FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
                                    NUMBER: 05-5-B03-2A -X

SUBSYSTEM NAME: DATA PROCESSING SYSTEM (DPS)
                                    REVISION: 7   04/08/81

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	: E-MULTIPLEXER-DEMULTIPLEXER	MC615-0004-7100
	HONEYWELL	8258000-901

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
FLIGHT FORWARD EMDM: "FF1", "FF2", "FF3", AND "FF4".

REFERENCE DESIGNATORS: 81V72A3
                          82V72A4
                          83V72A5
                          82V72A6

QUANTITY OF LIKE ITEMS: 4
FOUR

FUNCTION:
PROVIDES MULTIPLEXED INTERFACE BETWEEN THE GUIDANCE NAVIGATION AND
CONTROL (GN&C) SENSORS AND THE DATA PROCESSING SUBSYSTEM (DPS)
COMPUTER COMPLEX. CONVERTS ANALOG/SUBSYSTEM DATA TO A DIGITAL FORM
FOR DATA BUS TRANSFER. PROVIDES DATA BUFFERING, FORMAT CONVERSION AND
DISCRETE DATA CONDITIONING FOR TRANSFERRING COMMAND/RESPONSE DATA
BETWEEN THE COMPUTER AND THE GN&C SENSORS. EMDM'S ALSO PROVIDE LOGIC
SIGNALS FOR OPENING/CLOSING ELECTRO MECHANICAL DEVICES. PROVIDES
HANDOVER OF THE STATE VECTOR UPDATES AND COMMANDS FROM THE NETWORK
SIGNAL PROCESSORS (NSP) TO THE DPS VIA EMDM'S FF1 AND FF3. EMDM FF3
INTERFACES THE GN&C GENERAL PURPOSE COMPUTER'S (GPC) WITH THE KU-BAND
RADAR. EACH EMDM CONTAINS INTERNAL REDUNDANT POWER SUPPLY SECTIONS
AND REDUNDANT DATA HANDLING SECTIONS (PORTS).

FAILURE MODES EFFECTS ANALYSIS FMEA — CIL FAILURE MODE
NUMBER: 05-5-B03-2A- 02

REVISION#:   8   03/27/96

SUBSYSTEM NAME: DATA PROCESSING SYSTEM (DPS)
LRU: E-MULTIPLEXER-DEMULTIPLEXER   CRITICALITY OF THIS
ITEM NAME: E-MULTIPLEXER-DEMULTIPLEXER   FAILURE MODE: 1R2

FAILURE MODE:
 ERRONEOUS OUTPUT

MISSION PHASE: OO   ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102   COLUMBIA
                                     103   DISCOVERY
                                     104   ATLANTIS
                                     105   ENDEAVOUR

CAUSE:
 ADDRESS VALIDATION BY FAILED CHIP, ANALOG/DIGITAL (A/D), DENDRITE GROWTHS,
ADDRESS CHECK FAILURE, DATA ERROR TO EMDM MODULE, A/D CONVERTER FAILURE,
PIECE PART FAILURE IN THE SEQUENCE CONTROL UNIT (SCU).

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 SOURCE OF ERRONEOUS OUTPUT CANNOT BE IDENTIFIED
AND MAY BE ACCEPTED AS A VALID DATA.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF EMDM.

FAILURE MODES EFFECTS ANALYSIS (FMEA) — CIL FAILURE MODE
NUMBER: 05-5-B03-2A- 02

(B) INTERFACING SUBSYSTEM(S):
DATA FOR ANOTHER LINE REPLACEABLE UNIT (LRU) EXECUTED, OR WRONG TASK
SELECTED.
ON-ORBIT:
FF3 FAILURE WILL LOSE (VALID) RENDEZVOUS RADAR INPUT DATA TO GN&C. BACKUP
PROCEDURES ARE IN PLACE TO ALLOW A RENDEZVOUS WITHOUT THE DATA.

FOR ENTRY:
FF1/FF2 FAILURE WILL LOSE NOSE WHEEL STEERING 1 (NWS1) CAPABILITY.
FF3/FF4 FAILURE WILL LOSE NOSE WHEEL STEERING 2 (NWS2) CAPABILITY.

