

**CRITICAL ITEMS LIST**

PROJECT: SRMS (-5 MCIU INSTALLED)  
 ASS'Y NOMENCLATURE: MCIU

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51155F160-5

SHEET: 1

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWDR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2095	0	FAILURE DETECTOR QTY. 1. SCHEMATIC 812797	<p>MODE:                      MANUAL BRAKE DRIVE CIRCUIT FAILS TO "BRAKES OFF"</p> <p>CAUSE(S):                      1) FIRST BRAKE DRIVE FET OR CIRCUIT FAILS SHORTED.</p>	<p>AUTO BRAKES WILL BE APPLIED DUE TO H/W MCIU WATCH DOG TIMER BITE VERIFICATION TEST</p> <p>ONE SECOND AFTER D&amp;C PANEL BRAKES SWITCH IS TOGGLED FROM OFF TO ON, BRAKE TRUTH TABLE WILL FAIL FOR ONE SECOND AFTER BRAKE SWITCH TRANSITION. ALL OPERATIONAL MODES ARE STILL AVAILABLE.</p> <p>-----                      WORST CASE                      -----                      LOSS OF MANUAL BRAKES. UNEXPECTED MOTION. AUTOBRAKES</p> <p>REDUNDANT PATHS REMAINING</p> <p>-----                      AUTOBRAKES (FOR SAFING THE SYSTEM)</p>	<p>DESIGN FEATURES</p> <p>-----</p> <p>THE BRAKE DRIVER IS IMPLEMENTED USING FET POWER TRANSISTORS, CONNECTED IN A SERIES REDUNDANT CONFIGURATION. THE CIRCUIT EMPLOYS CONTINUOUS TESTING TO VERIFY THE INTEGRITY OF THE BRAKE DRIVE CIRCUIT.</p> <p>INDUCTORS ARE DESIGNED SPECIFICALLY FOR THE APPLICATION. THE DESIGN CRITERIA, INCLUDING CHOICE OF MATERIALS AND TEST REQUIREMENTS ARE IN ACCORDANCE WITH MIL-T-27. WORST CASE STRESS LEVELS DO NOT EXCEED THOSE ALLOWED BY SPAR-RMS-PA.003.</p> <p>ALL RESISTORS AND CAPACITORS USED IN THE DESIGN ARE SELECTED FROM ESTABLISHED RELIABILITY (ER) TYPES. LIFE EXPECTANCY IS INCREASED BY ENSURING THAT ALL ALLOWABLE STRESS LEVELS ARE DERATED IN ACCORDANCE WITH SPAR-RMS-PA.003. ALL CERAMIC AND ELECTROLYTIC CAPACITORS ARE ROUTINELY SUBJECTED TO RADIOGRAPHIC INSPECTION.</p> <p>DISCRETE SEMICONDUCTOR DEVICES SPECIFIED TO AT LEAST THE 1X LEVEL OF MIL-S-19500. ALL DEVICES ARE SUBJECTED TO RE-SCREENING BY AN INDEPENDANT TEST HOUSE. SAMPLES OF ALL PROCURED LOTS/DATE CODES ARE SUBJECTED TO DESTRUCTIVE PHYSICAL ANALYSIS (DPA) TO VERIFY THE INTEGRITY OF THE MANUFACTURING PROCESSES. DEVICE STRESS LEVELS ARE, DERATED IN ACCORDANCE WITH SPAR-RMS-PA.003 AND VERIFIED BY DESIGN REVIEW.</p> <p>THE D&amp;C BRAKE SWITCH CONTROLS THE OPERATION OF THE BRAKE DRIVER THROUGH AN OPTO-ISOLATOR WHICH ACTS AS A SOLID-STATE RELAY. OPTO-ISOLATORS (DIODE AND TRANSISTOR) MEET THE SAME QUALITY AND APPLICATION CRITERIA THAT HAVE BEEN APPLIED TO DISCRETE SEMICONDUCTORS.</p>	

S040237A  
 ATTACHMENT  
 PAGE 367 OF 471

PREPARED BY:

MWG

SUPERCEDING DATE: NONE

DATE: 11 JUL 91

CIC REV: 0

**CRITICAL ITEMS LIST**

PROJECT: SRMS (-5 MCIU INSTALLED)  
 ASS'Y NOMENCLATURE: MCIU

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51155FT60-5

SHEET: 2

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: A-PASS, B-PASS, C-PASS
2095	0	FAILURE DETECTOR QTY. 1. SCHEMATIC 812797	<p>MODE: MANUAL BRAKE DRIVE CIRCUIT FAILS TO "BRAKES OFF"</p> <p>CAUSE(S):                      1) FIRST BRAKE DRIVE FET OR CIRCUIT FAILS SHORTED.</p>	<p>AUTO BRAKES WILL BE APPLIED DUE TO H/W MCIU WATCH DOG TIMER BITE VERIFICATION TEST ONE SECOND AFTER D&amp;C PANEL BRAKES SWITCH IS TOGGLED FROM OFF TO ON. BRAKE TRUTH TABLE WILL FAIL FOR ONE SECOND AFTER BRAKE SWITCH TRANSITION. ALL OPERATIONAL MODES ARE STILL AVAILABLE.</p> <p>WORST CASE                      -----                      LOSS OF MANUAL BRAKES. UNEXPECTED MOTION. AUTOBRAKES</p> <p>REDUNDANT PATHS REMAINING                      -----                      AUTOBRAKES (FOR SAFING THE SYSTEM)</p>	<p>ACCEPTANCE TESTS                      -----                      THE MCIU IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTING AS AN LRU.</p> <p>0 VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 3.2</p> <p>0 THERMAL: +40 DEGREES C TO -16 DEGREES C (2 CYCLES)</p> <p>QUALIFICATION TESTS                      -----                      THE MCIU IS SUBJECTED TO THE FOLLOWING LRU QUALIFICATION ENVIRONMENTS:</p> <p>0 VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 3.2</p> <p>0 SHOCK: BY SIMILARITY TO -3 MCIU</p> <p>0 THERMAL: +51 DEGREES C TO -27 DEGREES C (10 CYCLES)</p> <p>0 HUMIDITY: BY SIMILARITY TO -3 MCIU</p> <p>0 ENC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TESTS CE01, CE03, CS01, CS02, CS06, RE02 (N/B), RS01, RS02)</p> <p>0 LIFE: 630 OPERATING HOURS                      1000 POWER ON/OFF CYCLES</p> <p>FLIGHT CHECKOUT                      -----                      PDORS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>	

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 ASS'Y NOMENCLATURE: MCIU

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51155F160-5

SHEET: 3

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2095	0	FAILURE DETECTOR QTY. 1. SCHEMATIC 812797	MODE: MANUAL BRAKE DRIVE CIRCUIT FAILS TO "BRAKES OFF"  CAUSE(S): 1) FIRST BRAKE DRIVE FET OR CIRCUIT FAILS SHORTED.	AUTO BRAKES WILL BE APPLIED DUE TO H/W MCIU WATCH DOG TIMER BITE VERIFICATION TEST ONE SECOND AFTER OBC PANEL BRAKES SWITCH IS TOGGLED FROM OFF TO ON. BRAKE TRUIN TABLE WILL FAIL FOR ONE SECOND AFTER BRAKE SWITCH TRANSITION. ALL OPERATIONAL MODES ARE STILL AVAILABLE.  WORST CASE ----- LOSS OF MANUAL BRAKES. UNEXPECTED MOTION. AUTOBRAKES  REDUNDANT PATHS REMAINING ----- AUTOBRAKES (FOR SAFING THE SYSTEM)	QA/INSPECTIONS ----- DOCUMENTED QUALITY CONTROLS ARE EXERCISED THROUGHOUT DESIGN PROCUREMENT, PLANNING, RECEIVING, PROCESSING FABRICATION, ASSEMBLY, TESTING AND SHIPPING OF THE MCIU. GOVERNMENT SOURCE INSPECTION IS INVOKED AT VARIOUS LEVELS OF COMPONENT ASSEMBLY AND TEST OPERATIONS. MANDATORY INSPECTION POINTS ARE EMPLOYED AT VARIOUS LEVELS OF ASSEMBLY AND TEST.  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.  WIRE IS PROCURED, INSPECTED, AND TESTED TO SPAR-RMS-PA.003.  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 IN PECTIONS 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-1) STANDARD.  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-ACCEPTANCE TEST INSPECTION, WHICH INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC., (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

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 ASS'Y NOMENCLATURE: MCIU

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51155F160-5

SHEET: 4

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: A-PASS, B-PASS, C-PASS
2095	0	FAILURE DETECTOR QTY. 1. SCHEMATIC 812797	MODE: MANUAL BRAKE DRIVE CIRCUIT FAILS TO "BRAKES OFF"  CAUSE(S): 1) FIRST BRAKE DRIVE FET OR CIRCUIT FAILS SHORTED.	AUTO BRAKES WILL BE APPLIED DUE TO H/W MCIU WATCH DOG TIMER BITE VERIFICATION TEST ONE SECOND AFTER D&C PANEL BRAKES SWITCH IS TOGGLED FROM OFF TO ON. BRAKE TRUTH TABLE WILL FAIL FOR ONE SECOND AFTER BRAKE SWITCH TRANSITION. ALL OPERATIONAL MODES ARE STILL AVAILABLE.  WORST CASE ----- LOSS OF MANUAL BRAKES. UNEXPECTED MOTION. AUTOBRAKES  REDUNDANT PATHS REMAINING ----- AUTOBRAKES (FOR SAFING THE SYSTEM)	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, VIBRATION, AND THERMAL TESTING (SPAR/GOVERNMENT REP. - MANDITORY INSPECTION POINT).

