PRINT DATE: 01/17/96

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER:05-1-FC3242 -X

SUBSYSTEM NAME: GUIDANCE, NAVIGATION, & CONTROL

REVISION: 0 06/28/88

PART DATA

| | PART NAME<br>VENDOR NAME | PART NUMBER<br>VENDOR NUMBER |
|---|---|---|
| LRU | :SPEED BRAKE THRUST CONTROL | MC621-0043-3240 |

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
SPEED BRAKE THRUST CONTROL (SBTC). CMDR AND PILOT.

REFERENCE DESIGNATORS: 31V73A2A2
35V73A3A3

QUANTITY OF LIKE ITEMS: 2
TWO REQUIRED

FUNCTION:
PROVIDES MANUAL MEANS TO POSITION THE SPEED BRAKE DURING ATMOSPHERIC FLIGHT AND PROVIDES MANUAL MEANS TO CONTROL THRUST OF THE MAIN PROPULSION SYSTEM ENGINES DURING ASCENT. SELECTION BETWEEN THRUST CONTROL AND SPEED BRAKE FUNCTIONS IS PROVIDED IN THE SOFTWARE.

PRINT DATE: 01/17/98

FAILURE MODES EFFECTS ANALYSIS FMEA – CIL FAILURE MODE
NUMBER: 05-1-FC3242-01

REVISION#: 1 01/03/96

SUBSYSTEM NAME: GUIDANCE, NAVIGATION, & CONTROL
LRU: SPEED BRAKE THRUST CONTROL
ITEM NAME: SPEED BRAKE THRUST CONTROL

CRITICALITY OF THIS FAILURE MODE: 1R2

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**FAILURE MODE:**
ERRONEOUS OR LOSS OF OUTPUT (TWO OR MORE CHANNELS)

**MISSION PHASE:** LO LIFT-OFF

**VEHICLE/PAYLOAD/KIT EFFECTIVITY:**

| | |
|---|---|
| 102 | COLUMBIA |
| 103 | DISCOVERY |
| 104 | ATLANTIS |
| 105 | ENDEAVOUR |

**CAUSE:**
PHYSICAL JAMMING DUE TO VIBRATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL FAILURE OR CONTAMINATION.

**CRITICALITY 1/1 DURING INTACT ABORT ONLY?** YES
TAL TRANS-ATLANTIC LANDING

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**REDUNDANCY SCREEN**

A) PASS
B) PASS
C) PASS

**PASS/FAIL RATIONALE:**
A)

B)

C)

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- FAILURE EFFECTS -

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**(A) SUBSYSTEM:**
NO EFFECT IN AUTO. LOSS OF MANUAL MAIN ENGINE THROTTLING CAPABILITY DURING ASCENT (PILOT'S STATION FAILURE ONLY).

**(B) INTERFACING SUBSYSTEM(S):**
SAME AS (A)

**(C) MISSION:**

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FIRST FAILURE (PILOT'S SBTC ANOMALY) NO EFFECT. SECOND FAILURE (AUTO THROTTLE ANOMALY COUPLED WITH FIRST FAILURE) RESULTS IN LOSS OF CAPABILITY TO THROTTLE MAIN ENGINE. FLIGHT SOFTWARE ONLY ACCEPTS INPUT COMMANDS FROM PILOT'S SBTC.

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
CRIT 1 FOR TAL BECAUSE LOSS OF MANUAL ENGINE THROTTLING MAY RESULT IN LOSS OF CREW/VEHICLE; ENGINES REQUIRED TO BE THROTTLED BACK TO PROVIDE TIME FOR OMS PROPELLANT DUMPING. CRIT 1R BECAUSE LOSS OF MAIN ENGINE THROTTLING CAPABILITY MAY CAUSE LOSS OF CREW/VEHICLE.

