

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : COMMUNICATION & TRACKING FMEA NO 05-2D -22700 -1 REV: 11/07/87

ASSEMBLY : AV BAY I, II	CRIT. FUNC: 1R
P/N RI : MC409-0015-0005	CRIT. HDW: 2
P/N VENDOR:	VEHICLE 102 103 104
QUANTITY : 2	EFFECTIVITY: X
: TWO	PHASE(S): PL X LO X OO DO X LS
:	

PREPARED BY: 11/11/87	REDUNDANCY SCREEN: A-PASS B-PASS C-PASS	APPROVED BY: W C ELDER
DES <i>W C Elder</i> W C ELDER	APPROVED BY: <i>W C Elder</i> 11/13/87	SSM <i>W C Elder</i>
REL 11/10/87 <i>AM</i> A L MASAI	REL <i>W C Elder</i> 11-14-87	REL <i>W C Elder</i> 11/10/87
QE 11/11/87 <i>J T</i> J T COURSEN	QE <i>W C Elder</i> 11/11/87	QE <i>W C Elder</i> 11/20/87

ITEM:
ALTIMETER, RADAR. (IMPROVED DESIGN)

FUNCTION:
PROVIDES PRECISION ALTITUDE UPDATES TO CREW DISPLAYS (AVVI & HUD) DURING LANDING PHASE OF THE MISSION. 81V74A15, 82V74A16.

FAILURE MODE:
LOSS OF OUTPUT

CAUSE(S):
VIBRATION, TEMPERATURE, MECHANICAL SHOCK, CONTAMINATION, MISHANDLING.

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

(A) LOSS OF REDUNDANCY.

(B) NO RADAR ALTIMETER DATA FROM THE FAILED RADAR ALTIMETER WOULD BE PRESENTED TO THE DISPLAYS.

(C) NO EFFECT.

(D) POSSIBLE LOSS OF CREW/VEHICLE AFTER TWO RADAR ALTIMETER FAILURES SINCE PRECISE ALTITUDE DATA FOR CREW DETERMINATION OF SINK RATE IS REQUIRED FOR SAFE NIGHT LANDING OR LANDINGS ON RUNWAYS WITHOUT MSBLS AND TO PREVENT POSSIBLE VEHICLE DAMAGE.

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

(A) DESIGN
THE ORBITER CONTAINS TWO INDEPENDENT RADAR ALTIMETER SYSTEMS, EACH WITH A TRANSMITTING ANTENNA AND A RECEIVING ANTENNA. THE SYSTEMS ARE

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INDEPENDENT AND CAN OPERATE SIMULTANEOUSLY WITHOUT AFFECTING EACH OTHER. BOTH COMMANDER AND PILOT STATIONS HAVE SWITCHES FOR SELECTING RADAR ALTIMETER 1 OR 2 FOR DISPLAY ON THE AVVI. THE "RA OFF" FLAG WILL APPEAR IF THERE IS LOSS OF POWER, LOSS OF LOCK, DATA BAD, OR AFTER THREE COMFAULTS. THE RADAR ALTIMETER IS OFF THE SHELF PROCUREMENT. EEE PARTS MEET OPPL REQUIREMENTS FOR USE OF APPROVED PARTS AND DERATING REQUIREMENTS. NASA SOLDERING REQUIREMENTS HAVE BEEN WAIVED PER OVEI PARA. 3.5.17. EEE PARTS TRACEABILITY WILL BE WAIVED BY AN IPAR. DESIGN UTILIZES HYBRID MODULES TO REDUCE THE NUMBER OF PARTS AND PART TYPES. DESIGN IS DERIVED FROM OTHER MATURE ALL SOLID-STATE ALTIMETER PROGRAMS AND HAS BEEN MODIFIED TO MEET ORBITER UNIQUE SENSITIVITY REQUIREMENTS, I.E., TO PREVENT NOSE GEAR LOCK-ON.