5040237A  
 ATTACHMENT  
 PAGE 370 OF 471

PREPARED BY: MFMG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 C/L REV: 0

**CRITICAL ITEMS LIST**

PROJECT: SRMS (-5 MCIU INSTALLED)  
 ASS'Y NOMENCLATURE: MCIU

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51155FT60-5

SHEET: 5

FMEA REF.	FMEA REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HMWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2095	0	FAILURE DETECTOR QTY. 1. SCHEMATIC 612797	MODE: MANUAL BRAKE DRIVE CIRCUIT FAILS TO "BRAKES OFF"  CAUSE(S): 1) FIRST BRAKE DRIVE FET OR CIRCUIT FAILS SHORTED.	AUTO BRAKES WILL BE APPLIED DUE TO H/W MCIU WATCH DOG TIMER BITE VERIFICATION TEST ONE SECOND AFTER D&C PANEL BRAKES SWITCH IS TOGGLED FROM OFF TO ON. BRAKE TRUTH TABLE WILL FAIL FOR ONE SECOND AFTER BRAKE SWITCH TRANSITION. ALL OPERATIONAL MODES ARE STILL AVAILABLE.  WORST CASE ----- LOSS OF MANUAL BRAKES. UNEXPECTED MOTION. AUTOBRAKES  REDUNDANT PATHS REMAINING ----- AUTOBRAKES (FOR SAFING THE SYSTEM)		FAILURE HISTORY ----- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

PREPARED BY: MFVG

SUPERCEDING DATE: NONE

DATE: 11 JUL 91

CIL REV: 0

S040237A  
 ATTACHMENT  
 PAGE 371 OF 471

**CRITICAL ITEMS LIST**

PROJECT: SRMS (-5 MCIU INSTALLED)  
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SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51155F160-5

SHEET: 6

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDMR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2095	0	FAILURE DETECTOR QTY. 1, SCHEMATIC 812797	<p>MODE: MANUAL BRAKE DRIVE CIRCUIT FAILS TO "BRAKES OFF"</p> <p>CAUSE(S): 1) FIRST BRAKE DRIVE FET OR CIRCUIT FAILS SHORTED.</p>	<p>AUTO BRAKES WILL BE APPLIED DUE TO H/W MCIU WATCH DOG TIMER 8ITE VERIFICATION TEST ONE SECOND AFTER O&amp;C PANEL BRAKES SWITCH IS TOGGLED FROM OFF TO ON. BRAKE TRUTH TABLE WILL FAIL FOR ONE SECOND AFTER BRAKE SWITCH TRANSITION. ALL OPERATIONAL MODES ARE STILL AVAILABLE.</p> <p>-----                      WORST CASE                      -----                      LOSS OF MANUAL BRAKES. UNEXPECTED MOTION. AUTOBRAKES                      -----                      REDUNDANT PATHS REMAINING                      -----                      AUTOBRAKES (FOR SAFING THE SYSTEM)</p>	<p>OPERATIONAL EFFECT -----                      AUTOBRAKES WILL BE APPLIED ONE SECOND AFTER MANUAL BRAKES SELECTED.                      CREW ACTION -----                      NONE                      CREW TRAINING -----                      CREW IS TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES.                      MISSION CONSTRAINT -----                      NONE</p>	

5040237A  
 ATTACHMENT  
 PAGE 372 OF 471

PREPARED BY: MFWG SUPERCEDING DATE: NONE

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PROJECT: SRMS (-5 MCIU INSTALLED)  
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SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51155FT&O-5

SHEET: 7

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDMR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
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S040237A  
 ATTACHMENT  
 PAGE 373 OF 471

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CIL REV: 0

**CRITICAL ITEMS LIST**

PROJECT: SRMS (-5 MCIU INSTALLED)  
 ASS'Y NOMENCLATURE: MCIU

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 31155F160-5

SHEET: 8

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDMR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
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5040237A  
 ATTACHMENT  
 PAGE 374 OF 471

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