FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-1B-027 -X

SUBSYSTEM NAME: LANDING/DECELERATION - BRAKE/SKID CONTROL SYS
REVISION: 0 09/19/88

PART DATA

	PART NAME **VENDOR NAME**	**PART NUMBER** **VENDOR NUMBER**
	: BRAKE/SKID CONTROL	
SRU	: MLG BRAKE SYSTEM HYDRO-AIRE	MC621-0055 42-40317

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
BUILT-IN TEST CIRCUIT CARD

QUANTITY OF LIKE ITEMS: 8
LEFT HAND-FOUR
RIGHT HAND-FOUR

FUNCTION:
BUILT-IN TEST CIRCUIT PROVIDES FAULT DETECTION CAPABILITY FOR A MAIN WHEEL SKID CONTROL CIRCUIT. PROVIDES CONTINUOUS MONITORING OF WHEEL SPEED SENSOR/CONTROL INTERFACE, SKID CONTROL SERVO VALVE/CONTROL INTERFACE, AND A SHORT DURATION PERFORMANCE ASSESSMENT TEST OF THE CONTROL CIRCUIT.

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REVISION#: 1 12/20/96
SUBSYSTEM NAME: LANDING/DECELERATION - BRAKE/SKID CONTROL SYS
LRU: MLG BRAKE SYSTEM **CRITICALITY OF THIS**
ITEM NAME: BUILT-IN-TEST CIRCUIT CARD **FAILURE MODE:** 1R3

FAILURE MODE:
FAILS TO DETECT FAULT IN SKID CONTROL CIRCUIT CARD.

MISSION PHASE: LS LANDING/SAFING

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102	COLUMBIA
103	DISCOVERY
104	ATLANTIS
105	ENDEAVOUR

CAUSE:
COMPONENT FAILURE, VIBRATION, MECHANICAL SHOCK.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:
A)

B)
FAILS SCREEN "B" BECAUSE TEST CARD DOES NOT ALERT THIS CONDITION WHEN SYSTEM IS ACTIVATED.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF ANTISKID BOX FAULT DETECTION.

(B) INTERFACING SUBSYSTEM(S):

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NO EFFECT - HOWEVER, SKID CARD FAILURE TO FUNCTION WILL CAUSE LOSS OF SKID PROTECTION TO HALF OF ONE BRAKE. SKID CARD FAILING IN THE "SKID" MODE (FAILED "ON") WILL CAUSE LOSS OF 12.5 % BRAKING. SKID CARD FAILURE TO PROVIDE SKID PROTECTION MAY RESULT IN LOSS OF 50% BRAKING AND POSSIBLE STRUT COLLAPSE DUE TO TIRE/WHEEL FAILURE(S) RESULTING FROM A SKID.

(C) MISSION:
POSSIBLE LOSS OF MISSION/CREW/VEHICLE WITH FAILURE OF FOUR(4) BUILT-IN TEST CARDS AND FAILURE OF THE CORRESPONDING FOUR(4) SKIDCARDS ALL ON THE SAME SIDE. ALSO, LOSS OF SKID PROTECTION MAY CAUSE LOSS OF CREW/VEHICLE (SEE B).

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

(E) FUNCTIONAL CRITICALITY EFFECTS:

-DISPOSITION RATIONALE-

(A) DESIGN:
BASIC DESIGN CONCEPT HAS BEEN PROVEN BY MANY HOURS OF COMMERCIAL AND MILITARY SERVICE. ELECTRONIC PARTS WERE SELECTED FROM ORBITER PROJECT PARTS LIST (OPPL). THOSE COMPONENTS NOT ON THE OPPL WERE AUTHORIZED ON AN IRREGULAR PARTS AUTHORIZATION REQUEST. THE CONTROL BOX IS DESIGNED TO OPERATE AFTER BEING SUBJECTED TO A SAWTOOTH SHOCK PULSE OF 20G PEAK MAGNITUDE FOR A DURATION OF 10 TO 12 MILLISECONDS. ELECTRICAL DESIGN REQUIREMENTS ARE IN ACCORDANCE WITH MF0004-002.

