SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :INSTRUMENTATION FMEA NO 05-4 -321200-1 REV:9/7/88

ASSEMBLY :FWD AV BAY 3B
P/N RI :MC456-0051
P/N VENDOR:
QUANTITY :1
:(ONE)
:

CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE EFFECTIVITY:	102	103	104
	X	X	X

PHASE(S): PL X LO X OO X DO X LS X

REDUNDANCY SCREEN: A-PASS B-PASS C-PASS

PREPARED BY:		APPROVED BY:		APPROVED BY (NASA):	
DES	P KEBEBEW	DES	9-2-88	SSM	9/8
REL	R GREGORIAN	REL	P-7-88	REL	9/6/88
QE	E GUTIERREZ	QE		QE	9/12/88

ITEM:
MASTER TIMING UNIT

FUNCTION:
PROVIDES MASTER TIMING REFERENCE TO THE DISPLAY AND CONTROL(D&C), COMMUNICATION AND TRACKING(C&T), DATA PROCESSING SYSTEMS(DPS), MODULAR AUXILIARY DATA SYSTEM(MADS), ORBITER EXPERIMENT(OEX), PAYLOADS AND OI. GMT AND MET ARE GENERATED WITH PROVISIONS FOR SETTING AND UPDATING THROUGH THE ONBOARD COMPUTERS.
REFERENCE DESIGNATOR: 85V75A3.

FAILURE MODE:
LOSS OF OUTPUT

CAUSE(S):
PIECE-PART STRUCTURAL FAILURE, VIBRATION, TEMPERATURE, MECHANICAL SHOCK, CONTAMINATION.

EFFECT(S) ON:
(A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE

(A) LOSS OF OUTPUT TO ORBITER TIMING BUFFER, PAYLOAD TIMING BUFFER, PULSE CODE MODULATION MASTER UNIT, AND PAYLOAD DATA INTERLEAVER.

(B) SINGLE POINT FAILURE OF MTU RESULTING IN LOSS OF OUTPUT WILL CAUSE ALL GENERAL PURPOSE COMPUTERS(GPC) TO FAULT DOWN TO A GPC TIME SOURCE. ON ORBIT: BACK UP FLIGHT SYSTEM(BFS) WILL BE "NO GO" FOR ENGAGEMENT DUE TO ITS INABILITY TO ESTABLISH BFS GPC TIME WHICH RESULTS IN LOSS OF GUIDANCE CAPABILITY.

(C) MISSION TERMINATION DECISION REQUIRED IF ALL MTU OUTPUTS ARE LOST.

(D) FIRST FAILURE CAUSES ALL GPC'S TO SELECT A GPC AS TIME SOURCE. ON ORBIT: BFS IS "NO GO" FOR ENGAGEMENT UNTIL THE MTU IS RESTORED AS A TIME SOURCE. SECOND FAILURE IS A GENERIC PASS FAILURE WHICH RESULTS IN LOSS OF CREW/VEHICLE.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :INSTRUMENTATION FMEA NO 05-4 -321200-1 REV:9/7/88

DISPOSITION & RATIONALE:
(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

(A) DESIGN
THE MTU IS A STABLE CRYSTAL CONTROLLED FREQUENCY SOURCE WHICH SHALL PROVIDE FREQUENCY OUTPUTS TO SELECTED SHUTTLE ORBITER SUBSYSTEMS AND PAYLOADS. 28 VDC WILL BE PROVIDED FROM REDUNDANT ORBITER ESSENTIAL BUSES. THE MTU INCLUDES REDUNDANT DOUBLE OVEN THERMALLY STABILIZED CRYSTAL CONTROLLED OSCILLATORS. THE 3 TIME ACCUMULATORS ARE DRIVEN BY 3 FREQUENCY DIVIDERS WHICH ARE OPERATING FROM THE AUTOMATICALLY SELECTED CRYSTAL OSCILLATOR. THE AUTOMATIC SELECTION CAN BE MANUALLY OVERRIDDEN. THE MTU CONTAINS THE NECESSARY BUILT-IN-TEST CAPABILITY TO DETECT AND REPORT FAILURES WHICH AFFECT OPERATION. EEE PARTS ARE SELECTED FROM OR IN ACCORDANCE WITH MF0004-400 OPPL REQUIREMENT. THE MTU IS DESIGNED WITH INPUT/OUTPUT ISOLATION SO THAT A FAILURE OF ONE I/O FUNCTION HAS NO ADVERSE EFFECT ON OPERATION OF ANY OTHER I/O FUNCTION. THE MTU SHALL HAVE A MINIMUM USEFUL LIFE OF 24,000 HOURS, WHICH IS EQUIVALENT TO 100 ORBITAL MISSIONS IN A 10 YEAR PERIOD FROM DATE OF DELIVERY.

