SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :COMMUNICATION & TRACKING FMEA NO 05-2D -22700 -2 REV:01/18/88

ASSEMBLY :AV BAY I, II
P/N RI :MC409-0015-0005
P/N VENDOR:
QUANTITY :2
:TWO
:

CRIT. FUNC: 1
CRIT. HDW: 1

VEHICLE EFFECTIVITY:	102	103 X	104
PHASE(S):	PL X LO X OO		DO X LS

REDUNDANCY SCREEN: A- B- C-

PREPARED BY:
DES 1-6 EE W C ELDER
REL 1-19-83 A L MASAI
QE 1-20-83 J T COURSEN

APPROVED BY:
DES 1/22/83
REL 1-25-83
QE

APPROVED BY (NASA):
SSM
REL
QE RT 2/1/88

ITEM:
ALTIMETER, RADAR. (IMPROVED DESIGN)

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

FAILURE MODE:
ERRONEOUS OUTPUT

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

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

(A) LOSS OF FUNCTION.

(B) ERRONEOUS RADAR ALTIMETER DATA PRESENTED TO DISPLAYS.

(C,D) POSSIBLE LOSS OF CREW/VEHICLE DURING LANDING SINCE PRECISI
ALTITUDE DATA IS REQUIRED FOR CREW DETERMINATION OF SINK RATE FOR SAF
NIGHT LANDING OR LANDING 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
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

COMMFAULTS. THE RADAR ALTIMETER IS OFF THE SHELF PROCUREMENT. EEE PART MEET OPPL REQUIREMENTS FOR USE OF APPROVED PARTS AND DERATIN REQUIREMENTS. NASA SOLDERING REQUIREMENTS HAVE BEEN WAIVED PER OV PARA. 3.5.17. EEE PARTS TRACEABILITY WILL BE WAIVED BY AN IPAR. DESIG UTILIZES HYBRID MODULES TO REDUCE THE NUMBER OF PARTS AND PART TYPES DESIGN IS DERIVED FROM OTHER MATURE ALL SOLID-STATE ALTIMETER PROGRAM 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 WORKMAN SHIP 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 T OTHER MATURE ALTIMETER DESIGNS. HARDWARE/SOFTWARE COMPATIBILITY TESTS A SAIL, CERTIFICATION, AND VERIFICATION WILL BE COMPLETED PRIOR TO USE O OV103, FLIGHT 7. GROUND TURNAROUND TEST - INCLUDE VERIFICATION OF RADA ALTIMETER DATA ACCURACY AND VERIFICATION OF RADAR ALTIMETER ALTITUDE OF THE FLIGHT DECK - PERFORMED EVERY FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION

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

CONTAMINATION CONTROL

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

ASSEMBLY/INSTALLATION

QUALITY PLANNING ENSURES THAT APPROPRIATE DRAWING AND PROCUREMEN REQUIREMENTS ARE INCORPORATED INTO IN-PROCESS WORK TICKETS. AL MANUFACTURING PROCESSES, INSTALLATION, AND ASSEMBLY OPERATIONS AR 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 AN CERTIFICATION ARE MONITORED BY INSPECTION.

TESTING

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

HANDLING/PACKAGING

PARTS PROTECTION DURING MANUFACTURING OPERATIONS IS VERIFIED B INSPECTION. ALL ASPECTS OF HANDLING, INSPECTION, AND ASSEMBLY FO ELECTROSTATIC-SENSITIVE DEVICES ARE MONITORED BY QA. (IMPLEMENTATION O 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 ATTEMPT TO ISOLATE A FAILED RADAR ALTIMETER BY COMPARING RADAR ALTIMETER DATA TO NAVIGATION DATA AND VISUAL CUES. IF A FAILED RADAR ALTIMETER IS IDENTIFIED, THE CREW SELECTS THE OTHER ALTIMETER, IF AVAILABLE, OR DISREGARDS RADAR ALTIMETER DATA AND RELIES ON NAVIGATION ALTITUDE. CREW IS TRAINED TO ATTEMPT TO ISOLATE A FAILED RADAR ALTIMETER BY COMPARING RADAR ALTIMETER DATA WITH NAVIGATION DATA AND VISUAL CUES.