SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :COMMUNICATION & TRACKING FMEA NO 05-2R -5100 -1 REV:06/27/88

ASSEMBLY :FWD BAY 3A
P/N RI :MC409-0025-100X
P/N VENDOR:
QUANTITY :1
:ONE
:

CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE EFFECTIVITY:	102 X	103 X	104 X

PHASE(S): PL LO OO X DO LS

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

PREPARED BY:
DES H D HADDAD
REL J Y HARADA 7-5-88
QE J T COURSEN

APPROVED BY:
DES 6/27/88
REL 7-26-88
QE 6/28/88

APPROVED BY (NASA):
SSM 9/1/88
REL 9/1/88
QE 9/8/88

ITEM:
KU-BAND, EA-1A KU-BAND, ELECTRONICS ASSEMBLY, PART 1A

FUNCTION:
PROVIDES CONTROL OF ANTENNA GIMBALS AND GIMBAL LOCK MOTOR DRIVE IN ALL STEERING MODES. PROVIDES RADAR & COMM MODE SWITCHING, DA WAVEGUIDE SWITCHING, REFERENCE FREQUENCIES TO DA, EA-2 AND SPA, MDM INTERFACES, SIGNAL DISTRIBUTION FOR THE KU-BAND SUBSYSTEM, COMM SUM CHANNEL FIRST IF DEMODULATION, CARRIER DETECTION, PN DECODING, GCIL AND D & C INTERFACES, ENABLING SIGNAL TO ADA (BSI), AND SELF-TEST. 83V74A23.

FAILURE MODE:
LOSS OF OUTPUT, ERRATIC OPERATION, INADVERTENT OPERATION, ERRONEOUS OUTPUT

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

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

EFFECTS ON ABILITY TO CONTROL, POSITION, OR LOCK ANTENNA GIMBALS - 1R/2

(A,B) LOSS OF ABILITY TO LOCK GIMBALS, REAL-TIME DECISION REQUIRED TO PERFORM IN-FLIGHT MAINTENANCE PROCEDURE WITH EVA OR JETTISON THE DEPLOYED ASSEMBLY.

(C,D) POSSIBLE LOSS OF CREW/VEHICLE AFTER TWO FAILURES IF DA CANNOT BE SECURED FOR REENTRY OR JETTISONED. REENTRY WITH GIMBALS UNLOCKED MAY CAUSE DAMAGE TO THE RADIATOR.

EFFECTS ON MISSIONS REQUIRING KU-BAND SYSTEM SUPPORT - 2/2

(A,B,C) LOSS OF ALL MISSION OBJECTIVES REQUIRING KU-BAND COMM DATA

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PROCESSING OR RENDEZVOUS RADAR.

(D) NO EFFECT.

EFFECTS ON PROVIDING DATA TO NSP FOR STATE VECTOR UPDATE - 1R/3

(A,B,C,D) LOSS OF ONE OF THREE REDUNDANT PATHS TO SUPPLY DATA TO NSP FOR STATE VECTOR UPDATE. UHF PROVIDES AN INDEPENDENT PATH FOR STATE VECTOR UPDATE. AFTER FOUR FAILURES POSSIBLE LOSS OF CREW/VEHICLE DUE TO LOSS OF STATE VECTOR UPDATE. NOTE- A SINGLE FAILURE OF A KU-BAND SPA DASH NUMBER -4001 CAN CAUSE THE LOSS OF POWER TO BOTH NSP'S, RESULTING IN ONLY ONE REMAINING PATH (UHF) TO UPDATE THE STATE VECTOR. THIS FAILURE CAN OCCUR DURING ANY MISSION PHASE. (KU-BAND POWERED ON OR OFF.)

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

(A) DESIGN
ALL EEE PARTS ARE SELECTED FROM OR IN ACCORDANCE WITH -MF0004-400 (OPPL) REQUIREMENTS. SUBASSEMBLIES ARE QUALIFIED BY TEST OR USE OF EXISTING DESIGNS QUALIFIED FOR OTHER NASA & MILITARY PROGRAMS. THE HOUSING IS SEALED AND PRESSURIZED WITH NITROGEN/HELIUM GAS TO PROTECT CIRCUITS AND COMPONENTS FROM DIRECT EXPOSURE TO THE ENVIRONMENT. THE SYSTEM DESIGN INCLUDES A DEPLOYED ASSEMBLY JETTISON CAPABILITY WHICH CAN BE USED IF THE SYSTEM FAILS TO RESPOND TO LOCK OR STOW COMMANDS.

