CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51140E391
SHEET:

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY RATIONALE FOR ACCEPTANCE
1340	0	THC DEMODULATOR SCHEMATIC QTY-3 E087325	MODE: LOSS OF OUTPUT ON ONE OR MORE AXES. CAUSE(S): (1) INTERNAL PARTS FAILURE.	LOSS OF THC COMMANDS. RHC COMMANDS STILL AVAILABLE. ARM WILL CONTINUE TO RESPOND TO RHC COMMANDS. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. WORST CASE UNEXPECTED MOTION. INCORRECT H/C COMMANDS. UNANNUNCIATED. CREW ACTION REQ. REDUNDANT PATHS REMAINING N/A	DESIGN FEATURES THE DEMODULATOR, FOR EACH OF THE THC AXES, COMPRISES OF A TRANSFORMER-DRIVEN DIODE/RESISTOR BRIDGE WHOSE OUTPUT IS CONDITIONED BY TWO OPERATIONAL AMPLIFIER STAGES. THREE IDENTICAL CIRCUITS ARE PACKAGED ON A PRINTED CIRCUIT BOARD WHICH IS MECHANICALLY JOINED TO A DUMMY BOARD, ALONG TWO EDGES BY MACHINED SPACERS. A CENTRAL SPACER PROVIDES ADDITIONAL STIFFENING OF THE ASSEMBLY. THE MODULE IS SUPPORTED IN MACHINED GUIDEWAYS IN THE ELECTRONICS PACKAGE. LATERAL RESTRAINT IS PROVIDED BY TWO PAIRS OF BOW SPRINGS ENGAGING THE GUIDEWAYS. THE LOWER EDGE OF EACH BOARD INTERFACES VIA A PRINTED CIRCUIT BOARD CONNECTOR, AND THE MODULE IS RESTRAINED BY THE ELECTRONICS PACKAGE COVER WHICH BEARS ON A PAIR OF COMPRESSIBLE WEDGES ON THE UPPER EDGE OF THE MODULE. THE +/- 12 VDC SUPPLY IS ROUTED THROUGH THE PCB CONNECTOR. THE CONNECTORS WERE SUBJECTED TO CONSTRUCTION ANALYSIS TO ENSURE THAT MATERIALS AND DESIGN ARE SUPPORTIVE OF RELIABLE PERFORMANCE. EEE PARTS HAVE BEEN SELECTED AND CONTROLLED IN ACCORDANCE WITH SPAR-RMS-PA.003. THIS DOCUMENT DEFINES THE PROGRAM REQUIREMENTS FOR MONITORING AND CONTROLLING EEE PARTS. THE REQUIREMENTS INCLUDE PARTS SELECTION TO AT LEAST "ESTABLISHED RELIABILITY" LEVELS, AND ADEQUATE DERATING OF PART STRESS LEVELS. PROCEDURES AND ACTIVITIES ARE SPECIFIED TO ENSURE AT LEAST EQUIVALENT QUALITY FOR NONSTANDARD AND IRREGULAR PARTS. RELIABILITY ANALYSIS HAS CONFIRMED NO PARTS WITH GENERICALLY HIGH FAILURE RATES. AEROSPACE DESIGN STANDARDS FOR DETAILING ELECTRONIC PARTS PACKAGING, MOUNTING AND STRUCTURAL/MECHANICAL/INTEGRITY OF ASSEMBLIES ARE APPLIED. SUCH DESIGN HAS BEEN REVIEWED AND FOUND SATISFACTORY THROUGH THE DESIGN AUDIT PROCESS, INCLUDING THE USE OF RELIABILITY, MAINTAINABILITY AND SAFETY CHECKLISTS. MATERIAL SELECTION AND USAGE CONFORMS TO SPAR-SG.368 WHICH IS EQUIVALENT TO THE NASA MATERIALS USAGE REQUIREMENTS. WORST CASE ANALYSIS HAS BEEN CONDUCTED TO ENSURE THAT PERFORMANCE CAN BE MET UNDER WORST CASE TEMPERATURE AND AGING EFFECTS. EEE PARTS STRESS ANALYSIS HAS BEEN COMPLETED AND CONFIRMS THAT THE PARTS MEET THE DERATING REQUIREMENTS. PRINTED CIRCUIT BOARD DESIGNS HAVE BEEN REVIEWED TO ENSURE ADEQUATE CIRCUIT PATH WIDTH AND SEPARATION AND TO CONFIRM APPROPRIATE DIMENSIONS OF CIRCUIT SOLDER PADS AND OF COMPONENT HOLE PROVISIONS. PARTS MOUNTING METHODS ARE CONTROLLED IN ACCORDANCE WITH MSFC-STD-136 AND CAE PD93489. THESE DOCUMENTS REQUIRE APPROVED MOUNTING METHODS, STRESS RELIEF, AND COMPONENT SECURITY. WHERE APPLICABLE, DESIGN DRAWINGS AND DOCUMENTATION GIVE CLEAR IDENTIFICATION OF HANDLING PRECAUTIONS FOR ESD SENSITIVE PARTS.