(B) TEST
ACCEPTANCE REQUIREMENTS INCLUDE:
EXAMINATION OF PRODUCT, FUNCTIONAL PERFORMANCE TEST, ACCEPTANCE VIBRATION TEST(AVT), ACCEPTANCE THERMAL TEST(ATT).

QUALIFICATION TEST INCLUDE:
ACCEPTANCE TEST, POWER TEST, EMC, CABIN ATMOSPHERE, THERMAL CYCLE, VIBRATION, ACCELERATION, THERMAL VACUUM, LIFE, LIGHTNING, SHOCK.

GROUND TURNAROUND TEST
MTU BITE AND OUTPUT VERIFICATION PERFORMED EVERY FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION
INCOMING PARTS AND MATERIALS ARE SUBJECTED TO A VISUAL AND DIMENSIONAL EXAMINATION WHERE APPLICABLE. CERTIFICATIONS ARE VERIFIED.

CONTAMINATION CONTROL
CONTAMINATION CONTROL PLAN IS VERIFIED BY INSPECTION. THE PROCESS IS IMPLEMENTED AND CLEAN ROOM ENVIRONMENTS ARE MAINTAINED.
(UP TO CLEANLINESS LEVEL 100,000)

ASSEMBLY/INSTALLATION
MANDATORY INSPECTIONS ARE SET UP IN THE ASSEMBLY PROCEDURE. MAGNIFICATION (10X) IS UTILIZED TO INSPECT PARTS IN DETAIL. ANTI-STATIC PROCESS IS HANDLED THROUGHOUT ASSEMBLY/INSTALLATION/SHIPPING FLOW. WIRE INSULATIONS ARE INSPECTED TO PRECLUDE ANY EXPOSED WIRE.

CRITICAL PROCESSES
WIRE CRIMPING, STRIPPING AND SWAGING IS VERIFIED BY INSPECTION. PARTS PROTECTION, COATING AND PLATING REQUIREMENTS ARE VERIFIED BY INSPECTION. SOLDERING, BONDING, AND SHIELDED WIRES ARE SUBJECTED TO INSPECTION.

NONDESTRUCTIVE EVALUATION
X-RAY PENETRANT TEST IS CONDUCTED ON SAMPLING INSPECTION.
ETCHING PROCESSES ARE CONDUCTED BY SUB-SUPPLIER (ROCKWELL COLLINS DIV.)

TESTING
ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGING FOR SHIPMENT IS VERIFIED AND BOUGHT OFF BY ROCKWELL PQA.

(D) FAILURE HISTORY
THE "NO OUTPUT" FAILURES WILL BE ADDRESSED ON THIS CIL.

(1) CAR# AC8378, OV102, KSC, MTU S/N 5, 7-12-84
AT KSC DURING OV102 CHECKOUT, GMT AND MET TIMES FROM THE NON-VOTED CHANNEL WERE ABSENT.
TESTING AT DOWNEY LABORATORY CONFIRMED THE FAILURE. THE FAILURE WAS ISOLATED TO U29, PINS 10,13,14 AND 15 WHICH EXHIBITED CRACKED SOLDER JOINTS. THE SOLDER JOINTS WERE RESOLDERED AND THE UNIT WAS SUCCESSFULLY RE-ACCEPTANCE TESTED.

(E) OPERATIONAL USE
ON ORBIT: THERE IS A PREFLIGHT APPROVED AND VERIFIED G-MEM PROCEDURE TO RECOVER PROPER BFS TIME.