-DISPOSITION RATIONALE-

(A) DESIGN:
THE ELECTROMECHANICAL DESIGN HAS A CERTIFIED OPERATIONAL LIFE OF 23,500 HOURS. THE QUALIFIED CYCLIC LIFE OF THE OPERATIONAL ENVELOPE WAS CERTIFIED FOR 5,000 ACTUATION TO EACH STOP. ANALYSIS OF THE LOAD BEARING MECHANISMS INDICATE A YIELD LIMIT OF AT LEAST 1.4 TIMES THE OPERATIONAL DESIGN LOAD. UNIT IS COMPLETELY ENCLOSED TO PREVENT DEBRIS FROM ENTERING AND JAMMING MECHANISM.

ALL ELECTRICAL, ELECTRONIC AND ELECTROMECHANICAL (EEE) PIECE PARTS WHICH MAKE UP THE SBTC ARE CONTROLLED TO THE ORBITER PROJECT PARTS LIST (OPPL) REQUIREMENTS OF MF0004-400. PASSIVE EEE PARTS AND ELECTRICAL CONNECTORS ARE MILITARY QUALIFIED AND 100% SCREENED TO OPPL REQUIREMENTS. MICRO-CIRCUITS ARE QUALIFIED TO MIL-M-38510 AND SCREENED TO MIL-S-883, LEVEL B. SEMICONDUCTOR DEVICES ARE JANTXV LEVEL. CIRCUIT DESIGN LIMITS WORST CASE JUNCTION TEMPERATURES TO 95 DEG C, AND ELECTRICAL STRESSES TO 50% OF RATED CAPABILITY FOR ALL PARTS.

(B) TEST:
ACCEPTANCE TESTING, WHICH INCLUDES ACCEPTANCE THERMAL TESTING (ATT) AND ACCEPTANCE VIBRATION TESTING (AVT), IS PERFORMED ON EACH UNIT. QUALIFICATION TESTING, INCLUDING VIBRATION, SHOCK, TEMPERATURE WAS COMPLETED TO CERTIFY DESIGN. INTEGRATED/SUBSYSTEM VERIFICATION IS PERFORMED DURING TURNAROUND. FUNCTIONAL TEST OF SPEED BRAKE AND THRUST CONTROL IS MONITORED TO VERIFY OPERATION WITHIN SPECIFICATION.

(C) INSPECTION:
RECEIVING INSPECTION
INCOMING MATERIAL IS VERIFIED BY RECEIVING INSPECTION.

CONTAMINATION CONTROL
HARDWARE AND FACILITY CONTAMINATION CONTROL MONITORED BY INSPECTION. FINAL ASSEMBLY AND REWORK PERFORMED IN A CLEAN ROOM.

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ASSEMBLY/INSTALLATION
QUALITY PLANNING ENSURES ALL DRAWING AND PROCUREMENT REQUIREMENTS ARE PUT INTO IN-PROCESS WORK TICKETS. TORQUING (ACCEPT/REJECT) VERIFIED BY INSPECTION. MECHANICAL RIGGING AND TORQUING ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
RADIOGRAPHIC ANALYSIS, ULTRASONIC TESTING, DYE PENETRANT AND MAGNETIC PARTICLE ANALYSIS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
POTTING, BONDING, FUSION WELDING, SOLDERING AND MATERIAL CLEANING VERIFIED BY INSPECTION.

TESTING
ENVIRONMENTAL ACCEPTANCE TESTING IS OBSERVED AND VERIFIED BY QUALITY CONTROL.

HANDLING/PACKAGING
THE PACKING AND PACKAGING REQUIREMENTS ARE MET BY USE OF SPECIAL QUALIFIED CONTAINERS FOR IN-PLANT TRANSPORTATION AND SHIPPING.

**(D) FAILURE HISTORY:**
NO PHYSICAL JAMMING FAILURES INCLUDING LINKAGE FAILURES HAVE OCCURRED DURING DEVELOPMENT, QUALIFICATION, ACCEPTANCE AND FIELD TESTING IN ADDITION TO FLIGHT OPERATIONS.

**(E) OPERATIONAL USE:**
NONE.

**- APPROVALS -**

| | | |
|---|---|---|
| EDITORIALLY APPROVED | : RI | : 1/17/96 |
| EDITORIALLY APPROVED | : JSC | : 1-25-96 |
| TECHNICAL APPROVAL | : APPROVAL FORM | : 95-CIL-001-RI |