PREPARED BY: MFWG   SUPERCEDING DATE: 11 SEP 86   APPROVED BY: DATE:

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: D&C PANEL
SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 5T1Z0E391
SHEET: 2

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE.	FAILURE EFFECT ON END ITEM	MDUR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
1340	0	THC DEMODULATOR SCHEMATIC QTY-3 ED87325	MODE: LOSS OF OUTPUT ON ONE OR MORE AXES. CAUSE(S): (1) INTERNAL PARTS FAILURE.	LOSS OF THC COMMANDS. RHC COMMANDS STILL AVAILABLE. ARM WILL CONTINUE TO RESPOND TO RHC COMMANDS. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. WORST CASE --------- UNEXPECTED MOTION. INCORRECT H/C COMMANDS. UNANNUNCIATED. CREW ACTION REQ. REDUNDANT PATHS REMAINING --------- N/A		BOARD ASSEMBLY DRAWINGS INCLUDE THE REQUIREMENT FOR SOLDERING STANDARDS IN ACCORDANCE WITH NHB 5300.4(3A) AND JSC 08800A.

PREPARED BY: MFWG
SUPERCEDING DATE: 11 SEP 86
APPROVED

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CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: D&C PANEL
SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 5114OE391
SHEET: 3

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY — RATIONALE FOR ACCEPTANCE
1340	0	THC DEMODULATOR SCHEMATIC QTY-3 E087325	MODE: LOSS OF OUTPUT ON ONE OR MORE AXES. CAUSE(S): (1) INTERNAL PARTS FAILURE.	LOSS OF THC COMMANDS. RHC COMMANDS STILL AVAILABLE. ARM WILL CONTINUE TO RESPOND TO RHC COMMANDS. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. WORST CASE UNEXPECTED MOTION. INCORRECT H/C COMMANDS. UNANNUNCIATED. CREW ACTION REQ. REDUNDANT PATHS REMAINING N/A	ACCEPTANCE TESTS THE HARDWARE ITEM IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTING AS PART OF THE D&C PANEL. O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1 O THERMAL: +100 DEGREES F TO +10 DEGREES F 2 CYCLES (9.5 HRS PER CYCLE) THE D&C PANEL ASSEMBLY IS FURTHER TESTED AS PART OF THE RMS SYSTEM (TPS18 RMS STRONGBACK TEST AND TP552 FLAT FLOOR TEST) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE. QUALIFICATION TESTS THE D&C PANEL HAS BEEN SUBJECTED TO THE FOLLOWING QUALIFICATION TEST ENVIRONMENT: O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1 O SHOCK: 20G/11MS - 3 AXES (6 DIRECTION) O THERMAL: 130 DEGREES F TO -23 DEGREES F (12 HRS PER CYCLE) (6 CYCLES) O HUMIDITY: 95% (120 DEGREES F TO 82 DEGREES F CYCLE IN 16 HRS) 10 CYCLES TOTAL O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TEST CE01, CE CE03, CS01(DC/AC), CS02, CS06, RE02 (B/N), RS02, RS03, RS04) RE02 (B/N) RS02, 03, 04) FLIGHT CHECKOUT PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987