CONFIGURATION - ALL LRU'S ARE OF THE LATEST DASH NUMBER CONFIGURATION WITH THE FOLLOWING EXCEPTIONS - S/N 103 AND S/N 105 RF MODULES ARE SEALED BUT NOT CONFORMALLY COATED. S/N 103 AIRBORNE CONNECTOR IS NOT CONFORMALLY COATED.

(B) TEST
ACCEPTANCE TESTING OF ALL UNITS INCLUDES EXAMINATION OF PRODUCT, AVT, ATT, LEAK AND FUNCTIONAL TEST. QUAL TEST INCLUDES POWER, EMC, CABIN ATMOSPHERE, LEAK, BONDING, LOW PRESSURE THERMAL, THERMAL CYCLE, QAVT, QVT, LIFE, SHOCK, AND PERFORMANCE AT THE LRU LEVEL. AS A PART OF QUAL TESTING, A SYSTEM TEST WAS PERFORMED WITH THE DA EXPOSED TO A QUAL LEVEL THERMAL VACUUM ENVIRONMENT AND THE EA-1, EA-2, AND SPA COLD PLATE TEMPERATURES CYCLED AT QUAL LEVELS. INTEGRATED AND SUBSYSTEM VERIFICATION IS PERFORMED AT KSC. SYSTEM DESIGN VERIFICATION TESTS WERE PERFORMED BY THE HUGHES AIRCRAFT COMPANY AT THEIR FACILITY. NASA CONDUCTED INTEGRATED KU-BAND AND TDRSS VERIFICATION TESTS AT THE ESTL (JSC) AND SOFTWARE COMPATIBILITY TEST AT SAIL AND PASSIVE RADAR PERFORMANCE EVALUATION TEST AT WSMR. LRU SOFTWARE VALIDATION TESTED AGAINST SOFTWARE REQUIREMENTS.

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GROUND TURNAROUND TEST - DEPLOY AND STOW ANTENNA TO VERIFY THAT GIMBALS UNLOCK/LOCK AND BSI AND BSII INDICATE CORRECTLY ON TM. PERFORM RADAR SELF TEST. VERIFY FORWARD LINK OPERATION BY RECEIVING GROUND COMMAND TO CHANGE STEERING MODE. VERIFY RETURN LINK OPERATION BY FRAME SYNC INDICATION OF 192 KBPS AT C&T STATION. VERIFY RADAR TRACKING OPERATION BY TRACKING CEILING OF OPF. IN COMM MODE MEASURE RF POWER AND IN RADAR MODE VERIFY THAT RF POWER RESPONDS CORRECTLY TO HIGH, MEDIUM AND LOW PANEL COMMANDS. VERIFY TWT TURNS OFF WHEN ENTERING OBSCURATION ZONE - PERFORMED EVERY FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION
RECEIVING INSPECTION VERIFIES INCOMING MATERIALS.

CONTAMINATION CONTROL
CONTAMINATION CONTROL PROCESSES ARE MONITORED BY QE. PRECAUTIONS ARE TAKEN TO PREVENT CONTAMINATION (SMOCKS, GLOVES, HATS, BOOTIES AS REQUIRED ARE WORN, AND EATING & DRINKING ARE PROHIBITED). SIGNS ARE POSTED IDENTIFYING CLEANLINESS REQUIREMENTS IN WORK AREAS.

