

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER:05-3A-IDP -X**

SUBSYSTEM NAME: MULTIFUNCTION ELECTRONIC DISPLAY SUBSYSTEM
REVISION: 1 12/05/97

PART DATA

PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
LRU :PROCESSOR, INTEGRATED DISPLAY	MC409-0185-001X

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
PROCESSOR, INTEGRATED DISPLAY, (IDP)

REFERENCE DESIGNATORS: 30V73A44
30V73A45
30V73A46
30V73A47

QUANTITY OF LIKE ITEMS: 4
FOUR

FUNCTION:

PERFORMS HIGH LEVEL DISPLAY PROCESSING, PROVIDES CRITICAL FORMAT STORAGE, AND INTERFACES WITH ORBITER GENERAL PURPOSE COMPUTERS (GPC'S) VIA FLIGHT CRITICAL (FC) AND DISPLAY KEYBOARD DATABUSES. RECEIVES AND PROCESSES DISPLAY DATA FROM THE MEDS ANALOG/DIGITAL CONVERTERS (ADC'S). PROCESSES EDGE KEY COMMANDS FROM THE MEDS MULTIFUNCTION DISPLAY UNITS (MDU'S). THE IDP'S (NAMELY IDP1, IDP2, IDP3, AND IDP4) COMMUNICATE WITH MDU'S AND ADC'S VIA 1553B DATABUS NETWORK. THE CONNECTION BETWEEN IDP'S AND ASSOCIATED MDU PORTS ARE AS FOLLOW:

MDU	IDP1	IDP2	IDP3	IDP4
CDR1	SECONDARY		PRIMARY	
CDR2	PRIMARY	SECONDARY		
CRT1	PRIMARY			
CRT2		PRIMARY		
CRT3			PRIMARY	
MFD1		PRIMARY	SECONDARY	
MFD2	PRIMARY		SECONDARY	
PLT1	SECONDARY	PRIMARY		

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PLT2		SECONDARY	PRIMARY	
CRT4				PRIMARY
AFD1		SECONDARY		PRIMARY

THE CONNECTION BETWEEN IDP'S AND ADC'S ARE AS FOLLOW:

ADC	IDP1	IDP2	IDP3	IDP4
ADC 1A	CONNECTED	CONNECTED		
ADC1B			CONNECTED	CONNECTED
ADC2A	CONNECTED	CONNECTED		
ADC2B			CONNECTED	CONNECTED

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SUBSYSTEM NAME: MULTIFUNCTION ELECTRONIC DISPLAY SUBSYSTEM

LRU: PROCESSOR, INTEGRATED DISPLAY

CRITICALITY OF THIS

ITEM NAME: PROCESSOR, INTEGRATED DISPLAY

FAILURE MODE: 1/1

FAILURE MODE:

ERRONEOUS OUTPUT

MISSION PHASE:

PL PRE-LAUNCH
 LO LIFT-OFF
 OO ON-ORBIT
 DO DE-ORBIT
 LS LANDING/SAFING

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102	COLUMBIA
103	DISCOVERY
104	ATLANTIS
105	ENDEAVOUR

CAUSE:

PIECE-PART FAILURE (MECHANICAL STRESS, VIBRATION), CONTAMINATION, ELECTRICAL STRESS, THERMAL STRESS, PROCESSING ANOMALY, RADIATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO**CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? NO****REDUNDANCY SCREEN**

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

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

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(A) SUBSYSTEM:

ERRONEOUS INFORMATION IS PROVIDED TO MDU'S AND/OR GPC'S

(B) INTERFACING SUBSYSTEM(S):

GPC MAY ACCEPT AND PROCESS ERRONEOUS DATA. DISPLAYS ERRONEOUS DATA ON ASSOCIATED MDU'S. ERRONEOUS OUTPUTS CAN CAUSE MIXED PERCEPTION (NON-UNIVERSAL I/O ON THE DISPLAY KEYBOARD (DK) DATA BUS) RESULTING IN LOSS OF THE REDUNDANT SET (RS). BACKUP FLIGHT SYSTEM (BFS) ENGAGE WILL BE REQUIRED FOR RECOVERY.

