FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-2C-C01-SW-C -X

SUBSYSTEM NAME: FLIGHT CONTROL - ELEVON ACTUATOR
REVISION: 2 04/30/93

PART DATA

	PART NAME **VENDOR NAME**	**PART NUMBER** **VENDOR NUMBER**
LRU	:ELEVON ACTUATOR	MC621-0014
SRU	:SWITCHING VALVE MOOG	A39490

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

QUANTITY OF LIKE ITEMS: 4
ONE PER ACTUATOR

FUNCTION:
AUTOMATICALLY PROVIDES POWER FROM ONE OF THREE HYDRAULIC SYSTEMS. THE VALVE SENSES AN ACTIVE SYSTEM LOSS AND AUTOMATICALLY SWITCHES TO A STANDBY SYSTEM. THE VALVE WILL RESET IF THE FAILED SYSTEM REGAINS ITS PROPER PRESSURE LEVEL. VALVE SPOOL POSITION IS PROVIDED.

PRINT DATE: 08/24/98

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 02-2C-C01-SW-C- 02

REVISION#: 1 08/20/98

SUBSYSTEM NAME: FLIGHT CONTROL - ELEVON ACTUATOR
LRU: ELEVON ACTUATOR
ITEM NAME: SWITCHING VALVE

CRITICALITY OF THIS FAILURE MODE: 1R2

FAILURE MODE:
SECONDARY SPOOL FAILS IN SECOND STANDBY SYSTEM POSITION.

MISSION PHASE:
LO LIFT-OFF
DO DE-ORBIT

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

CAUSE:
CONTAMINATION, JAMMED

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:
LOSS OF USE OF PRIMARY AND FIRST STANDBY HYDRAULIC SYSTEM DUE TO INABILITY TO SWITCH OUT SECOND STANDBY HYDRAULIC SYSTEM.

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(B) INTERFACING SUBSYSTEM(S):
NONE

(C) MISSION:
POSSIBLE ABORT DECISION.

(D) CREW, VEHICLE, AND ELEMENT(S):
NONE

(E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS OF MISSION, CREW/VEHICLE AFTER TWO FAILURES: SECOND SWITCHING VALVE STUCK IN STANDBY POSITION AND SUBSEQUENT LOSS OF SECOND STANDBY SYSTEM. LOSS OF FUNCTION CAN RESULT IN LOSS OF VEHICLE CONTROL.

-DISPOSITION RATIONALE-

(A) DESIGN:
SPOOL AND SLEEVE ARE 440C MATERIAL, HARDENED AND LAPPED FOR A MATCHED SET. SPOOL IS GROOVED TO CLEAR SILTING. EACH HYDRAULIC SYSTEM HAS A 5 MICRON FILTER UPSTREAM OF ACTUATOR THAT PROTECTS THE SWITCHING VALVE FROM CONTAMINATION. FORCE DEVELOPED ON SWITCHING VALVE SPOOL IS IN EXCESS OF 500 POUNDS TO CLEAR CONTAMINATION.

(B) TEST:
QUALIFICATION: 20,000 SWITCHING CYCLES PERFORMED. ACTUATOR WAS VIBRATED TO FLIGHT LEVELS AND WAS TESTED AT -65 AND 250 DEGREES F. 100,000 PRESSURE IMPULSE CYCLES AT EACH SUPPLY AND RETURN PORT, AT 225 DEGREES F. SUPPLY PORTS WERE CYCLED FROM 3,000 PSIG TO 4,500 PSIG TO 1,500 PSIG, BACK TO 3,000 PSIG EACH CYCLE; RETURN PORTS, FROM 750 PSIG TO 1,500 PSIG TO 0 PSIG, BACK TO 750 PSIG. VERIFIED THAT ALL PARTS WERE WITHIN ACCEPTABLE LIMITS DURING QUALIFICATION.

ACCEPTANCE: FOUR SWITCHING VALVE CYCLES AT HIGH (MAIN PUMP) AND LOW (CIRCULATION PUMP) PRESSURES. PERFORMANCE TESTS VERIFY THAT THE SWITCHING VALVE IS OPERATIONAL. FLUID FROM ACTUATOR IS VERIFIED TO MEET CLEANLINESS LEVEL 190 PER MAO110-301.

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

(C) INSPECTION:
RECEIVING INSPECTION
RAW MATERIAL CERTIFICATION ARE VERIFIED. SPECIAL MATERIAL REQUIREMENTS ARE IDENTIFIED IN CERTIFICATIONS.

NDE
PIECE PARTS EVALUATED BY SELECTED PENETRANT, MAGNETIC PARTICLE, ULTRASONIC, AND RADIOGRAPHIC INSPECTIONS.

SPECIAL PROCESSES
CRITICAL/CLOSE TOLERANCE DIMENSIONS AND FINISHES ARE 100 PERCENT INSPECTED FOLLOWING MACHINING.

CONTAMINATION CONTROL
ASSEMBLY AREA CLEANLINESS IS VERIFIED BY CONTAMINATION CONTROL PLAN. COMPONENTS ARE PRECLEANED PRIOR TO ASSEMBLY. PARTS AND TOOLS/AIDS ARE CLEANED PRIOR TO ASSEMBLY. END ITEM FLUID SAMPLE IS VERIFIED PRIOR TO ACTUATOR DELIVERY.

TESTING
ROCKWELL DESIGN AND QUALITY PERSONNEL, WITH NASA PARTICIPATION, CONDUCT A DETAILED ACCEPTANCE REVIEW OF THE HARDWARE AT THE VENDOR'S FACILITY, PRIOR TO THE SHIPMENT OF EACH END ITEM COVERED BY CONTROL PLAN. ATP VERIFICATION IS MIP FOR RI QA REPRESENTATIVE.

(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. Kemuss 8-24-98
TECHNICAL APPROVAL	: VIA APPROVAL FORM	: 95-CIL-009_02-2C