SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :COMMUNICATION & TRACKING FMEA NO 05-2R -5134 -2 REV:06/27/88

ASSEMBLY :PNL A2
P/N RI :MC432-0255-0001
P/N VENDOR:
QUANTITY :1
:ONE
:

CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE EFFECTIVITY:	102	103	104
	X	X	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 8/17/88
REL 8-30-88
QE

APPROVED BY (NASA):
SSM 9/9/88
REL 9/7
QE 9/8/88
MC SSM 9/14/88
MC REL 9/14/88

ITEM:
M2, DIGITAL DISPLAY (RENDEZVOUS RADAR INDICATOR), KU-BAND DIGITAL DISPLAY, KU-BAND RANGE, RANGE RATE, ELEVATION, AND AZIMUTH ANGLES.

FUNCTION:
PROVIDES DIGITAL DISPLAY OF RANGE AND RANGE RATE OR ELEVATION AND AZIMUTH ANGLES PER SELECTION BY DEDICATED SWITCH (FMEA # 05-2R-5101). 36V73A2M2:

FAILURE MODE:
SHORTS TO GROUND, INTERNAL SHORT TO CASE (GROUND)

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 OF 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 PROCEDURES 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 PROCESSING OR RENDEZVOUS RADAR.

(D) NO EFFECT.

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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

THE RENDEZVOUS RADAR INDICATOR (RRI) PROVIDES TWO FOUR DIGIT DISPLAYS WITH A PLUS OR MINUS SIGN TO INDICATE RANGE/ELEVATION AND RANGE RATE/AZIMUTH INFORMATION FROM ONE OF TWO DATA SOURCES (SELECTION OF WHICH IS DETERMINED BY EXTERNAL SWITCH). THE ELECTRICAL, ELECTRONIC AND ELECTRICAL MECHANICAL COMPONENTS ARE SELECTED FROM OR IN ACCORDANCE WITH THE ORBITER PREFERRED PARTS LIST (OPPL) REQUIREMENTS. COMPONENT APPLICATIONS ARE EVALUATED TO ASSURE COMPLIANCE WITH DERATING REQUIREMENTS.

(B) TEST

QUALIFICATION/CERTIFICATION
TESTING AND ANALYSIS HAVE BEEN COMPLETED, APPROVED AND INCLUDES: FUNCTIONAL, VIBRATION INCLUDING QUAL/ACCEPTANCE VIBRATION (QAVT), FLIGHT VIBRATION ACCELERATION, THERMAL CYCLING, SHOCK, THERMAL VACUUM, TOUCH TEMPERATURE, ELECTROMAGNETIC INTERFERENCE (EMI), LIGHTING, VOLTAGE TRANSIENT AND VOLTAGE EXCURSION TESTS ALONG WITH BONDING AND POWER TEST.

ACCEPTANCE AND SCREENING
ALL UNITS ARE SUBJECTED TO ACCEPTANCE AND SCREENING TESTS WHICH INCLUDE FUNCTIONAL, LIGHTING, VIBRATION, THERMAL, AND INSULATION RESISTANCE (IR) TESTS.

GROUND TURNAROUND TEST
RADAR SELF-TEST PERFORMED EVERY FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION
PERFORMS VISUAL AND DIMENSIONAL EXAMINATION OF ALL INCOMING PARTS PER QUALITY CONTROL (QC) INSTRUCTIONS. CERTIFICATION RECORDS/TEST REPORTS ARE MAINTAINED CERTIFYING MATERIALS AND PHYSICAL PROPERTIES.

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CONTAMINATION CONTROL
QUALITY ASSURANCE (QA) VERIFIES THAT APPROPRIATE PROCEDURES AND SHOP PRACTICES ARE UTILIZED FOR CONTAMINATION CONTROL IN ALL PHASES OF MANUFACTURING.

ASSEMBLY/INSTALLATION
HARDWARE IS ASSEMBLED WITH CONTROLLED PRINTS AND SEQUENTIAL BUILD OPERATION SHEETS WHICH INCLUDE MANDATORY INSPECTION POINTS. ASSEMBLY BENCHES ARE EQUIPPED WITH GROUND STRAPS AND BENCH COVERS FOR USE DURING HANDLING OF STATIC SENSITIVE DEVICES.

CRITICAL PROCESSES
ALL CRITICAL PROCESSES (WAVE SOLDERING, CONFORMAL COATING, AND FLAME RETARDANT COATING) ARE PERFORMED IN ACCORDANCE WITH SUPPLIER PROCESS STANDARDS, AUDITED BY QA, AND INSPECTED PER OPERATION SHEET.

TESTING
ACCEPTANCE TESTS PROCEDURE IS OBSERVED AND VERIFIED BY QC, INCLUDING LIGHTING, AVT, ATT AND INSULATION RESISTANCE (IR) TESTS.

HANDLING/PACKAGING
PARTS PACKAGED AND PROTECTED ARE VERIFIED BY INSPECTION TO APPLICABLE REQUIREMENTS.

(D) FAILURE HISTORY

THERE HAVE BEEN NO FIELD (POST DELIVERY) FAILURES OF THE RENDEZVOUS RADAR INDICATOR. THERE WERE THREE FAILURES REPORTED DURING QUALIFICATION TESTING; ONE WAS NOT DUPLICATED OR VERIFIED AND TEST SEQUENCE WAS CONTINUED (CAR AB7825). ANOTHER (CAR AB7071), THE LOSS OF A SEGMENT IN ONE DISPLAY DIGIT WAS ISOLATED TO MINUTE CRACKS IN THE METALLIZATION OF THE DECODER/DRIVER INTEGRATED CIRCUIT. AN INCOMING INSPECTION SCREENING TEST WAS ESTABLISHED AND INCORPORATED FOR ALL DECODER/DRIVER DEVICES. THE THIRD FAILURE (CAR AB8679), WAS EXPERIENCED DURING VIBRATION WHERE TWO DISPLAY DIGITS FAILED TO ILLUMINATE. THESE WERE ISOLATED TO THE LAMP MODULES WHICH WERE LOST BEFORE FAILURE ANALYSIS WAS ACCOMPLISHED. SIMILAR FAILURES WITHIN OTHER DISPLAYS HAVE ATTRIBUTED THIS TYPE OF FAILURE TO WIRE CONNECTION WITHIN THE LAMP MODULE. ADDITIONAL INSPECTION AND SCREENING TESTS WERE INCORPORATED.

WHILE THERE WERE SEVERAL ACCEPTANCE TEST FAILURES, ONLY ONE WAS SIGNIFICANT (CAR AC0874). THIS WAS A FUNCTIONAL FAILURE RESULTING IN AN INCORRECT DISPLAY. ANALYSIS DISCLOSED THAT THE DESIGN PARAMETER MARGINS WERE INADEQUATE AND UNDESIRED OSCILLATION COULD OCCUR. AN ENGINEERING DESIGN CHANGE PROPOSAL (EDCP) WAS PROCESSED AND APPROVED THAT ADDED A POSITIVE FEEDBACK CIRCUIT, THUS ELIMINATING THE POTENTIAL CIRCUIT OSCILLATION. ALL FLIGHT UNITS WERE RECONFIGURED AND IDENTIFIED AS -0002.

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(E) OPERATIONAL USE

WORKAROUND TO REGAIN ABILITY TO CONTROL, POSITION, OR LOCK ANTENNA GIMBALS
REAL-TIME DECISION TO PERFORM EA-1 ALTERNATE POWER IN-FLIGHT MAINTENANCE PROCEDURE TO LOCK THE GIMBALS AND STOW THE DA 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.