(B) TEST

CIRCUIT CARDS ARE SUBJECTED TO 100% BURN-IN AND SCREENING FOR WORKMANSHIP DEFECTS. ACCEPTANCE TESTING, INCLUDING FUNCTIONAL, THERMAL (ATT) AND VIBRATION (AVT), IS PERFORMED ON EACH RADAR ALTIMETER AT THE VENDOR. QUALIFICATION OF THE IMPROVED RADAR ALTIMETER WILL BE BY SIMILARITY TO OTHER MATURE ALTIMETER DESIGNS. HARDWARE/SOFTWARE COMPATIBILITY TESTS AT SAIL, CERTIFICATION, AND VERIFICATION WILL BE COMPLETED PRIOR TO USE ON OV103, FLIGHT 7. GROUND TURNAROUND TESTS INCLUDE VERIFICATION OF RADAR ALTIMETER DATA ACCURACY AND VERIFICATION OF RADAR ALTIMETER ALTITUDE OFF THE FLIGHT DECK - PERFORMED EVERY FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION

RECEIVING INSPECTION VERIFIES ALL INCOMING PARTS AND MATERIALS, INCLUDING THE PERFORMANCE OF VISUAL AND DIMENSIONAL EXAMINATIONS. CERTIFICATION RECORDS AND TEST REPORTS ARE MAINTAINED CERTIFYING MATERIALS AND PHYSICAL PROPERTIES.

CONTAMINATION CONTROL

QUALITY ASSURANCE (QA) VERIFIES THAT REQUIRED PROCEDURES AND SHOP PRACTICES ARE UTILIZED FOR CONTAMINATION CONTROL.

ASSEMBLY/INSTALLATION

QUALITY PLANNING ENSURES THAT APPROPRIATE DRAWING AND PROCUREMENT REQUIREMENTS ARE INCORPORATED INTO IN-PROCESS WORK TICKETS. ALL MANUFACTURING PROCESSES, INSTALLATION, AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. TORQUING (ACCEPT/REJECT) VERIFIED BY INSPECTION. ACUITY TESTS ARE GIVEN TO INSPECTION PERSONNEL ON A YEARLY BASIS.

CRITICAL PROCESSES

OPERATORS ARE CERTIFIED FOR SOLDERING. OPERATOR PERFORMANCE AND CERTIFICATION ARE MONITORED BY INSPECTION.

TESTING

INSPECTION PERFORMS THE ATP AND CHECKS THE PRODUCT TO THE APPROPRIATE PARAMETERS.

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HANDLING/PACKAGING

PARTS PROTECTION DURING MANUFACTURING OPERATIONS IS VERIFIED BY INSPECTION. ALL ASPECTS OF HANDLING, INSPECTION, AND ASSEMBLY FOR ELECTROSTATIC-SENSITIVE DEVICES ARE MONITORED BY QA. (IMPLEMENTATION OF SHOP CONTROLS TO PREVENT ELECTROSTATIC DISCHARGE WAS INITIATED IN JUNE 1984 AND COMPLETED IN DECEMBER 1985.) PARTS PACKAGING IS VERIFIED BY INSPECTION TO APPLICABLE REQUIREMENTS.

(D) FAILURE HISTORY

ALTHOUGH THERE IS A FAILURE HISTORY ON THE EXISTING DESIGN RADAR ALTIMETER UNITS, NO FAILURE HISTORY IS AVAILABLE FOR THIS NEW GENERATION RADAR ALTIMETER SOON TO BE INCORPORATED INTO ORBITER USE. DURING THE PROCUREMENT OF THIS EQUIPMENT, FAILURE HISTORY FROM OTHER APPLICATIONS WILL BE PROVIDED AS THAT DATA BECOMES AVAILABLE.

(E) OPERATIONAL USE

RADAR ALTIMETER DATA IS AVAILABLE AT 5,000 FEET. DE-ORBIT IS NOT ATTEMPTED IF CEILING IS LESS THAN 8,000 FEET (10,000 FEET IF NO MSBLS AVAILABLE) TO ENSURE GOOD VISIBILITY AT LOW ALTITUDE. MOST ORBITER RUNWAYS ARE EQUIPPED WITH MSBLS GROUND STATIONS WHICH PROVIDE A REDUNDANT SOURCE OF LOW ALTITUDE DATA DOWN TO 50 FEET. RADAR ALTIMETER DATA IS DISPLAYED ON THE HUD AND AVVI NEXT TO NAVIGATION ALTITUDE DATA. CREW CAN ISOLATE A FAILED RADAR ALTIMETER AND THEN SELECT THE OTHER ALTIMETER, IF AVAILABLE, OR DISREGARD RADAR ALTIMETER DATA AND RELY ON NAVIGATION ALTITUDE AND/OR VISUAL CUES.