(C) MISSION:

POTENTIAL LOSS OF CREW/VEHICLE

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

POSSIBLE LOSS OF CREW/VEHICLE IF IDP INPUTS ERRONEOUS DATA INTO THE GPC'S DUE TO INTERNAL FAILURE OR IDP PROCESSING RELATED FAILURES IN WHICH THE GPC'S MAY ACCEPT IT AS VALID DATA.

-DISPOSITION RATIONALE-

(A) DESIGN:

ALL PARTS USED IN THE DESIGN AND FABRICATION OF THE IDP ARE SELECTED FROM MF0004-400 ORBITER PROJECT PARTS LIST (OPPL), EXCEPT WHERE THE USE OF NON-OPPL PARTS OR "OFF THE SHELF" HARDWARE HAD BEEN AUTHORIZED. OPPL PARTS UTILIZATION ARE BASED UPON SELECTION OF QUALIFIED PARTS, PROPER DERATING, AND MINIMIZING THE NUMBER OF PART TYPES. FOR THE USE OF PARTS WHICH ARE NOT IN THE OPPL AND DO NOT MEET THE OPPL REQUIREMENTS, A NON-OPPL PART APPROVAL REQUEST (NOPAR) FORM MUST BE SUBMITTED FOR APPROVAL ON OR BEFORE THE CRITICAL DESIGN REVIEW AND PRIOR TO PART PROCUREMENT FOR THE PROPOSED DESIGN. APPROVAL OF NOPAR PARTS ARE ALSO BASED ON CIRCUIT APPLICATION AND CRITICALITY. "OFF THE SHELF" HARDWARE ARE COMPARED, ANALYZED, OR TESTED TO MEET SPECIFIED REQUIREMENTS BEFORE BEING AUTHORIZED FOR USE. REDUNDANT COMMAND/SIGNALS ARE ROUTED THROUGH SEPARATE IDP'S. THE APPLICABLE FAULT TOLERANCES ARE BEING ACHIEVED AT THE LRU LEVEL.

THE IDP DESIGN UTILIZED ERROR DETECTION AND CORRECTION CIRCUITRY, CYCLIC PROCESSING, AND/OR RADIATION TOLERANT EEE PARTS TO PRECLUDE ADVERSE EFFECTS DUE TO RADIATION INDUCED SINGLE EVENT UPSETS OR RADIATION INDUCED LATCHUP.

THERE ARE VARIOUS BUILT-IN-TEST-EQUIPMENT (BITE) SELF-TEST CAPABILITY FOR THE MEDS TO DETECT AND ISOLATE FAULTS TO THE LRU LEVEL DURING FLIGHT AND GROUND OPERATIONS. OPERATIONAL BITE IN THE IDP IS PERFORMED CONTINUOUSLY

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WHILE THE COMPONENT IS OPERATING. COMPREHENSIVE SELF TEST IS USED TO VERIFY, AT A MINIMUM, THE PROCESSORS, MEMORIES, POWER SUPPLIES AND INTERFACES. POWER ON SELF TEST (POST) IN THE IDP, A SUBSET OF COMPREHENSIVE SELF TEST, IS USED TO VERIFY SYSTEM INTEGRITY BEFORE RESUMING OPERATION AFTER A POWER INTERRUPTION OR CYCLE.

(B) TEST:

ACCEPTANCE REQUIREMENTS INCLUDE:

EXAMINATION OF PRODUCT
FUNCTIONAL AND PERFORMANCE
ACCEPTANCE THERMAL TEST
ACCEPTANCE VIBRATION TEST
FUNCTIONAL AND PERFORMANCE RECHECK.

AVT

20 TO 80 HZ	PLUS 3 DB/OCTAVE
80 TO 350 HZ	0.04 G ² /HZ
350 TO 2000 HZ	MINUS 3 DB/OCTAVE

ATT

THE IDP SHALL BE THERMAL CYCLED FROM 70 F TO 120 F, TO 20 F, TO PLUS 120 F, AND TO 70 F WITH CONTINUITY MONITORED THROUGHOUT. RATE OF CHANGE SHALL NOT EXCEED 240 F PER HOUR, NOR BE LESS THAN 60 F PER HOUR. DWELL AT EACH LIMIT TEMPERATURE SHALL BE A MINIMUM OF 60 MINUTES AFTER THERMAL STABILIZATION OF THE TEST ARTICLE. SELECTED PERFORMANCE TEST AT EACH HIGH TEMPERATURE EXTREME AND LOW TEMPERATURE EXTREME.

