CRITICAL ITEMS LIST

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. CRITICALITY	RATIONALE FOR ACCEPTANCE
1075	0	OUTPUT MULTIPLEXER QTY-1 SCHEMATIC ED 87305	MODE: INCORRECT OUTPUT CAUSE(S): (1) PARTS FAILURE.	LOSS OF COMMUNICATION WITH D&C INTERFACE WILL INITIATE D&C COMMUNICATION FAILURE DETECTION. AUTOBRAKES. ARM COMES TO REST. GPC GOES INTO IDLE MODE. LOSS OF COMPUTER SUPPORTED MODES. ABE COMMUNICATION PATH REMAINS OPERABLE. IF D&C RESPONSE EE COMMAND BITS ARE CORRUPT; ONE OR MORE EE COMMANDS MAY FAIL ON. EE MAY BE COMMANDED AS SOON AS EE MODE SWITCH SET TO AUTO. DURING AUTO CAPTURE LIMPING IS LOST. WORST CASE --------- UNEXPECTED PAYLOAD MOTION. UNCOMMANDED END EFFECTOR AUTO RELEASE SEQUENCE, IF EE MODE SET TO AUTO. CREW ACTION REQUIRED. ANNUNCIATED. REDUNDANT PATHS REMAINING --------------- N/A 1) AUTOBRAKES AND EE MODE SWITCH (FOR SAFING THE SYSTEM) 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING D&C OPERATION)	HDWR 2/1R SCREENS: N/A A-PASS, B-PASS, C-PASS	**DESIGN FEATURES** -------------- OUTPUT MULTIPLEXING IS PERFORMED BY THREE, QUAD AND/OR SELECT GATES. THESE ARE 'A' TYPE CMOS DEVICES, GENERIC TYPE 4019. CMOS DEVICES OPERATE AT LOW POWER AND HENCE DO NOT EXPERIENCE SIGNIFICANT OPERATING STRESSES. THE TECHNOLOGY IS MATURE, AND DEVICE RELIABILITY HISTORY IS WELL DOCUMENTED. ALL STRESSES ARE ADDITIONALLY REDUCED BY DERATING THE APPROPRIATE PARAMETERS IN ACCORDANCE WITH SPAR-RMS-PA.003. SPECIAL HANDLING PRECAUTIONS ARE USED AT ALL STAGES OF MANUFACTURE TO PRECLUDE DAMAGE/STRESS DUE TO ELECTROSTATIC DISCHARGE. 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. BOARD ASSEMBLY DRAWINGS INCLUDE THE REQUIREMENT FOR SOLDERING STANDARDS IN ACCORDANCE WITH NHB 5300.4(3A) AND JSC 08800A.

PREPARED BY: MFWG
SUPERCEDING DATE: NONE
DATE: 11 JUL 91
CIL REV: 0

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ATTACHMENT -
PAGE 70 OF 4?

RMS/D&C - 202

PROJECT: SRMS (-5 MCIU INSTALLED)
ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51160E391   SHEET: __2__

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 1FF 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A A-PASS, B-PASS, C-PASS
1075	0	OUTPUT MULTIPLEXER QTY-1 SCHEMATIC ED 87305	MODE: INCORRECT OUTPUT CAUSE(S): (1) PARTS FAILURE.	LOSS OF COMMUNICATION WITH D&C INTERFACE WILL INITIATE D&C COMMUNICATION FAILURE DETECTION. AUTOBRAKES. ARM COMES TO REST. GPC GOES INTO IDLE MODE. LOSS OF COMPUTER SUPPORTED MODES. ABE COMMUNICATION PATH REMAINS OPERABLE. IF D&C RESPONSE EE COMMAND BITS ARE CORRUPT: ONE OR MORE EE COMMANDS MAY FAIL ON. EE MAY BE COMMANDED AS SOON AS EE MODE SWITCH SET TO AUTO. DURING AUTO CAPTURE LIMPING IS LOST. WORST CASE --------- UNEXPECTED PAYLOAD MOTION. UNCOMMANDED END EFFECTOR AUTO RELEASE SEQUENCE, IF EE MODE SET TO AUTO. CREW ACTION REQUIRED. ANNUNCIATED. REDUNDANT PATHS REMAINING ---------------- N/A 1) AUTOBRAKES AND EE MODE SWITCH (FOR ENTERING THE SYSTEM) 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS)		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-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: NONE   DATE: 11 JUL 91   CIL REV: 0

