

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE  
NUMBER:05-1-FC6342 -X

SUBSYSTEM NAME: GUIDANCE, NAVIGATION, & CONTROL

REVISION: 0 02/09/88

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PART DATA

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PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
LRU :REACTION JET DRIVER AFT	MC621-0043-6344

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EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
REACTION JET DRIVER AFT (RJDA).

REFERENCE DESIGNATORS: 54V79A10  
56V79A11

QUANTITY OF LIKE ITEMS: 2  
TWO REQUIRED

FUNCTION:  
PROVIDES THE ELECTRONIC CIRCUITRY NECESSARY TO DECODE COMMANDS  
RECEIVED THROUGH THE MDM'S AND DRIVES THE APPROPRIATE REACTION JET  
SOLENOIDS. PROVIDES SIGNALS TO THE DPS FOR REDUNDANCY MANAGEMENT  
FUNCTIONS.

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**LRU: REACTION JET DRIVER AFT**

**ITEM NAME: REACTION JET DRIVER AFT**

**CRITICALITY OF THIS**

**FAILURE MODE: 1/1**

**FAILURE MODE:**

ERRONEOUS OUTPUT TO ONE JET

**MISSION PHASE:**

- PL PRE-LAUNCH
- OO ON-ORBIT
- LS LANDING/SAFING

**VEHICLE/PAYLOAD/KIT EFFECTIVITY:**

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

**CAUSE:**

VIBRATION, TEMPERATURE, CONTAMINATION, MISHANDLING/ABUSE, MECHANICAL SHOCK THERMAL SHOCK, PIECE PART FAILURE (C-E SHORT OF EITHER OF THE MATCHED PAIR OF OUTPUT TRANSISTORS FOR UP TO 44 JETS).

**CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO**

**REDUNDANCY SCREEN**

- A) N/A
- B) N/A
- C) N/A

**PASS/FAIL RATIONALE:**

A)

B)

C)

**- FAILURE EFFECTS -**

**(A) SUBSYSTEM:**

APPLICATION OF DRIVER POWER TO THE RCS JET LOGIC CIRCUIT WOULD RESULT IN JET FIRING. LOSS OF UP TO FOUR THRUSTERS DUE TO MANIFOLD ISOLATION.

**(B) INTERFACING SUBSYSTEM(S):**

SAME AS (A)

**(C) MISSION:**

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POSSIBLE LOSS OF PAYLOAD AND/OR REMOTE MANIPULATOR SYSTEM. MISSION MODIFICATION MAY BE REQUIRED.

**(D) CREW, VEHICLE, AND ELEMENT(S):**

POSSIBLE LOSS OF VEHICLE DUE TO DAMAGE CAUSED BY IMPACT WITH TARGET -  
POSSIBLE LOSS OF EVA CREWMAN IF STRUCK BY ORBITER, TARGET, OR JET PLUME -  
POSSIBLE LOSS OF GROUND CREWMAN IF STRUCK BY JET PLUME. POSSIBLE LOSS OF  
VEHICLE DURING DOCKED OPERATIONS DUE TO OVERLOAD OF DOCKING SYSTEM  
STRUCTURE

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

CRITICALITY 1 BECAUSE INADVERTENT JET FIRING MAY CAUSE LOSS OF LIFE, VEHICLE AND/OR MISSION.

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**

ALL ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) PIECE PARTS WHICH MAKE UP THE RJDA 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. THE RJDA AS AN ASSEMBLY HAS A CERTIFIED LIFE OF 10,000 HOURS (100 MISSIONS) EQUIVALENT TO TEN YEARS.

