ACCOMPLISHED WHEN A VALID
VERIFICATION IS UNOBTAINABLE DURING FLIGHT, OR FOLLOWING LRU
REPLACEMENT. ALSO, SINGLE MOTOR OPERATION IS VERIFIED EVERY FLOW:
DEPLOY MOTOR 1/STOW MOTOR 2 IS VERIFIED ON ODD FLOWS; AND DEPLOY MOTOR
2/STOW MOTOR 1 IS VERIFIED ON EVEN FLOWS.

(C) INSPECTION:

RECEIVING INSPECTION

INSPECTION VERIFIES MATERIAL AND PROCESS CERTIFICATIONS.

CONTAMINATION CONTROL

INSPECTION VERIFIES CORROSION PROTECTION PER MA0608-301 AND
MAINTENANCE OF COMPONENT CLEANLINESS PER MA0110-311 AND MA0110-306.

ASSEMBLY/INSTALLATION

INSPECTION VERIFIES ASSEMBLY AND RIGGING PER MLO308-0125 SPECIFICATION
REQUIREMENTS. INSPECTION VERIFIES DIMENSIONS AND SURFACE FINISHES.
INSPECTION VERIFIES INSTALLATION OF RIVETS, INSERTS, THREADED FASTENERS
AND LOCKWIRE PER SPECIFICATION REQUIREMENTS. INSPECTION VERIFIES
BEARING INSTALLATION.

NONDESTRUCTIVE EVALUATION

INSPECTION VERIFIES PENETRANT INSPECTION OF DETAIL PARTS.

CRITICAL PROCESSES

INSPECTION VERIFIES CHROME PLATING OF PIN, SOLDERING OF GROUNDING
SPRING ASSEMBLY, AND HEAT TREATING OF DETAIL PARTS.

TESTING

FUNCTIONAL TESTING OF THE ASSEMBLY IS VERIFIED PER PROCEDURE.

HANDLING/PACKAGING

HANDLING AND PACKAGING REQUIREMENTS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT
FAILURES ASSOCIATED WITH THIS FAILURE MODE.

(E) OPERATIONAL USE:

FAILURE WILL REQUIRE JETTISON OF KU-BAND TO ALLOW PAYLOAD BAY DOOR
CLOSURE AND PREVENT LOSS OF CREW/VEHICLE DURING ENTRY.

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- APPROVALS -

RELIABILITY ENGINEERING: D. M. MAYNE
DESIGN ENGINEERING : S. L. SHARP
QUALITY ENGINEERING : O. J. BUTTNER
NASA RELIABILITY :
NASA SUBSYSTEM MANAGER :
NASA QUALITY ASSURANCE :

G.E

D.M. Mayne 12/6/90
~~*S.L. Sharp*~~
~~*O.J. Buttner*~~
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[Signature] 3/6/91