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 / **VENDOR NAME**	**PART NUMBER** / **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		

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

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

FAILURE MODES EFFECTS ANALYSIS FMEA – CIL FAILURE MODE
NUMBER: 05-3A-IDP-01

REVISION#: 1 12/05/97
SUBSYSTEM NAME: MULTIFUNCTION ELECTRONIC DISPLAY SUBSYSTEM
LRU: PROCESSOR, INTEGRATED DISPLAY **CRITICALITY OF THIS**
ITEM NAME: PROCESSOR, INTEGRATED DISPLAY **FAILURE MODE:** 1R3

FAILURE MODE:
LOSS OF 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) PASS
B) PASS
C) FAIL

PASS/FAIL RATIONALE:
A)

B)

C)
FAILS SCREEN "C" SINCE EXTERNAL LEAKAGE OF THE SINGLE MAIN CABIN RETURN AIR DUCT COULD RESULT IN LOSS OF COOLING FOR ALL IDP'S.

- FAILURE EFFECTS -

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: 05-3A-IDP-01

(A) SUBSYSTEM:
LOSS OF ONE IDP

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT FIRST FAILURE

(C) MISSION:
NO EFFECT FIRST FAILURE

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT FIRST FAILURE

(E) FUNCTIONAL CRITICALITY EFFECTS:
CRITICALITY 1R3:
POSSIBLE LOSS OF CREW/VEHICLE AFTER THREE FAILURES (LOSS OF IDP1, IDP2, AND IDP3) DUE TO INABILITY TO MONITOR/RESPOND TO SYSTEM FAILURES AND/OR LAND THE VEHICLE SAFELY.

NOTE: HEAD UP DISPLAY IS NOT A USABLE SOURCE OF INFORMATION PRIOR TO MAJOR MODE 305.

-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 OFFICIAL 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

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: 05-3A-IDP-01

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 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

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE NUMBER: 05-3A-IDP-01

OPERATING LIFE TEST
AUDIBLE NOISE TEST
QUALIFICATION ACCEPTANCE VIBRATION TEST
THERMAL VACUUM TEST
THERMAL CYCLE TEST
LIFE
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.

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: 05-3A-IDP-01

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:
THERE IS NO CONFIGURATION POSSIBLE TO MINIMIZE THE EFFECTS OF LOSS OF COOLING. IDP POWER CYCLE MAY RECOVER IDP FUNCTION. ON ORBIT, FOR LOSS OF IDPS 1, 2, OR 3, THE AFT IDP MAY BE USED AS A REPLACEMENT.

- APPROVALS -

PAE MANAGER	: P.A. STENGER-NGUYEN	: P A Stenger Nguyen 5/12/98
PRODUCT ASSURANCE ENGR	: N.D. NGUYEN	: [signature] 5/7/98
DPS SYSTEM	: G.L. PRICE	: [signature] 5/7/98
MEDS SYSTEM	: M.B. WARNER	: [signature] 5/7/98
MEDS HARDWARE	: R.M. SITAPARA	: [signature] 5/8/98
NASA SSMA	:	: Cheryl M Tokos 5/20/98
NASA SUBSYSTEM MANAGER	:	: James Newsome 5/20/98
NASA MOD	:	: Michelle MacIntyre 5/20/98