PROJECT: SRMS (-5 MCIU INSTALLED)   SYSTEM: D&C SUBSYSTEM

ASS'Y NOMENCLATURE: D&C PANEL   ASS'Y P/N: 51140E191   SHEET: 3

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A A-PASS, B-PASS, C-PASS
1075	0	OUTPUT MULTIPLEXER QTY-1 SCHEMATIC EO 87305	MODE: INCORRECT OUTPUT CAUSE(S): (1) PARTS FAILURE.	LOSS OF COMMUNICATION WITH D&C INTERFACE WILL INITIATE D&C COMMUNICATION FAILURE DETECTION. AUTOBRAKES. ARM COMES TO REST. GPC GOES INTO IDLE MODE. LOSS OF COMPUTER SUPPORTED MODES. ABE COMMUNICATION PATH REMAINS OPERABLE. IF D&C RESPONSE EE COMMAND BITS ARE CORRUPT: ONE OR MORE EE COMMANDS MAY FAIL ON. EE MAY BE COMMANDED AS SOON AS EE MODE SWITCH SET TO AUTO. DURING AUTO CAPTURE LIMPING IS LOST. WORST CASE ---------- UNEXPECTED PAYLOAD MOTION. UNCOMMANDED END EFFECTOR AUTO RELEASE SEQUENCE. IF EE MODE CREW ACTION SET TO REQUIRED. AUTO. ANNUNCIATED. REDUNDANT PATHS REMAINING ---------------- N/A 1) AUTOBRAKES AND EE MODE SWITCH (FOR SAFING THE SYSTEM) 2)DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS)	2/1R	QA/INSPECTIONS -------------- 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-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) 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,

PREPARED BY: MFWG   SUPERCEDING DATE: NONE   RMS/D&C - 205   DATE: 11 JUL 91   CIL REV: 0

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. ~~HW~~ 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: ~~N/A~~ A-PASS, B-PASS, C-PASS
1075	0	OUTPUT MULTIPLEXER QTY·1 SCHEMATIC ED 87305	MODE: INCORRECT OUTPUT CAUSE(S): (1) PARTS FAILURE.	LOSS OF COMMUNICATION WITH D&C INTERFACE WILL INITIATE D&C COMMUNICATION FAILURE DETECTION. AUTOBRAKES. ARM COMES TO REST. GPC GOES INTO IDLE MODE. LOSS OF COMPUTER SUPPORTED MODES. ABE COMMUNICATION PATH REMAINS OPERABLE. IF D&C RESPONSE EE COMMAND BITS ARE CORRUPT: ONE OR MORE EE COMMANDS MAY FAIL ON. EE MAY BE COMMANDED AS SOON AS EE MODE SWITCH SET TO AUTO. DURING AUTO CAPTURE LIMPING IS LOST. WORST CASE ---------- UNEXPECTED PAYLOAD MOTION. UNCOMMANDED END EFFECTOR AUTO RELEASE SEQUENCE, IF EE MODE SET TO AUTO. CREW ACTION REQUIRED. ANNUNCIATED. REDUNDANT PATHS REMAINING -------------- ~~N/A~~		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) 1)AUTOBRAKES AND EE MANUAL MODE SWITCH (FOR SAFING THE SYSTEM) 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS)

PROJECT: SRMS (-5 MCIU INSTALLED)
ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51140E391   SHEET: 5

