FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-2A-011300 -X

SUBSYSTEM NAME: FLIGHT CONTROL MECH R/SB & BF
REVISION: 0 02/02/88

PART DATA

	PART NAME **VENDOR NAME**	**PART NUMBER** **VENDOR NUMBER**
	RUDDER/SPEEDBRAKE (R/SB)	
SRU	: ROTARY ACTUATOR	MC621-0053-0051
SRU	: ROTARY ACTUATOR	MC621-0053-0052
SRU	: ROTARY ACTUATOR	MC621-0053-0055
SRU	: ROTARY ACTUATOR	MC621-0053-0056

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
ROTARY ACTUATOR

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 4
FOUR

FUNCTION:
TRANSMITS RPM/TORQUE FROM RUDDER OR SPEEDBRAKE DRIVE SHAFTS TO NEXT DRIVE SHAFT AND LEFT HAND AND RIGHT HAND PANELS.

FAILURE MODES EFFECTS ANALYSIS FMEA – CIL FAILURE MODE
NUMBER: 02-2A-011300- 01

REVISION#: 1 08/07/98

SUBSYSTEM NAME: FLIGHT CONTROL - RUDDER SPEED BRAKE
LRU:
ITEM NAME: ROTARY ACTUATOR

CRITICALITY OF THIS FAILURE MODE: 1/1

FAILURE MODE:
FAILS TO TRANSMIT RPM/TORQUE. JAMMED OR OPEN DRIVELINE.

MISSION PHASE: DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102	COLUMBIA
103	DISCOVERY
104	ATLANTIS
105	ENDEAVOUR

CAUSE:
BROKEN GEAR TEETH, SEIZED GEAR OR BEARING, OVERLOAD, MATERIAL DEFECT.

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:
LOSS OF RPM TORQUE OUTPUT FROM ONE OR MORE ROTARY ACTUATORS. RESULTING IN LOSS OF RUDDER AND SPEEDBRAKE FUNCTIONS.

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(B) INTERFACING SUBSYSTEM(S):
NONE

(C) MISSION:
LOSS OF MISSION, CREW/VEHICLE.

(D) CREW, VEHICLE, AND ELEMENT(S):
SAME AS (C)

-DISPOSITION RATIONALE-

(A) DESIGN:
GEARS AND SHAFTS DESIGNED BY SIZING FOR MAXIMUM TORQUE WITH 1.4 SAFETY FACTOR. CARBURIZED STEEL FOR GEARS VACUUM MELT PER AMS 6265 WITH CARBURIZING TO AGMA 246.01. SHOT PEEN TO MIL-S-13165. HEAVILY LOADED GEARS ARE GRIT BLASTED TO REMOVE SURFACE INTERGRANULAR OXIDATION (IGO), WITH LIGHTLY LOADED GEARS GROUND FOR IGO REMOVAL. GEAR STRESS ANALYSIS PER LEWIS EQUATION WITH FATIGUE ANALYSIS BASED ON MISSION DUTY CYCLES X 4 FOR DESIGN REQUIREMENT. SEALED PROPERLY ASSEMBLED GEARBOXES ACCEPTED PER MCR231. BEARINGS DESIGNED FOR B-10 LIFE MINIMUM.

(B) TEST:
QUALIFICATION TESTS: QUALIFICATION TESTING - CYCLE TESTED FOR OPERATING AND DYNAMIC LOAD CYCLES PER MISSION X 4 PLUS AN ULTIMATE LOAD TEST TO 1.4 X THE DESIGN LIMIT LOAD, THERMAL CYCLE (-40 DEG F TO +275 DEG F), VIBRATION (20 TO 2,000 HZ), ULTIMATE LOAD, STIFFNESS, AND FATIGUE LIFE.

ACCEPTANCE TESTS: FREEPLAY OPERATING HINGE MOMENT AND SURFACE RATE.

GROUND TURNAROUND TEST
ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:
RECEIVING INSPECTION
MATERIAL AND PROCESS CERTIFICTIONS VERIFIED, INCLUDING GEAR CERTIFICATION, CONTROLS, AND MATERIAL IDENTIFICATION, CODE, MILL SOURCE, HEAT NUMBER, CHEMICAL ANALYSIS AND HARDNESS VERIFICATION.

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CONTAMINATION CONTROL
CORROSION/CONTAMINATION PROTECTION REQUIREMENTS ARE VER FIED BY INSPECTION.

ASSEMBLY/INSTALLATION
ASSEMBLY AND INSTALLATIONS ARE VERIFIED BY SHOP TRAVELER MANDATORY INSPECTION POINTS (MIPS). BALL BEARINGS ARE INSTALLED. BALL CONTROLLED AND VERIFIED PER DRAWING REQUIREMENTS. ALIGNMENT REQUIREMENTS VERIFIED. SHAFT AND SPLINE MATERIAL INSPECTED AND VERIFIED PER DRAWING REQUIREMENTS. BEARING LUBRICATION VERIFIED

NONDESTRUCTIVE EVALUATION
ULTRASONIC INSPECTION AND MAGNETIC PARTICLE INSPECTION ARE VERIFIED.

CRITICAL PROCESSES
HEAT TREATMENT AND PARTS PASSIVATION ARE VERIFIED. PLATING, SHOT PEENING, AND COATING PROCESS VERIFIED. APPLICATION OF DRY FILM LUBE TO INTERNAL SPLINE AFTER PLATING VERIFIED BY INSPECTION.

TESTING
ACCEPTANCE TESTS CERTIFICATIONS VERIFIED BY INSPECTION

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:
NONE.

- APPROVALS -

EDITORIALLY APPROVED	: BNA	J. Kumura 8-18-98
TECHNICAL APPROVAL	: VIA APPROVAL FORM	. 95-CIL-009_02-2A