QUALIFICATION REQUIREMENTS INCLUDE:

ACCEPTANCE TEST
PERFORMANCE TESTS
POWER TEST
EMC TEST
LIGHTNING
CABIN ATMOSPHERE
HUMIDITY
SALT FOG
SAND AND DUST
ACCELERATION
OPERATING LIFE TEST
AUDIBLE NOISE TEST
QUALIFICATION ACCEPTANCE VIBRATION TEST
THERMAL VACUUM TEST
THERMAL CYCLE TEST
LIFE

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SHOCK
POST PERFORMANCE TESTS
PACKAGE QUALIFICATION TEST

QAVT

20 TO 80	PLUS 3 DB/OCTAVE TO .067 G ² /HZ
80 TO 350 HZ	CONSTANT .067 G ² /HZ
350 TO 2000 HZ	MINUS 3 DB/OCTAVE FROM .067 G ² /HZ
DURATION	5 TIMES AVT

ACCELERATION
ACCELERATION TEST REQUIREMENT SHALL BE MET BY ANALYSIS.

GROUND TURNAROUND TEST
ANY 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 SCREENED FOR LOOSE PARTICLE DETECTION IN RECEIVING
INSPECTION. ALL HYBRID COMPONENTS ARE LOT SAMPLED IN RECEIVING INSPECTION.

CONTAMINATION CONTROL
LRU'S SHALL BE CLEANED TO LEVEL GC (GENERALLY CLEAN) OF MA0110-301.

ASSEMBLY/INSTALLATION
VISUAL INSPECTION IS PERFORMED AT KIT RELEASE. PRINTED WIRING BOARD
MICROSECTION ANALYSIS IS PERFORMED AND MONITORED BY INSPECTION FOR EACH
LOT OF PWB'S. QUALITY CONTROL VERIFIES AND WITNESSES TORQUE OPERATIONS.
QUALITY CONTROL VERIFIES SOLDERED CONNECTIONS AND ASSEMBLY OF PARTS.
TOOL CERTIFICATIONS ARE MAINTAINED. QUALITY CONTROL PERFORMS PRE-CAP
VISUAL INSPECTION FOR CLEANLINESS. QUALITY CONTROL VERIFIES CONVEYOR
FURNACE PROFILE/TEMPERATURE EVERY 90 DAYS. POPULATED PWB'S WILL BE
PURGED OF IONIC CONTAMINATION PRIOR TO CONFORMAL COAT.

CRITICAL PROCESSES
INSPECTION VERIFIES CRIMPING OPERATIONS AND CERTIFICATION. SOLDERING
REQUIREMENTS PER NHB5300.4(3A) AND MIL-STD-2000 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.

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(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:

THERE IS NO OPERATIONAL CONSTRAINTS OR SPECIAL CONFIGURATIONS POSSIBLE TO MINIMIZE THE EFFECTS OF THE FIRST FAILURE. IDP POWER CYCLE MAY RECOVER IDP FUNCTION.

- APPROVALS -

PAE MANAGER	: P.A. STENGER-NGUYEN	: <u>P.A. Stenger-Nguyen 5/12/98</u>
PRODUCT ASSURANCE ENGR	: N.D. NGUYEN	: <u>N.D. Nguyen 5/14/98</u>
DPS SYSTEM	: G.L. PRICE	: <u>G.L. Price 5/8/98</u>
MEDS SYSTEM	: M.B. WARNER	: <u>M.B. Warner 5/7/98</u>
MEDS HARDWARE	: R.M. SITAPARA	: <u>R.M. Sitapara 5/3/98</u>
NASA SSMA	:	: <u>Cherish M. Fokson 5/20/98</u>
NASA SUBSYSTEM MANAGER	:	: <u>James Newsome 5/20/98</u>
NASA MOD	:	: <u>Michelle MacBryden 5/20/98</u>