PREPARED BY: MFWG SUPERCEDING DATE: 11 SEP 86 APPROVED BY: _____ DATE: _____

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: DSC PANEL
SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51T20E301
SHEET: ____

ITEM REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
1340	0	THC DEMODULATOR SCHEMATIC QTY-3 ED87325	MODE: LOSS OF OUTPUT ON ONE OR MORE AXES. CAUSE(S): (1) INTERNAL PARTS FAILURE.	LOSS OF THC COMMANDS. RHC COMMANDS STILL AVAILABLE. ARM WILL CONTINUE TO RESPOND TO RHC COMMANDS. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. WORST CASE ---------- UNEXPECTED MOTION. INCORRECT H/C COMMANDS. UNANNUNCIATED. CREW ACTION REQ. REDUNDANT PATHS REMAINING ---------- N/A		QA/INSPECTIONS ---------- THC DEMODULATOR MODULES ARE MANUFACTURED TO THE REQUIREMENTS OF CAE DRAWING NO. MA87325. THIS DRAWING DEFINES THE ASSEMBLY, PROCESS, INSPECTION AND TEST REQUIREMENTS FOR THE MODULES. TESTING OF UNITS IS PERFORMED TO CAE SPECIFICATION NO. IS87325. UNITS ARE QUALIFICATION AND ACCEPTANCE TESTED AS PART OF THE THC ASSEMBLY. EEE PARTS INSPECTION IS PERFORMED AS REQUIRED BY SPAR-RMS-PA.003. EACH EEE PART IS QUALIFIED AT THE PART LEVEL TO THE REQUIREMENTS OF THE APPLICABLE SPECIFICATION. ALL EEE PARTS ARE 100% SCREENED AND BURNED IN, AS A MINIMUM, AS REQUIRED BY SPAR-RMS-PA.003, BY THE SUPPLIER. ADDITIONALLY, EEE PARTS ARE 100% RE-SCREENED IN ACCORDANCE WITH REQUIREMENTS, BY AN INDEPENDENT SPAR APPROVED TESTING FACILITY. DPA IS PERFORMED AS REQUIRED BY PA.003 ON A RANDOMLY SELECTED 5% OF PARTS, MAXIMUM 5 PIECES, MINIMUM 3 PIECES FOR EACH LOT NUMBER/DATE CODE OF PARTS RECEIVED. WIRE IS PROCURED TO SPECIFICATION MIL-W-22759 OR MIL-W-81381 AND INSPECTED AND TESTED TO NASA JSCM8080 STANDARD NUMBER 95A. RECEIVING INSPECTION VERIFIES THAT ALL PARTS RECEIVED ARE AS IDENTIFIED IN THE PROCUREMENT DOCUMENTS, THAT NO PHYSICAL DAMAGE HAS OCCURRED TO PARTS DURING SHIPMENT, THAT THE RECEIVING DOCUMENTS PROVIDE ADEQUATE TRACEABILITY INFORMATION AND SCREENING DATA CLEARLY IDENTIFIES ACCEPTABLE PARTS. PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE, PRINTED CIRCUIT BOARD INSPECTION FOR TRACK SEPARATION, DAMAGE AND ADEQUACY OF PLATED THROUGH HOLES, COMPONENT MOUNTING INSPECTION FOR CORRECT SOLDERING, WIRE LOOPING, STRAPPING, ETC. OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA NHB 5300.4(3A) STANDARD, AS MODIFIED BY JSC 08800A. CONFORMAL COATING INSPECTION FOR ADEQUATE PROCESSING IS PERFORMED USING ULTRAVIOLET LIGHT TECHNIQUES. POST P.C. BD. INSTALLATION INSPECTION, CLEANLINESS AND WORKMANSHIP (SPAR/GOVERNMENT REP. MANDATORY INSPECTION POINT) P.C. BD. INSTALLATION INSPECTION, CHECK FOR CORRECT BOARD INSTALLATION, ALIGNMENT OF BOARDS, PROPER CONNECTOR CONTACT MATING, WIRE ROUTING, STRAPPING OF WIRES ETC., PRE-CLOSURE INSPECTION, WORKMANSHIP AND CLEANLINESS (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT) PRE-TEST INSPECTION, INCLUDES CHECKING FOR DAMAGED COMPONENTS, THE TEST AREA ENVIRONMENT, VISUAL INSPECTION OF THE TEST JIG COMPONENTS THAT ARE IN CONTACT WITH THE UNIT, CALIBRATION/VALIDATION OF TEST EQUIPMENT ETC.

