PRINT DATE: 01/17/96

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER:05-1-FC3142 -X

SUBSYSTEM NAME: GUIDANCE, NAVIGATION, & CONTROL
REVISION: 0 02/09/88

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:TRANSLATION HAND CONTROL	MC621-0043-3140

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
TRANSLATION HAND CONTROL (THC), CMDRS AND AFT STATION.

REFERENCE DESIGNATORS: 30V73A8
30V73A9

QUANTITY OF LIKE ITEMS: 2
TWO REQUIRED

FUNCTION:
PROVIDES MANUAL COMMANDS FOR ORBITER TRANSLATION THROUGH REACTION JET CONTROL.

PRINT DATE: 01/17/96

FAILURE MODES EFFECTS ANALYSIS FMEA – CIL FAILURE MODE
NUMBER: 05-1-FC3142-01

REVISION#: 1 01/03/96

SUBSYSTEM NAME: GUIDANCE, NAVIGATION, & CONTROL
LRU: TRANSLATION HAND CONTROL
ITEM NAME: TRANSLATION HAND CONTROL

CRITICALITY OF THIS FAILURE MODE: 1R2

FAILURE MODE:
LOSS OF OUTPUT (FAIL OFF) OF TWO OR MORE CHANNELS

MISSION PHASE: LO LIFT-OFF

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102	COLUMBIA
103	DISCOVERY
104	ATLANTIS
105	ENDEAVOUR

CAUSE:
PHYSICAL JAMMING OR LOSS OF DISCRETE SWITCH DRIVE LINKAGE DUE TO CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, THERMAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL FAILURE.

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:
NO EFFECT FOR FIRST FAILURE. REMAINING THC UTILIZED BY FLIGHT CONTROL IN MANUAL MODE EXCEPT ON ASCENT. NO EFFECT IN AUTO.

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

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(C) MISSION:
FIRST FAILURE (LOSS OF TWO OR MORE CHANNELS ON FORWARD THC) HAS NO EFFECT. SECOND FAILURE, AUTO MINUS Z TRANSLATION RESULTS IN LOSS OF MINUS Z TRANSLATION MANEUVER CAPABILITY.

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
CRIT 1R FOR ASCENT BECAUSE LOSS OF MINUS Z TRANSLATION CAPABILITY FOLLOWING ET SEPARATION 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 FOR THE MAJOR AXES (X,Y AND Z) OF THE OPERATIONAL ENVELOPE IS CERTIFIED FOR 50,000 ACTUATIONS TO EACH POSITIVE AND NEGATIVE HARDSTOP. UNIT IS COMPLETELY ENCLOSED TO PREVENT DEBRIS FROM ENTERING AND JAMMING MECHANISM. ANALYSIS OF THE LOAD BEARING MECHANISMS INDICATE A YIELD LIMIT OF AT LEAST 1.4 TIMES THE OPERATIONAL DESIGN LOAD. EACH OF THE NULL RETENTION SPRINGS ARE TIED THROUGH COIL CENTER TO PREVENT A JAMMING CONDITION SHOULD ONE BREAK.

ALL ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) PIECE PARTS WHICH MAKE UP THE THC 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. MICROCIRCUITS 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°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.

(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.

NONDESTRUCTIVE EVALUATION

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

ASSEMBLY/INSTALLATION
TORQUING VERIFICATION BY INSPECTION. MECHANICAL RIGGING AND TORQUING ARE 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