PRINT DATE 08/18/98

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-2A-021111 -X

SUBSYSTEM NAME: FLIGHT CONTROL MECH - RUDDER SPEED BRAKE & BF
REVISION: 0 02/02/88

PART DATA

	PART NAME / **VENDOR NAME**	**PART NUMBER** / **VENDOR NUMBER**
ASSY	: BODY FLAP ACTUATION	MC621-0056-0083
SRU	: SUMMER DIFFERENTIAL	

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
SUMMER DIFFERENTIAL (SECOND STAGE)

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 2
TWO REQUIRED

FUNCTION:
FIRST AND SECOND STAGE DIFFERENTIALS SUM THE RPM/TORQUE OUTPUT FROM THREE BODY FLAP HYDRAULIC MOTORS INTO A SINGLE SHAFT RPM/TORQUE OUTPUT. FIRST STAGE SUMS OUTPUT FROM TWO HYDRAULIC MOTORS. SECOND STAGE SUMS OUTPUT FROM THE FIRST STAGE DIFFERENTIAL AND THIRD HYDRAULIC MOTOR.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE
NUMBER: 02-2A-021111-05

REVISION#: 1 08/07/98
SUBSYSTEM NAME: FLIGHT CONTROL MECH - RUDDER SPEED BRAKE & BF
LRU: **CRITICALITY OF THIS**
ITEM NAME: SUMMER DIFFERENTIAL **FAILURE MODE:** 1/1

FAILURE MODE:
NO RPM/TORQUE OUTPUT, OPEN DRIVELINE

MISSION PHASE: DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102	COLUMBIA
103	DISCOVERY
104	ATLANTIS
105	ENDEAVOUR

CAUSE:
FRACTURED OUTPUT SHAFT, SPLINE, OR GEAR

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 FIRST STAGE SUMMER DIFFERENTIAL FUNCTION. THIRD HYDRAULIC MOTOR RPM/TORQUE OUTPUT BACKDRIVES INTO FIRST STAGE DIFFERENTIAL/OPEN DRIVELINE, RESULTING IN LOSS OF BODY FLAP FUNCTION.

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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:
SEALED GEARBOXES ACCEPTED BY PROGRAM PER MCR 231. MANUFACTURING PROCESSES ELIMINATE SURFACE DEFECTS AND INTERNAL CARBIDES. GEARS/SHAFTS DESIGNED FOR MAXIMUM TORQUE X 1.4 SAFETY FACTOR. CARBURIZED STEEL FOR GEARS VACUUM MELT PER AMS 6265 WITH CARBURIZING TO AGMA 246.01. SHOTPEEN TO MIL-S-13165. HEAVILY LOADED GEARS GRIT BLASTED FOR REMOVAL OF INTERGRANNULAR OXIDATION (IGO); LIGHTLY LOADED GEARS ARE GROUND FOR IGO REMOVAL. GEAR STRESS ANALYSIS PER LEWIS EQUATION. FATIGUE ANALYSIS BASED ON GREATEST MISSION DUTY CYCLES X 4 FOR DESIGN REQUIREMENTS. BEARING DESIGNED FOR B-10 LIFE MINIMUM.

(B) TEST:
QUALIFICATION TESTS: QUALIFICATION TESTING INCLUDES OPERATING CYCLE TEST FOR MAXIMUM LOAD CYCLES PER MISSION X 4 WITH A RUN IN AND STATIC PROOF TORQUE TO 1.5 X OPERATIONAL HYDRAULIC PRESSURE, THERMAL CYCLE (-40 DEG F TO +275 DEG F), VIBRATION FROM 20 TO 2,000 HZ RANDOM, ULTIMATE LOAD, STIFFNESS, AND FATIGUE LIFE.

ACCEPTANCE TESTS: PRESSURE IMPULSE AND THERMAL CYCLING, OPERATING HINGE MOMENT AND SURFACE RATE.

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

(C) INSPECTION:
RECEIVING INSPECTION

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MATERIAL AND PROCESS CERTIFICATIONS VERIFIED, INCLUDING GEAR CERTIFICATIONS. CONTROLS. AND MATERIAL IDENTIFICATION CODE. MILL SOURCE, HEAT NUMBER. CHEMICAL ANALYSIS AND HARDNESS VERIFICATION.

CONTAMINATION CONTROL
CONTAMINATION/CORROSION CONTROL PROCEDURES AND PRACTICES ARE VERIFIED.

ASSEMBLY/INSTALLATION
ASSEMBLY AND INSTALLATION OPERATIONS VERIFIED BY SHOP TRAVELER MANDATORY INSPECTION POINTS (MIPS). ALIGNMENT REQUIREMENTS ARE VERIFIED SURFACE TEMPER INSPECTION (MICROSTRUCTURE EVALUATION WITH NITAL ETCH) IS VERIFIED.

NONDESTRUCTIVE EVALUATION
ULTRASONIC INSPECTION AND MAGNETIC PARTICLE INSPECTION ARE VERIFIED.

CRITICAL PROCESSES
DRY FILM LUBRICANT, ELECTROLESS NICKEL PLATE, SHOT PEEN, AND GRIT BLAST ARE VERIFIED. HEAT TREATING, INCLUDING CARBURIZATION, IS VERIFIED.

TESTING
CERTIFICATIONS OF ACCEPTANCE TESTS VERIFIED.

HANDLING/PACKAGING
HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED.

(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 -

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