

CRITICAL ITEMS LIST

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

SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51140391

SHEET: 1

TREA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RDMN / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
1510	1	HAND CONTROLLER OSCILLATOR Q1Y-1 REFERENCE: SCHEMATIC E087899	<p>MODE: LOSS OF OUTPUT VOLTAGE.</p> <p>CAUSE(S): (1) FAILURE OF AMPLIFIER.</p> <p>(2) FAILURE OF AMPLIFIER CIRCUIT.</p> <p>(3) TRANSFORMER, PRIMARY OR SECONDARY FAILS OPEN OR CLOSED.</p>	<p>NO OUTPUT FROM HAND CONTROLLERS. ARM WILL COME TO REST IF IN MANUAL AUGMENTED MODES.</p> <p>WORST CASE</p> <p>LOSS OF MISSION. MANUAL AUGMENTED MODES INOPERATIVE.</p> <p>REDUNDANT PATHS REMAINING</p> <p>N/A</p>	DESIGN FEATURES	<p>ALL EEE PARTS UTILIZED IN THE OSCILLATOR ARE OF MATURE TECHNOLOGY. THE PACKAGE CONFIGURATION ENSURES THERMAL ISOLATION BETWEEN THE BASIC OSCILLATOR AND VOLTAGE CONTROL FEEDBACK ELEMENTS, AND THE POWER OUTPUT STAGE. THE OUTPUT TRANSISTORS ARE MOUNTED TO A MACHINED HEAT SINK WHICH IN TURN IS MOUNTED TO A MACHINED HOUSING. ATTACHMENT OF THE HOUSING TO THE BASIC PANEL STRUCTURE ENSURES GOOD HEAT TRANSFER.</p> <p>THE OUTPUT TRANSFORMER CONFORMS TO THE DESIGN REQUIREMENTS OF MIL-1-27 AND IS SUBJECTED TO THE ADDITIONAL SCREENING REQUIREMENT OF PA.003.</p> <p>THE OSCILLATOR OUTPUT AMPLITUDE IS CONTROLLED BY A FEEDBACK LOOP COMPRISED, ESSENTIALLY, OF A COMPARATOR AND A FIELD-EFFECT TRANSISTOR (FET). THE AMPLIFIER (LM100), AND THE FET (2N3023) ARE STANDARD EEE PARTS. CIRCUIT ANALYSIS, SUPPORTED BY ENGINEERING THERMAL TESTING, HAS VERIFIED ADEQUATE STRESS AND STABILITY MARGINS.</p> <p>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 GENERALLY 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.360 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.</p> <p>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.</p> <p>PARTS MOUNTING METHODS ARE CONTROLLED IN ACCORDANCE WITH NSFC-STD-136 AND CAE PD93489. THESE DOCUMENTS REQUIRE APPROVED MOUNTING METHODS, STRESS RELIEF, AND COMPONENT SECURITY.</p> <p>WHERE APPLICABLE, DESIGN DRAWINGS AND DOCUMENTATION GIVE CLEAR IDENTIFICATION OF HANDLING PRECAUTIONS FOR ESD SENSITIVE PARTS.</p> <p>BOARD ASSEMBLY DRAWINGS INCLUDE THE REQUIREMENT FOR SOLDERING STANDARDS IN ACCORDANCE WITH RHB 5300.4(1A) AND JSC 08801A.</p>

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SHEET: 2

ITEM REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	DOWN / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
1310	1	HAND CONTROLLER OSCILLATOR QTY-1 REFERENCE: SCHEMATIC EDD7899	MODE: LOSS OF OUTPUT VOLTAGE. CAUSE(S): (1) FAILURE OF AMPLIFIER. (2) FAILURE OF AMPLIFIER CIRCUIT. (3) TRANSFORMER. PRIMARY OR SECONDARY FAILS OPEN OR CLOSED.	NO OUTPUT FROM HAND CONTROLLERS. ARM WILL COME TO REST IF IN MANUAL AUGMENTED MODES. WORST CASE ----- LOSS OF MISSION. MANUAL AUGMENTED MODES INOPERATIVE. REDUNDANT PATHS REMAINING ----- N/A		

PREPARED BY: MWG

SUPERSEDING DATE: 03 DEC 86

APPRO

DATE:

CRITICAL ITEMS LIST

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

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

SHEET: 3

AREA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
1310	1	HAND CONTROLLER OSCILLATOR QTY-1 REFERENCE: SCHEMATIC EDD7899	MODE: LOSS OF OUTPUT VOLTAGE. CAUSE(S): (1) FAILURE OF AMPLIFIER. (2) FAILURE OF AMPLIFIER CIRCUIT. (3) TRANSFORMER, PRIMARY OR SECONDARY FAILS OPEN OR CLOSED.	NO OUTPUT FROM HAND CONTROLLERS. ARM WILL COME TO REST IF IN MANUAL AUGMENTED MODES. WORST CASE ----- LOSS OF MISSION. MANUAL AUGMENTED MODES INOPERATIVE. 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 (TP518 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-S10-461 AS MODIFIED BY SL-E-0002 (TEST CE01, CE CE03, CS01(DC/AC), CS02, CS06, RE02 (B/W), RS02, RS03, RS04) RE02 (B/W) RS02, 03, 04) FLIGHT CHECKOUT ----- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987

PREPARED BY: HFWG

SUPERSEDING DATE: 03 DEC 86

APPROVED BY:

DATE:

CRITICAL ITEMS LIST

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

SYSTEM: D&C SUBSYSTEM
 ASS'Y P/N: 51140E301

SHEET: 4

ITEM REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOW / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
1310	1	HAND CONTROLLER OSCILLATOR QTY-1 REFERENCE: SCHEMATIC EDD7899	<p>MODE: LOSS OF OUTPUT VOLTAGE.</p> <p>CAUSE(S): (1) FAILURE OF AMPLIFIER. (2) FAILURE OF AMPLIFIER CIRCUIT. (3) TRANSFORMER, PRIMARY OR SECONDARY FAILS OPEN OR CLOSED.</p>	<p>NO OUTPUT FROM HAND CONTROLLERS. ARM WILL COME TO REST IF IN MANUAL AUGMENTED MODES.</p> <p>WORST CASE ----- LOSS OF MISSION. MANUAL AUGMENTED MODES INOPERATIVE.</p> <p>REDUNDANT PATHS REMAINING ----- N/A</p>	<p>QA/INSPECTIONS -----</p>	<p>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 100X SCREENED AND BURNED IN, AS A MINIMUM, AS REQUIRED BY SPAR-RMS-PA.003, BY THE SUPPLIER. ADDITIONALLY, EEE PARTS ARE 100X 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.</p> <p>WIRE IS PROCURED TO SPECIFICATION MIL-W-22759 OR MIL-W-81381 AND INSPECTED AND TESTED TO NASA JSCN8080 STANDARD NUMBER 95A.</p> <p>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.</p> <p>PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE,</p> <p>PRINTED CIRCUIT BOARD INSPECTION FOR TRACK SEPARATION, DAMAGE AND ADEQUACY OF PLATED THROUGH HOLES,</p> <p>COMPONENT MOUNTING INSPECTION FOR CORRECT SOLDERING, WIRE LOOPING, STRAPPING, ETC. OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA WH8 5300.4(3A) STANDARD, AS MODIFIED BY JSC 08800A.</p> <p>CONFORMAL COATING INSPECTION FOR ADEQUATE PROCESSING IS PERFORMED USING ULTRAVIOLET LIGHT TECHNIQUES.</p> <p>POST P.C. BD. INSTALLATION INSPECTION, CLEANLINESS AND WORKMANSHIP (SPAR/GOVERNMENT REP. MANDATORY INSPECTION POINT)</p> <p>P.C. BD. INSTALLATION INSPECTION, CHECK FOR CORRECT BOARD INSTALLATION, ALIGNMENT OF BOARDS, PROPER CONNECTOR CONTACT MATING, WIRE ROUTING, STRAPPING OF WIRES ETC.,</p> <p>PRE-TEST INSPECTION OF D&C PANEL ASSY INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILD CONFIGURATION VERIFICATION TO AS DESIGN ETC. (SPAR/GOVERNMENT REP. MANDATORY INSPECTION POINT)</p> <p>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 TESTING (ACCEPTANCE OR QUALIFICATION).</p> <p>ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT PERFORMANCE,</p>

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SYSTEM: D&C SUBSYSTEM
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SHEET: 5

PMA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
1310	1	HAND CONTROLLER OSCILLATOR QTY-1 REFERENCE: SCHEMATIC EDB7899	MODE: LOSS OF OUTPUT VOLTAGE. CAUSE(S): (1) FAILURE OF AMPLIFIER. (2) FAILURE OF AMPLIFIER CIRCUIT. (3) TRANSFORMER, PRIMARY OR SECONDARY FAILS OPEN OR CLOSED.	NO OUTPUT FROM HAND CONTROLLERS. ARM WILL COME TO REST IF IN MANUAL AUGMENTED MODES. WORST CASE LOSS OF MISSION. MANUAL AUGMENTED MODES INOPERATIVE. REDUNDANT PATHS REMAINING ----- N/A		THERMAL AND VIBRATION TESTING, (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT). INTEGRATION OF DEC PANEL, RHC, THC AND MC1U. 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: MFMG

