

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER: 02-1B-032 -X**

**SUBSYSTEM NAME: LANDING/DECELERATION - BRAKE/SKID CONTROL SYS
REVISION: 0 03/07/88**

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
	: BRAKE SKID CONTROL	
LRU	: MLG BRAKE SYSTEM HYDRO-AIRE	MC621-0055 40-899

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
BRAKE CONTROL COMMAND TRANSDUCER.**

QUANTITY OF LIKE ITEMS: 8
RH/LH PILOT-TWO
RH/LH COMMANDER-TWO

FUNCTION:
CONTROL SYSTEM UTILIZES FOUR COMMAND TRANSDUCERS (EACH TRANSDUCER HAS 4 OUTPUT COMMANDS) THAT CONVERT BRAKE PEDAL DEFLECTION INTO COMMAND SIGNALS TO THE CONTROL CIRCUIT ASSOCIATED WITH ONE OF THE FOUR BRAKE CHAMBERS ON EACH LANDING GEAR.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 02-1B-032- 02

REVISION#: 0 12/20/96

SUBSYSTEM NAME: LANDING/DECELERATION - BRAKE/SKID CONTROL SYS

LRU: MLG BRAKE SYSTEM

CRITICALITY OF THIS

ITEM NAME: BRAKE CONTROL COMMAND TRANSDUCER

FAILURE MODE: 1R2

FAILURE MODE:

NO OUTPUT (MECHANICAL).

MISSION PHASE: DO DE-ORBIT

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

CAUSE:

BINDING OR BROKEN LINKAGE, STRUCTURAL FAILURE.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN	A) PASS
	B) FAIL
	C) PASS

PASS/FAIL RATIONALE:

A)

B)

SCREEN "B" FAILS BECAUSE THERE IS NO INDICATION OF THIS FAILURE UNTIL BRAKES ARE APPLIED.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF REDUNDANCY FOR BRAKE APPLICATION.

(B) INTERFACING SUBSYSTEM(S):

LOSS OF BRAKE APPLICATION CONTROL BY ONE CREW MEMBER.

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(C) MISSION:

POSSIBLE LOSS OF MISSION/CREW/VEHICLE WITH TWO FAILURES THAT CAUSE LOSS OF BRAKE CONTROL BY COMMANDER AND PILOT.

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

(E) FUNCTIONAL CRITICALITY EFFECTS:

-DISPOSITION RATIONALE-

(A) DESIGN:

LINKAGES ARE DESIGNED AND FABRICATED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF MIL-H-5440, MIL-H-8775 AND MIL-V-5529. THE CMD XDCR IS DESIGNED TO OPERATE AFTER BEING SUBJECTED TO A SAWTOOTH SHOCK PULSE OF 50-G PEAK MAGNITUDE FOR A DURATION OF 10 - 12 MILLISECONDS. DESIGN MINIMUM FACTOR OF SAFETY FOR THE LINKAGES IS 1.4.

(B) TEST:

QUALIFICATION TEST: ENVIRONMENT TESTING INCLUDE; HUMIDITY, SALT FOG, VIBRATION ACCELERATION AND SHOCK - TEST SPECIMEN ARE SUBJECTED TO FUNCTIONAL TESTS BEFORE AND AFTER EACH ENVIRONMENT TEST. EQUIPMENT NORMALLY OPERATING DURING EXPOSURE TO THESE ENVIRONMENTS ARE ALSO FUNCTIONALLY MONITORED DURING QUALIFICATION TESTING. LANDING ACCELERATION - THE COMMAND TRANSDUCER IS SUBJECTED TO 10G UPWARD/7.5G DOWNWARD LANDING ACCELERATION IN THE VERTICAL AXIS AND 0.8 AFT/2G FORWARD IN THE LONGITUDINAL AXIS. THIS LANDING ACCELERATION IS MAINTAINED FOR A MINIMUM OF 5 MINUTES.

ACCEPTANCE TEST: ACCEPTANCE TESTS ARE PERFORMED ON ALL UNITS DELIVERED FOR FUNCTIONAL USE - THE TESTS INCLUDE; COMPONENT FUNCTIONAL TESTS AND PROOF PRESSURE TESTING. ALL HYDRAULIC COMPONENTS ARE CAPABLE OF WITHSTANDING 60,000 PRESSURE IMPULSLE CYCLES WHILE AT FLUID TEMPERATURE OF 200 DEG F.

OMRSD: BRAKE PEDAL/HYDRAULIC DYNAMIC INSTABILITY;
TEST CONDITIONS -

- (1) RMG/LMG WOW SIGNALS ACTIVATED (INDICATORS OFF)
- (2) HYDRAULIC SYSTEM 1,2 & 3 SUPPLY PRESSURE AT 3000 PLUS OR MINUS 200 PSI.
- (3) SKID CONTROL ACTIVATED (FAIL INDICATOR OFF)

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DURING THIS TEST EACH BRAKE PEDAL IS PUMPED TO 1/4, 1/2, 3/4 AND FULL STROKE WHILE IT'S ADJACENT PEDAL IS HELD IN THE FULLY DEPRESSED POSITION-THE CORRESPONDING BRAKE PRESSURES ARE VERIFIED.

FREQUENCY - ALL VEHICLES AT GROUND TURNAROUND.

(C) INSPECTION:
RECEIVING INSPECTION
MATERIAL AND PROCESS CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS, CONTAMINATION CONTROL, AND CORROSION PROTECTION
REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
TRANSDUCER IS VISUALLY AND DIMENSIONALLY VERIFIED DURING FABRICATION.
INSPECTION VERIFIES DIMENSIONS OF DETAIL PARTS AND VERIFIES FABRICATION AND ASSEMBLY OPERATIONS.

CRITICAL PROCESSES
INSPECTION VERIFIES SILVER TORCH BRAZING AND SOLDERING OF THE COIL. HEAT-TREATMENT OF THE PROBE AND ANODIZATION OF THE CASES ARE VERIFIED BY INSPECTION.

TESTING
ACCEPTANCE TESTING IS VERIFIED BY INSPECTION.

PACKAGING/HANDLING
HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
NONE.

(E) OPERATIONAL USE:
PEDALS CHECKED DURING FLIGHT CONTROL SYSTEMS CHECKOUT WHICH OCCURS ONE DAY BEFORE ENTRY.

- APPROVALS -

EDITORIALLY APPROVED : RI
EDITORIALLY APPROVED : JSC
TECHNICAL APPROVAL : VIA JSC

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: 96-CIL-011