PREPARED BY: MFWG
SUPERCEDING DATE: 11 SEP 86
APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SSMS
ASS'Y NOMENCLATURE: D&C PANEL
SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: ST1Z0E301
SHEET: 5

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	POWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
1340	D	THC DEMODULATOR SCHEMATIC QTY-3 ED87325	MODE: LOSS OF OUTPUT ON ONE OR MORE AXES. CAUSE(S): (1) INTERNAL PARTS FAILURE.	LOSS OF THC COMMANDS. RHC COMMANDS STILL AVAILABLE. ARM WILL CONTINUE TO RESPOND TO RHC COMMANDS. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. WORST CASE --- UNEXPECTED MOTION. INCORRECT H/C COMMANDS. UNANNUNCIATED. CREW ACTION REQ. REDUNDANT PATHS REMAINING --- N/A	MODULE TESTING, INCLUDES CALIBRATION AND AMBIENT FUNCTIONAL TESTING. (CAE/GOVERNMENT REP. - MANDATORY INSPECTION POINT). PRE-TEST INSPECTION OF THC ASSY. INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT). A TEST READINESS REVIEW (TRR) WHICH INCLUDES VERIFICATION OF TEST PERSONNEL, TEST DOCUMENTS, TEST EQUIPMENT CALIBRATION/ VALIDATION STATUS AND HARDWARE CONFIGURATION IS CONVENED BY QUALITY ASSURANCE IN CONJUNCTION WITH ENGINEERING, RELIABILITY, CONFIGURATION CONTROL, SUPPLIER AS APPLICABLE, AND THE GOVERNMENT REPRESENTATIVE, PRIOR TO THE START OF ANY FORMAL TESTING (ACCEPTANCE OR QUALIFICATION). ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT PERFORMANCE, THERMAL AND VIBRATION TESTING, (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT). INTEGRATION OF D&C PANEL, RHC, THC AND MCIU, INSPECTIONS ARE PERFORMED AT EACH STAGE OF INTEGRATION, WHICH INCLUDES GROUNDING CHECKS, INTER CONNECT CABLE VERIFICATION, CONNECTOR INSPECTION FOR BENT OR PUSHBACK CONTACTS ETC. SUB-SYSTEM PERFORMANCE TESTING (ATP), INCLUDES AN AMBIENT PERFORMANCE TEST. (MANDATORY INSPECTION POINT). SRMS SYSTEMS INTEGRATION, THE INTEGRATION OF MECHANICAL ARM SUBASSEMBLIES AND THE FLIGHT CABIN EQUIPMENT TO FORM THE SRMS. INSPECTIONS ARE PERFORMED AT EACH PHASE OF INTEGRATION WHICH INCLUDES GROUNDING CHECKS, THRU WIRING CHECKS, WIRING ROUTING, INTERFACE CONNECTORS FOR BENT OR PUSH BACK CONTACTS ETC. SRMS SYSTEMS TESTING - STRONGBACK AND FLAT FLOOR AMBIENT PERFORMANCE TEST. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)

PREPARED BY: MFWG SUPERCEDING DATE: 11 SEP 86 APPROVED BY: _____ DATE: _____

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: D&C PANEL
SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51140E391
SHEET: 6