THESE TRANSISTORS WHICH HAVE BEEN PIND TESTED, ARE ADEQUATELY DERATED FOR BOTH CURRENT AND VOLTAGE AND EXCEED OPPL REQUIREMENT. PROBABILITY OF A COLLECTOR-EMITTER SHORT IS VERY LOW FOR THESE TRANSISTORS. MCR 5982 MODIFIED THE FORWARD AND AFT RJD'S FOR STS-2 AND SUBS TO ELIMINATE SINGLE FAILURE POINTS WHICH RESULT IN MULTIPLE JET FIRINGS, AND TO PROVIDE FOR THE CAPABILITY TO ARM THE VERNIER JETS INDEPENDENTLY FROM THE PRIMARY JETS. MCR 6778 MODIFIED THE RJD'S FOR STS-5 AND SUBS TO PROVIDE FOR A TOGGLING FEATURE TO ENSURE ONLY VALID MDM COMMANDS FIRE JETS. TWO MDM SIGNALS MUST BE PRESENT TO COMMAND A GIVEN JET.

THE RJDA IS DESIGNED AS A HERMETICALLY SEALED UNIT TO PREVENT OR ELIMINATE THE ENVIRONMENTAL EFFECTS OF RAIN, SAND, DUST, AS WELL AS MOISTURE. INTERNAL COMPONENTS ARE CONFORMAL COATED TO ELIMINATE THE ADVERSE EFFECTS OF MOISTURE, PRESSURE, AND/OR TEMPERATURE VARIATIONS IN ADDITION TO SHORT CIRCUIT PROTECTION. THE RJDA ALSO INCORPORATES A BUILT IN TEST EQUIPMENT (BITE) CIRCUIT TO INDICATE JET COMMAND "ON" VS "OFF" STATUS.

**(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, HAS BEEN PERFORMED TO CERTIFY DESIGN. INTEGRATED/SUBSYSTEM VERIFICATION IS

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PERFORMED DURING TURNAROUND. FUNCTIONAL TEST IS MONITORED TO DETECT INADVERTENT OR PREMATURE OPERATIONS OF ELECTRONIC CIRCUITRY FUNCTIONS.

**(C) INSPECTION:**

RECEIVING INSPECTION

INCOMING MATERIAL IS VERIFIED BY RECEIVING INSPECTION.

CONTAMINATION CONTROL

FINAL ASSEMBLY AND REWORK PERFORMED IN A CLEAN ROOM AND MONITORED BY INSPECTION.

ASSEMBLY/INSTALLATION

QUALITY PLANNING ENSURES ALL DRAWING AND PROCUREMENT REQUIREMENTS ARE PUT INTO IN-PROCESS WORK TICKETS. ALL ASSEMBLY BENCHES ARE EQUIPPED WITH GROUNDING STRAPS AND BENCH COVERS. TORQUING VERIFICATION 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 SATISFIED BY USE OF SPECIAL QUALIFIED CONTAINERS FOR IN-PLANT TRANSPORTATION AND SHIPPING. RETURNED AND ACCEPTED GOODS ARE STORED IN A BONDED AREA.

**(D) FAILURE HISTORY:**

CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURE EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATABASE.

**(E) OPERATIONAL USE:**

ORBITAL OPERATIONS EXCEPT SLEEP PERIODS AND EVA OUTSIDE PAYLOAD BAY. A C-E SHORT IN THE RJD OUTPUT TRANSISTORS (WITH JET POWER ON) WILL CAUSE UNCOMMANDED FIRING OF THAT JET, THUS NECESSITATING CLOSURE OF THE MANIFOLD ISOLATION VALVE CONTROLLING PROPELLANT FLOW TO THAT JET. POWER TO RJD'S MUST BE TERMINATED PRIOR TO CREW EGRESS.

**- APPROVALS -**

S&R ENGINEERING  
S&R ENGINEERING ITM  
SUBSYSTEM MANAGER

: T. T. AI  
: P. A. STENGER  
: B. MCDERMOTT

: *[Signature]* 1/12/01  
: *[Signature]* 1/15/01  
: *[Signature]* 1-12-01

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE  
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MOD : M. MOSES  
USA SAM : G. HILLIER  
USA ORBITER ELEMENT : S. LITTLE

*M. J. Moses*  
*G. Hillier*  
*S. Little*