(B) TEST:
QUALIFICATION TESTS: ENVIRONMENTAL TESTING INCLUDES; 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.

ACCEPTANCE VIBRATION TEST IN ACCORDANCE WITH NASA SPECIFICATION SP-T- 0023B ARE PERFORMED ON THE BRAKE/SKID CONTROL BOX. THE BRAKE/SKID CONTROL SYSTEM IS SUBJECTED TO 10G UPWARD/7G 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.

OMRSD: BRAKE/SKID ON-OFF FLIGHT QUALIFICATION TEST;

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EACH BRAKE PEDAL IS DEPRESSED TO A POSITION THAT PRODUCES 1.7 VDC OF XDCR OUTPUT AND THE CORRESPONDING SKID CONTROL FAULT DETECTION (SELF TEST) INDICATIONS, WHEEL/VALVE FAULT DETECTION INDICATIONS AND BRAKE PRESSURES ARE VERIFIED.

WITH THE PEDAL STILL DEPRESSED, THE SKID CONTROL IS SWITCHED "OFF" AND THEN "ON" AGAIN - ALL THE PARAMETERS MENTIONED ABOVE ARE VERIFIED FOR PROPER INDICATIONS AT EACH STEP.

FREQUENCY: 102, 103 AND 104 - NEXT FLIGHT AND AT FIVE FLIGHT INTERVALS THEREAFTER. FOR 105 - FIRST, SECOND, FIFTH FLIGHTS AND AT FIVE FLIGHT INTERALS THEREAFTER.

BRAKE/SKID CONTROL TEST (WOW):
VERIFIES OPERATION OF THE ANTI-SKID FUNCTIONS OF CONTROL BOXES "A" AND "B".

FREQUENCY - ALL VEHICLES AT GROUND TURNAROUND.

(C) INSPECTION:
RECEIVING INSPECTION
MATERIAL AND PROCESS CERTIFICATION ARE VERIFIED BY INSPECTION. RECEIVING INSPECTION VERIFIES FUNCTIONAL CHARACTERISTICS. INSPECTION VERIFIES COUNT AND INSPECTS FOR IDENTITY AND DAMAGE.

ASSEMBLY/INSTALLATION
FABRICATION IS CONTROLLED BY SEQUENCE. DESIGNATED SHUTTLE PROJECT FABRICATION AREA VERIFIED BY INSPECTION, ACCEPTABLE PRIOR TO FABRICATION.

CRITICAL PROCESSES
INSPECTION VERIFIES ORIENTATION IS CORRECT ON ORIENTATION SENSITIVE PARTS PRIOR TO SOLDERING. SOLDERING CONTROLLED PER NMB 5300.4. TECHNICIANS AND INSPECTOR CERTIFIED.

NONDESTRUCTIVE EVALUATION
INSPECTION VERIFIES BLACK-LIGHT INSPECTION FOR SOLDER RESIN RESIDUE.

TESTING
ATP IS VERIFIED BY INSPECTION, INCLUDING CIRCUIT BOARDS INSPECTED FOR CONTINUITY, RESISTANCE, AND OUTPUT.

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

(D) FAILURE HISTORY:
NONE.

(E) OPERATIONAL USE:

PRINT DATE: 12/20/96

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CREW CAN COMPENSATE EITHER BY CHANGING BRAKING PROCEDURE AND/OR BY USING NWS TO MAINTAIN DIRECTIONAL CONTROL.

- APPROVALS -

EDITORIALLY APPROVED	: RI	: Robert Stell Jr 12/20/96
EDITORIALLY APPROVED	: JSC	: Sam Geary
TECHNICAL APPROVAL	: VIA JSC	:96-CIL-011