(C) MISSION:
LOSS OF ONE FF EMDM RESULTS IN POSSIBLE EARLY MISSION TERMINATION DUE TO
LOSS OF REDUNDANCY.

(D) CREW, VEHICLE, AND ELEMENT(S):
POSSIBLE LOSS OF CREW/VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:
CRITICALITY 1R2 BECAUSE OF THE FOLLOWING REASONS:

ALL PHASES:
(1) A SINGLE ANALOG OUTPUT PROBLEM TO THE GPC HAS NO EFFECT. TWO LIKE
ANALOG OUTPUT FAILURES TO THE GPC THAT PRODUCE A BIASED OUTPUT THAT IS
BELOW THE SOFTWARE REDUNDANCY MANAGEMENT THRESHOLD CAN RESULT IN A
LOSS OF VEHICLE DUE TO ERRONEOUS DATA INPUT TO THE GPC FOR NUMEROUS
SUBSYSTEMS (AA, RHC, SBTC, RPTA, ETC.).CR79963C PROVIDES PARTIAL DETECTION
OF ANALOG INPUT CARD FAILURES BY EXECUTING INPUT OUTPUT MODULE (IOM) BUILT
IN TEST EQUIPMENT (BITE) TEST.
(2) LOSS OF OUTPUT FROM ONE INERTIAL MEASUREMENT UNIT (IMU) OR A FF EMDM
CHANNEL PROCESSING IMU DATA, FOLLOWED BY FAILURE OF ANOTHER IMU OR FF
EMDM WITH ERRONEOUS OUTPUT SUCH THAT THE AVERAGE OF THE TWO REMAINING
CHANNELS IS CORRUPTED, WILL LEAD TO INCORPORATION OF FAULTY IMU DATA BY
ALL COMPUTERS AND POSSIBLE LOSS OF VEHICLE/CREW.

FOR ASCENT/ENTRY:
A FAILURE CONDITION SUCH THAT RESPONSE DATA FROM EMDMS TO GPCS HAS LESS
THAN 5 MICROSECOND GAPS BETWEEN CONSECUTIVE WORDS, CAN CAUSE A NON-
UNIVERSAL I/O ERROR CONDITION DUE TO DIFFERING PERCEPTION OF ARRIVING DATA
AMONG THE GPCS OF THE PASS REDUNDANT SET. DURING ASCENT AND ENTRY,
ENGAGE OF THE BFS IS THEN REQUIRED. A SUBSEQUENT FAILURE CAUSING LOSS OF
BFS CAN RESULT IN LOSS OF VEHICLE/CREW.

FOR ASCENT:

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: 05-5-B03-2A-02

TWO FF EMDM FAILURES THAT CAUSE IMPROPER COMMANDS OF A SUFFICIENT
NUMBER OF JETS CAN RESULT IN ORBITER EXTERNAL TANK (ET) CONTACT OR AN
ORBITER OUT-OF-CONTROL CONDITION AT SEPARATION.

-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/EMDM'S. DESIGN ALSO INCORPORATES RELIABILITY,
MAINTAINABILITY, ENVIRONMENTAL AND TRANSPORTABILITY REQUIREMENTS AND
OTHER DESIGNS AND CONSTRUCTION PER SPECIFICATION MC615-0004.

(B) TEST:
EACH UNIT SUBJECTED TO ACCEPTANCE TEST PROCEDURE (ATP) TEST (TP8258000) 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 (T8258181) 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

FAILURE MODES EFFECTS ANALYSIS (FMEA) — CIL FAILURE MODE
NUMBER: 05-5-B03-2A- 02

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.

CRITICAL PROCESSES
INSPECTION VERIFIES CRIMPING OPERATIONS AND CERTIFICATION. SOLDERING
REQUIREMENTS PER NHB5300.4(3A) AND ISCO8800A 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)

FAILURE MODES EFFECTS ANALYSIS (FMEA) — CIL FAILURE MODE
NUMBER: 05-5-B03-2A-02

- APPROVALS -		
EDITORIALLY APPROVED	: RI	
EDITORIALLY APPROVED	: JSC	
TECHNICAL APPROVAL	: VIA APPROVAL FORM	: 96-CIL-013_05/5