SUPERSEDING DATE: 03 DEC 86

APPROVED BY: _____

DATE: _____

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: DCC PANEL

SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51120E391

SHEET: 6

P/N & REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	DWR / FUNC. 2/2 CRITICALITY RATIONALE FOR ACCEPTANCE
1310	1	HAND CONTROLLER OSCILLATOR QTY: 1 REFERENCE: SCHEMATIC ED87899	<p>MODE: LOSS OF OUTPUT VOLTAGE.</p> <p>CAUSE(S): (1) FAILURE OF AMPLIFIER. (2) FAILURE OF AMPLIFIER CIRCUIT. (3) TRANSFORMER, PRIMARY OR SECONDARY FAILS OPEN OR CLOSED.</p>	<p>NO OUTPUT FROM HAND CONTROLLERS. ARM WILL COME TO REST IF IN MANUAL AUGMENTED MODES.</p> <p>WORST CASE ----- LOSS OF MISSION. MANUAL AUGMENTED MODES INOPERATIVE.</p> <p>REDUNDANT PATHS REMAINING ----- N/A</p>	<p>FAILURE HISTORY -----</p> <p>NO EEE PARTS FAILURES HAVE OCCURRED SUBSEQUENT TO ASSEMBLY OF PARTS.</p> <p>QUALIFICATION THERMAL TESTS IDENTIFIED A DESIGN ERROR IN THE OSCILLATOR WHICH RESULTED IN UNACCEPTABLE OUTPUT VOLTAGES AT TEMPERATURE EXTREMES. REFER FAR 4025. THE ERROR WAS CORRECTED BY IMPLEMENTATION OF DESIGN CHANGES (ECR'S 121647, 121648, AND 121649). THE REVISED DESIGN WAS PROVEN BY CONDUCTING THERMAL TESTING OF THE OSCILLATOR SUBASSEMBLY TO QUALIFICATION EXTREMES.</p> <p>THE FOLLOWING FAILURE ANALYSIS REPORT(S) ARE RELEVANT:</p> <p>FAR 4025: S/N 201 JUL 80</p> <p>DESCRIPTION ----- OSCILLATOR VOLTAGE TOO HIGH CAUSED BY DESIGN ERROR</p> <p>CORRECTIVE ACTION ----- ECR'S 121647 121648, 121649</p>

PREPARED BY: HMG

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SHEET: 7

FMEA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
1310	1	HAND CONTROLLER OSCILLATOR QTY: 1 REFERENCE: SCHEMATIC EDB7899	MODE: LOSS OF OUTPUT VOLTAGE. CAUSE(S): (1) FAILURE OF AMPLIFIER. (2) FAILURE OF AMPLIFIER CIRCUIT. (3) TRANSFORMER, PRIMARY OR SECONDARY FAILS OPEN OR CLOSED.	NO OUTPUT FROM HAND CONTROLLERS. ARM WILL COME TO REST IF IN MANUAL AUGMENTED MODES. WORST CASE LOSS OF MISSION. MANUAL AUGMENTED MODES INOPERATIVE. REDUNDANT PATHS REMAINING N/A		<p>OPERATIONAL EFFECTS</p> <p>IF IN MANUAL AUGMENTED MODE THE ARM WILL STOP. LOSS OF ALL MANUAL AUGMENTED MODES. SINGLE, DIRECT DRIVE AND BACKUP MODES AVAILABLE. IF ALL DRIVE MODES LOST THEN ARM CAN BE JETTISONED.</p> <p>CREW ACTION</p> <p>SELECT ALTERNATE MODE.</p> <p>CREW TRAINING</p> <p>NONE</p> <p>MISSION CONSTRAINT</p> <p>NONE</p> <p>SCREEN FAILURES</p> <p>N/A</p> <p>OMRSD OFFLINE</p> <p>APPLY REPRESENTATIVE LOAD TO D&C OSCILLATOR OUTPUT. VERIFY OSCILLATOR OUTPUT AT D&C PANEL OUTPUT.</p> <p>OMRSD ONLINE INSTALLATION</p> <p>NONE</p> <p>OMRSD ONLINE TURNAROUND</p> <p>EXERCISE RHC AND THC. VERIFY CORRECT BIT COUNT IN EACH AXIS.</p>

PREPARED BY: MFNG

SUPERCEDING DATE: 03 DEC 86

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