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PRINT DATE: 3/27/96

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE
 NUMBER: 05-5-B03-1 -X

SUBSYSTEM NAME: DATA PROCESSING SYSTEM (DPS)

REVISION: 8 08/23/93

 PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: MULTIPLEXER-DEMULPLEXER HONEYWELL	MC615-0004-5210 4020534-942
LRU	: MULTIPLEXER-DEMULPLEXER HONEYWELL	MC615-0004-5210 4020534-952

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
 FLIGHT AFT MDM: "FA1", "FA2", "FA3", AND "FA4".

REFERENCE DESIGNATORS: 54V72A7
 55V72A8
 56V72A9
 56V72A10

QUANTITY OF LIKE ITEMS: 4
 FOUR

FUNCTION:

PROVIDES MULTIPLEXED INTERFACE BETWEEN THE COMPUTER, ACTUATORS, AND SOME GUIDANCE NAVIGATION AND CONTROL (GN&C) SENSORS. CONVERTS ANALOG/DISCRETE SUBSYSTEM DATA TO A DIGITAL FORM FOR DATA BUS TRANSFER. PROVIDES DATA BUFFERING, FORMAT CONVERSION AND DISCRETE DATA CONDITIONING FOR COMMAND OUTPUTS TO CRITICAL FUNCTIONS SUCH AS AEROSURFACES ACTUATION, ENGINE GIMBALLING, ELECTRO MECHANICAL DEVICES, REACTION CONTROL SYSTEM (RCS) CONTROL, ETC. EACH MDM CONTAINS INTERNAL REDUNDANT POWER SUPPLY SECTION AND REDUNDANT DATA HANDLING SECTIONS (CORES).

FAILURE MODES EFFECTS ANALYSIS FMEA - CIL FAILURE MODE

NUMBER: 05-5-B03-1-01

REVISION#: 9 03/27/96

SUBSYSTEM NAME: DATA PROCESSING SYSTEM (DPS)

LRU: MULTIPLEXER-DEMUTIPLEXER

CRITICALITY OF THIS

ITEM NAME: MULTIPLEXER-DEMUTIPLEXER

FAILURE MODE: 1R2

FAILURE MODE:
LOSS OF OUTPUTMISSION PHASE: LO LIFT-OFF
DO DE-ORBITVEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR

CAUSE:

PIECE-PART FAILURE, VIBRATION, CONTAMINATION, TEMPERATURE, CHEMICAL REACTION, FAILED MDM PORT - SEQUENCE CONTROL UNIT (SCU), MULTIPLEXER INTERFACE ADAPTER (MIA), POWER SUPPLIES OR I/O CARD/CHANNEL FAILURE.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? YES

AOA ABORT ONCE AROUND
RTLS RETURN TO LAUNCH SITE
TAL TRANS-ATLANTIC LANDINGREDUNDANCY SCREEN A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF ONE MDM.

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(B) INTERFACING SUBSYSTEM(S):

LOSS OF COMMAND/DATA PATHS ASSOCIATED WITH THE FAILED MDM.

(C) MISSION:

POSSIBLE EARLY MISSION TERMINATION DECISION DUE TO LOSS OF REDUNDANCY.

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

NO EFFECT FIRST FAILURE.

(E) FUNCTIONAL CRITICALITY EFFECTS:

CRITICALITY 1R2 BECAUSE OF THE FOLLOWING REASONS:

FOR ASCENT/ENTRY: THIS FAILURE COUPLED WITH AN UNDETECTED FLIGHT CONTROL SYSTEM (FCS) FAILURE (E.G., IN THE AEROSURFACE AMPLIFIER (ASA) OR ASCENT THRUST VECTOR CONTROLLER (ATVC)), COULD RESULT IN THE TWO HEALTHY PATHS BEING VOTED OUT. THIS COULD RESULT IN A VOTING DILEMMA IN THE FCS (E.G., "FORCE FIGHT" IN THE SERVO ACTUATORS, RESULTING IN LOSS OF THE THRUST VECTOR CONTROL (ASCENT) OR THE LOSS OF AEROSURFACE CONTROL (ENTRY) WHICH MAY CAUSE LOSS OF VEHICLE. REFERENCE FMEA 05-1-FC6042-1 AND 05-1-FC6542-1 FOR ADDITIONAL INFORMATION).

FOR ASCENT: DURING INTACT ABORT (RTL, TAL OR AOA), CRITICALITY 1 IF UNABLE TO PURGE AFT FUSELAGE COMPARTMENTS OF POST MAIN ENGINE CUTOFF (MECO) GAS MIXTURE (BY OPENING HELIUM BLOW DOWN VALVE) RESULTING IN POSSIBLE FIRE/EXPLOSION AND MAY RESULT IN LOSS OF VEHICLE AND CREW (FA3 OR FA4 MDM)

-DISPOSITION RATIONALE-

(A) DESIGN:

ALL PARTS SELECTED FROM MF0004-400 ORBITER PROJECT PARTS LIST (OPPL) WHICH CALLS FOR JANTXV LEVEL PARTS, OR HAVE ADEQUATE DERATING FACTORS OF 25-50% ON HYBRIDS & TRANSISTORS, 25-30% ON RESISTORS, CAPACITORS AND OTHER COMPONENTS. PARTS THAT DID NOT MEET ORBITER PROJECT PARTS LIST REQUIREMENTS FOR QUALIFICATION, TRACEABILITY SCREENING OR BURN-IN WERE REVIEWED AND WERE FOUND ACCEPTABLE FOR THEIR GIVEN FUNCTIONS. REDUNDANT COMMAND/SIGNALS FOR CRITICAL FUNCTIONS ROUTED THROUGH SEPARATE MDM'S. DESIGN ALSO INCORPORATES RELIABILITY, MAINTAINABILITY, ENVIRONMENTAL AND TRANSPORTABILITY REQUIREMENTS AND OTHER DESIGNS AND CONSTRUCTION PER SPECIFICATION MC615-0004.