ASSEMBLY/INSTALLATION
INSPECTION WITNESSES CONTAMINATION CONTROL, SOLDERING, BONDING AND TORQUE OPERATIONS. QE INSURES WORK TICKETS REFLECT DRAWING AND SPEC REQUIREMENTS. DETAILED INSPECTION IS PERFORMED ON ALL ASSEMBLY AND DETAIL PARTS PRIOR TO NEXT OPERATION PER PROGRAM QUALITY REQUIREMENT AND WORK TRANSFER QUALITY REQUIREMENTS. INSPECTION REQUIREMENTS ARE TRANSMITTED TO OUTSIDE VENDORS, AND COMPLIANCE IS VERIFIED BY SOURCE INSPECTION AND VENDOR SURVEILLANCE. A FORMAL CONNECTOR ASSEMBLY/HANDLING TRAINING COURSE FOR ALL TECHNICIANS AND INSPECTORS WAS IMPLEMENTED IN NOVEMBER, 1986. SPECIAL HANDLING OF COMMUNICATION BOARDS, INCLUDING BAKEOUT PRIOR TO ASSEMBLY, LIMITED APPLICATION OF HEAT, AND USE OF SPECIALLY TRAINED ASSEMBLY OPERATORS, WAS ADDED IN 1986 TO PRECLUDE BOARD DELAMINATION. NEW WORK STATIONS WERE INSTALLED IN THE EA-1/SPA ASSEMBLY AREA IN 1987 WHICH PROVIDE IMPROVED LAYOUT, REDUCED DAMAGE SUSCEPTIBILITY, AND IMPROVED LIGHTING.

CRITICAL PROCESSES
CRITICAL PROCESSES, SUCH AS, SOLDERING AND CRIMPING, ARE CERTIFIED. THE FORMAL CERTIFICATION OF ALL TECHNICIANS AND INSPECTORS FOR CRIMPING OPERATIONS WAS IMPLEMENTED IN NOVEMBER, 1986. ANNUAL VISION TESTS ARE GIVEN TO INSPECTORS. ALL CRITICAL PROCESSES ARE MONITORED AND VERIFIED BY QC PER PROGRAM QUALITY REQUIREMENT INSTRUCTIONS.

TESTING
INSPECTION VERIFIES ATT/AVT, LEAK AND INSULATION RESISTANCE/DIELECTRIC STRENGTH TESTS. USE OF NON-SKID TEST PROBES TO MINIMIZE SLIPPAGE WAS IMPLEMENTED IN SEPTEMBER, 1986.

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HANDLING/PACKAGING
ALL KITTING, ASSEMBLY, TEST, INSPECTION, TROUBLESHOOTING, AND REWORK OPERATIONS ON STATIC-SENSITIVE DEVICES ARE PERFORMED AT STATIC-SAFE WORK STATIONS AND IN ACCORDANCE WITH PROGRAM INSTRUCTION. HARDWARE ITEMS ARE PACKAGED, PROTECTED, AND INSPECTED PER ENGINEERING DRAWING REQUIREMENTS AND PROGRAM QUALITY REQUIREMENT INSTRUCTIONS.

(D) FAILURE HISTORY
POST-ATP FAILURE HISTORY - CAR 17F005-010 S/N 105 BETA MOTOR DRIVE TRANSISTORS FAILED DUE TO SHORT IN THE DA MOTOR, REFERENCE DA FMEA # 05-2R-5300-1 (SCREW REPLACED WITH CAPTIVE DEVICE). CAR 24F008-010 S/N 102 (LOST ON GV099) SELF-TEST FAILED INDICATING EA-1 FAILURE. PRE AND POST MISSION TESTING INDICATED NO PROBLEM, MOST PROBABLE CAUSE A SINGLE EVENT UPSET. CAR 14F006-010, S/N 104, ANTENNA OSCILLATION CAUSED BY STARTING SCAN OUTSIDE PERFORMANCE LIMITS, MODIFIED CREW PROCEDURES. SIMILAR OSCILLATION CAN OCCUR DURING ANTENNA FAST SLEWING.

(E) OPERATIONAL USE

WORKAROUND TO REGAIN ABILITY TO CONTROL, POSITION, OR LOCK ANTENNA GIMBALS
REAL-TIME DECISION REQUIRED TO PERFORM THE GIMBAL LOCK IN-FLIGHT MAINTENANCE PROCEDURE WITH EVA OR TO JETTISON THE DA.

WORKAROUND TO REGAIN SUPPORT OF MISSION OBJECTIVES
COMM: NONE. RADAR: ATTEMPT RENDEZVOUS WITH ALTERNATE SENSORS. USE BACK-UP RENDEZVOUS PROCEDURES.

WORKAROUND TO PROVIDE THE STATE VECTOR UPDATE
THE STATE VECTOR CAN BE UPDATED VIA THE NORMAL S-BAND COMMUNICATIONS LINK OR VIA UHF/AUDIO.