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 1/R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: NOT A-PASS, B-PASS, C-PASS
1075	0	OUTPUT MULTIPLEXER QTY-1 SCHEMATIC ED 87305	MODE: INCORRECT OUTPUT CAUSE(S): (1) PARTS FAILURE.	LOSS OF COMMUNICATION WITH D&C INTERFACE WILL INITIATE D&C COMMUNICATION FAILURE DETECTION. AUTOBRAKES. ARM COMES TO REST. GPC GOES INTO IDLE MODE. LOSS OF COMPUTER SUPPORTED MODES. ABE COMMUNICATION PATH REMAINS OPERABLE. IF D&C RESPONSE EE COMMAND BITS ARE CORRUPT: ONE OR MORE EE COMMANDS MAY FAIL ON. EE MAY BE COMMANDED AS SOON AS EE MODE SWITCH SET TO AUTO. DURING AUTO CAPTURE LIMPING IS LOST. WORST CASE ---------- UNEXPECTED PAYLOAD MOTION. UNCOMMANDED END EFFECTOR AUTO RELEASE SEQUENCE, IF EE MODE SET TO AUTO, CREW ACTION REQUIRED. ANNUNCIATED. REDUNDANT PATHS REMAINING ------------- N/R		FAILURE HISTORY -------------- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM. 1) AUTOBRAKES AND EE MODE SWITCH (FOR SAFING THE SYSTEM) 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS)

PREPARED BY: MFWG

SUPERCEDING DATE: NONE

I   RMS/D&C - 207

DATE: 11 JUL 91   CIL REV: 0

PROJECT: SRMS (-5 MCIU INSTALLED)
ASS'Y NOMENCLATURE: D&C PANEL
SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51164E391   **SHEET: 6**

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A A-PASS, B-PASS, C-PASS
1075	0	OUTPUT MULTIPLEXER QTY-1 SCHEMATIC ED 87305	MODE: INCORRECT OUTPUT CAUSE(S): (1) PARTS FAILURE.	LOSS OF COMMUNICATION WITH D&C INTERFACE WILL INITIATE D&C COMMUNICATION FAILURE DETECTION. AUTOBRAKES. ARM COMES TO REST. GPC GOES INTO IDLE MODE. LOSS OF COMPUTER SUPPORTED MODES. A8E COMMUNICATION PATH REMAINS OPERABLE. IF D&C RESPONSE EE COMMAND BITS ARE CORRUPT: ONE OR MORE EE COMMANDS MAY FAIL ON. EE MAY BE COMMANDED AS SOON AS EE MODE SWITCH SET TO AUTO. DURING AUTO CAPTURE LIMPING IS LOST. WORST CASE ---------- UNEXPECTED PAYLOAD MOTION. UNCOMMANDED END EFFECTOR AUTO RELEASE SEQUENCE, IF EE MODE CREW ACTION SET TO REQUIRED. AUTO. ANNUNCIATED. REDUNDANT PATHS REMAINING ----------------		OPERATIONAL EFFECTS ------------------- COMPUTER SUPPORTED MODES CANNOT BE USED TO COMPLETE THE MISSION. DIRECT DRIVE AND BACKUP MODES REMAIN. IF PAYLOAD ATTACHED, THE ARM SHOULD BE MANEUVERED TO A SAFE POSITION FOR PAYLOAD RELEASE. LOSS OF NEXT REDUNDANT PATH RESULTS IN BEING ONE FAILURE AWAY FROM INABILITY TO CRADLE ARM. IF WITH SUBSEQUENT FAILURES ALL DRIVE MODES ARE LOST, THE ARM MAY BE JETTISONED. CREW ACTION ----------- USE DIRECT DRIVE. CREW TRAINING -------------- NONE MISSION CONSTRAINT ------------------ NONE OMRSD OFFLINE ------------ EXERCISE ALL SWITCHES. VERIFY CORRECT BITS IN DATA BUS. OMRSD ONLINE INSTALLATION ------------------------- NONE OMRSD ONLINE TURNAROUND ----------------------- EXERCISE ALL SWITCHES ON D&C PANEL. VERIFY NO UNSCHEDULED CAUTION AND WARNING ANNUNCIATORS.

NOTE 1) AUTOBRAKES AND EE MODE SWITCH
(FOR SAFING THE SYSTEM)
2) DIRECT DRIVE AND EE MANUAL MODES
(FOR CONTINUING OPERATIONS)

PREPARED BY: MFWG   **SUPERCEDING DATE:** NONE   **DATE:** 11 JUL 91   **CIL REV:** 0