FMEA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
1340	F	THC DEMODULATOR SCHEMATIC QTY-3 ED87325	MODE: LOSS OF OUTPUT ON ONE OR MORE AXES. CAUSE(S): (1) INTERNAL PARTS FAILURE.	LOSS OF THC COMMANDS. RHC COMMANDS STILL AVAILABLE. ARM WILL CONTINUE TO RESPOND TO RHC COMMANDS. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. WORST CASE --- UNEXPECTED MOTION. INCORRECT H/C COMMANDS. UNANNUNCIATED. CREW ACTION REQ. REDUNDANT PATHS REMAINING --- N/A		FAILURE HISTORY --- REFER FAR 4013. ONE DEMODULATOR OUTPUT WAS INTERMITTENTLY OPEN CIRCUIT. DURING QUALIFICATION TESTING AND SUBSEQUENT FLIGHT HARDWARE TESTING, A NUMBER OF OPEN CIRCUIT AND INTERMITTENT CIRCUIT FAILURES WERE EXPERIENCED. THESE FAILURES WERE ATTRIBUTABLE TO A POOR QUALITY FEATURE ASSOCIATED WITH THE PRINTED CIRCUIT BOARD CONNECTORS WITHIN THE D&C ELECTRONICS PACKAGE. THE FEMALE CONNECTORS, FORMING PART OF THE FILM WIRING ASSEMBLY, WERE A PRODUCT OF THE AIRBORN COMPANY AND WERE PROCURED TO MIL-C-55302. THE SOCKET CONTACTS OF THESE CONNECTORS EXHIBITED INTERMITTENT CONTACT BETWEEN THE SOCKET CONTACT LEAVES AND THE SOLDER TAIL. CONNECTOR FROM ALTERNATE SUPPLIERS WERE EVALUATED FOR CONSTRUCTION FEATURES OF SOCKET CONTACTS AND THE TEXAS INSTRUMENT PRODUCT WAS SELECTED. ALL ELECTRONICS PACKAGE FILM WIRING ASSEMBLIES HAVE BEEN REWORKED TO FIT THE IMPROVED CONNECTOR. NO SUBSEQUENT FAILURES HAVE BEEN EXPERIENCED. FAR 4013: S/N 202 MAY 80 DESCRIPTION --- FOLLOWING Y AXIS VIB, Z AXIS METER READS 2.0 VOLTS @ 6.0 DUE TO INTERMITTANT CONTACTS OF E.P. FILM WIRING UNIT S/N 203. CORRECTIVE ACTION --- MRR 80742 80744 PROVIDES FOR REDUNDANT CONTACTS ON FILM WIRING SIGNALS.

PREPARED BY: MFHG
SUPERCEDING DATE: 06 OCT 87
APPROVED
DATE:

CRITICAL ITEMS LIST

PROJECT: SAMS
ASS'Y NOMENCLATURE: D&C PANEL
SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51T40E391
SHEET: 1

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
1340	A	THC DEMODULATOR SCHEMATIC QTY-3 ED87325	MODE: LOSS OF OUTPUT ON ONE OR MORE AXES. CAUSE(S): (1) INTERNAL PARTS FAILURE.	LOSS OF THC COMMANDS. RHC COMMANDS STILL AVAILABLE. ARM WILL CONTINUE TO RESPOND TO RHC COMMANDS. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. WORST CASE --- UNEXPECTED MOTION. INCORRECT H/C COMMANDS. UNANNUNCIATED. CREW ACTION REQ. REDUNDANT PATHS REMAINING --- N/A		OPERATIONAL EFFECTS --- ARM DOES NOT RESPOND PROPERLY TO HAND CONTROLLER COMMANDS. CREW INHERENTLY COMPENSATES FOR ANY UNDESIRED ARM TRAJECTORY. CREW ACTION --- APPLY BRAKES. CREW TRAINING --- THE CREW WILL BE TRAINED TO OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES. MISSION CONSTRAINT --- OPERATE UNDER VERNIER RATES WITHIN 10 FT OF STRUCTURE. THE OPERATOR MUST BE ABLE TO DETECT THAT THE ARM IS RESPONDING PROPERLY TO COMMANDS VIA WINDOW AND/OR CCTV VIEWS DURING ALL ARM OPERATIONS. SCREEN FAILURES --- N/A OMRSD OFFLINE --- APPLY VOLTAGES TO X,Y,Z INPUTS. VERIFY THC DEMODULATOR X,Y,Z OUTPUTS AT D&C PANEL OUTPUT. OMRSD ONLINE INSTALLATION --- NONE OMRSD ONLINE TURNAROUND --- EXERCISE THC ALL AXES VERIFY BIT COUNTS IN EACH AXIS

PREPARED BY: MMG
SUPERCEDING DATE: 06 OCT 87
APPROVED BY: _____ DATE: _____