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(B) TEST:

EACH UNIT SUBJECTED TO ACCEPTANCE TEST PROCEDURE (ATP) TEST (T4025545) AT HONEYWELL INCLUDING CONTINUITY, FULL FUNCTIONAL, ACCEPTANCE VIBRATIONAL TEST (AVT), ACCEPTANCE THERMAL TEST (ATT), EXAMINATION OF PRODUCT, INSULATION RESISTANCE TEST, DIELECTRIC STRENGTH TEST, PERFORMANCE, AND POWER VARIATION TEST.

QUALIFICATION TEST (T4025763) COMPLETED AT HONEYWELL INCLUDING FULL FUNCTIONAL, POWER, ELECTROMAGNETIC COMPATIBILITY (EMC), HUMIDITY, THERMAL, VIBRATION, THERMAL VACUUM, LIGHTNING, SHOCK, SALT/FOG, 1000 ON/OFF CYCLE LIFE TEST, ACCELERATION, AND EXPLOSIVE/CORROSIVE ATMOSPHERE.

EACH UNIT SUBJECTED TO ACCEPTANCE TEST PROCEDURE (ATP) TEST (T4025545) AT HONEYWELL INCLUDING CONTINUITY, FULL FUNCTIONAL, ACCEPTANCE VIBRATIONAL TEST (AVT), ACCEPTANCE THERMAL TEST (ATT), EXAMINATION OF PRODUCT, INSULATION RESISTANCE TEST, DIELECTRIC STRENGTH TEST, PERFORMANCE, AND POWER VARIATION TEST.

QUALIFICATION TEST (T4025763) COMPLETED AT HONEYWELL INCLUDING FULL FUNCTIONAL, POWER, ELECTROMAGNETIC COMPATIBILITY (EMC), HUMIDITY, THERMAL, VIBRATION, THERMAL VACUUM, LIGHTNING, SHOCK, SALT/FOG, 1000 ON/OFF CYCLE LIFE TEST, ACCELERATION, AND EXPLOSIVE/CORROSIVE ATMOSPHERE.

GROUND TURNAROUND TEST: ALL TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

RECEIVING INSPECTION CERTIFICATIONS & SOURCE INSPECTION TEST REPORTS ARE ON FILE. CASES AND FLATPACKS ARE ENVIRONMENTALLY SCREENED, INCLUDING LOOSE PARTICLE DETECTION IN RECEIVING INSPECTION. ALL HYBRID COMPONENTS ARE LOT SAMPLED IN RECEIVING INSPECTION.

CONTAMINATION CONTROL CLEANLINESS TO CLASS 100,000 LEVEL IS VERIFIED BY INSPECTION

ASSEMBLY/INSTALLATION VISUAL INSPECTION IS PERFORMED AT KIT RELEASE. PRINTED WIRING BOARD MICROSECTION ANALYSIS IS PERFORMED AND MONITORED BY INSPECTION. QUALITY CONTROL VERIFIES AND WITNESSES TORQUE OPERATIONS. QUALITY CONTROL VERIFIES SOLDERED CONNECTIONS AND ASSEMBLY OF PARTS. TOOL CERTIFICATION AND TENSILE TESTS ARE MAINTAINED. QUALITY CONTROL PERFORMS PRE-CAP VISUAL INSPECTION FOR CLEANLINESS. QUALITY CONTROL VERIFIES CONVEYOR FURNACE PROFILE/TEMPERATURE EVERY 90 DAYS. QUALITY CONTROL VERIFIES ALL FLATNESS & SURFACE ROUGHNESS FOR PROPER HEAT TRANSFER. THERMAL PROTECTION CONTROLS EXIST FOR ALL SOLDERED CONNECTIONS.

NONDESTRUCTIVE EVALUATION RADIOGRAPHIC INSPECTION OF SELECTED COMPONENTS, I.E., TANTALUM CAPACITORS, IS PERFORMED.

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CRITICAL PROCESSES INSPECTION VERIFIES CRIMPING OPERATIONS AND CERTIFICATION. SOLDERING REQUIREMENTS PER NHB5300.4(3A) ARE VERIFIED BY INSPECTION.

TESTING ATP IS OBSERVED AND VERIFIED BY QUALITY CONTROL INCLUDING AVT AND ATT.

HANDLING/PACKAGING PROPER GROUNDING OF ELECTRICALLY STATIC SENSITIVE DEVICES WHEN HANDLING IS PERFORMED. PACKAGING AND PROTECTION VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

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

(E) OPERATIONAL USE:

PORT MODING TO RECOVER MDM FUNCTIONALITY IS AVAILABLE AS FOLLOWS:

A) MM102 - PORTMODING WILL NOT BE PERFORMED UNLESS IT IS NECESSARY FOR CRITICAL CAPABILITY.

B) POST MM102 TO PRE MECO - PORTMODING MAY BE PERFORMED TO REGAIN CRITICAL CAPABILITY OR AFTER ANY SECOND FAILURE. NON-CRITICAL RECOVERY WILL NOT BE PERFORMED FOR NON-UNIVERSAL I/O ERROR CASES.

C) POST MECO - PORTMODING MAY BE PERFORMED IN ANY VALID PHASE OR OPS, EXCEPT FOR NON-UNIVERSAL I/O ERROR CASES.

(REFERENCE FLIGHT RULE 7-31)

- APPROVALS -

EDITORIALLY APPROVED
EDITORIALLY APPROVED
TECHNICAL APPROVAL

RI
JSC
VIA APPROVAL FORM

A. Chapman
5-1-96
96-CIL-013_05-5