

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 OR END ITEM | HOWR / FUNC. Z/1R CRITICALITY | RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS |
|-----------|-----------|--|--|---|-------------------------------|---|
| 2045 | 0 | MICRO-COMPUTER QTY. 1. CPU - SCHEMATIC 812806 RAM AND PARITY - SCHEMATIC 812804 EPROM - SCHEMATIC 813357 | MODE: CORRUPT PROCESSING AND DATA TRANSFER TO/FROM CPU-- CPU RE-INITIALIZED CAUSE(S): MICRO COMP. ----- 1) CONSTANT "0" OR "1" ON ONE OR MORE INSTRUCTION/ DATA LINES OF MAIN DATA BUS. 2) CONSTANT 0 OR 1 ON 1 OR MORE ADDRESS LINES. 3) INCORRECT INPUTS/ OUTPUTS OF BUS CONTROLLER 4) CLOCK GENERATOR FAILS. 5) PERMANENT CPU RESET OR CPU FAILURE. 6) I/O WRITE OR READ ADDRESS DECODER CIRCUIT FAILS. 7) READY SIGNAL FAILS HIGH OR LOW. 8) INTERRUPT CONTROLLER FAILS. 9) ABE READY OR D&C READY INTERRUPT FAILS HIGH | CPU WILL BE RE-INITIALIZED DUE TO NMU. MCIU FAILURE WARNING. LOSS OF COMMUNICATION WITH ABE, GPC AND D&C. GPC WILL STOP COMMUNICATIONS AFTER TWO GPC CYCLES. AUTOBRAKES. ARM COMES TO REST. LOSS OF ALL COMPUTER SUPPORTED MODES. MCIU SAFING MAY STILL BE AVAILABLE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. LOSS OF EE AUTO DRIVE MODE. EE AUTO SEQUENCE IN PROGRESS WILL STOP. WORST CASE ----- UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTOBRAKES. REDUNDANT PATHS REMAINING ----- 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES. (FOR CONTINUING OPERATIONS). | | DESIGN FEATURES ----- 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 PART 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 WHICH DEFINES 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 REQUIREMENTS FOR SOLDERING STANDARDS IN ACCORDANCE WITH NHB 5300.4(3) AND JSC 08800. TTL LOGIC DEVICES HAVE GOOD NOISE IMMUNITY. MANUFACTURING TECHNOLOGY, AND RELIABILITY HISTORY, ARE WELL ESTABLISHED AND DOCUMENTED. LIFE EXPECTANCY IS INCREASED BY ENSURING THAT ALL ALLOWABLE STRESS LEVELS ARE DERATED IN ACCORDANCE WITH SPAR-RMS-PA.003. 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. DISCRETE SEMICONDUCTOR DEVICES SPECIFIED TO AT LEAST THE 1X LEVEL OF MFL-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. |

PREPARED BY:

MFWG

SUPERCEDING DATE: NONE

DATE: 11 JUL 91

CIL REV: 0

CRITICAL ITEMS LIST

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

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

SHEET: 2

| FMEA REF. | FMEA REV. | NAME, QTY, & DRAWING REF. DESIGNATION | FAILURE MODE AND CAUSE | FAILURE EFFECT ON END ITEM | NDWR / FUNC. 2/1R CRITICALITY | RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS |
|-----------|-----------|--|---|---|---|---|
| 2045 | 0 | <p>COMPUTER I/F QTY. 1. SCHEMATIC 812753</p> <p>DIGITAL I/F QTY. 1. SCHEMATIC 812796</p> | <p>OR LOW. 10) RAM CHIP OR SELECT SIGNALS OR RAM PARITY BIT FAILS HIGH OR LOW. 11) EPROM CHIPS OR SELECT SIGNAL, OR EPROM PARITY BIT FAILS HIGH OR LOW. 12) DMA CONTROLLER FAILS SUCH THAT ACCESS TO CPU MEMORY CANNOT BE PERFORMED. 13) LOSS OF FRAME SYNC TO CPU 14) ERROR DETECTION CIRCUIT FAILS HIGH. 15) EPROM WRITE DETECTION FAILS HIGH.</p> <p>----- COMPUTER I/F ----- 16) LOSS OF 62.5 KHZ CLOCK. 17) LOSS OF 50 KHZ CLOCK</p> <p>----- DIGITAL I/F ----- 18) LOSS OF WRITE ENABLE PULSES TO TIMING CIRCUIT. 19) ABE OR DEC READY SIGNAL OUTPUT FAILS. 20) LOSS OF READ ENABLE PULSES TO</p> | <p>CPU WILL BE RE-INITIALIZED DUE TO NMI. MCIU FAILURE WARNING. LOSS OF COMMUNICATION WITH ABE, GPC AND DEC. GPC WILL STOP COMMUNICATIONS AFTER TWO GPC CYCLES. AUTOBRAKES. ARM COMES TO REST. LOSS OF ALL COMPUTER SUPPORTED MODES. MCIU SAFING MAY STILL BE AVAILABLE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. LOSS OF EE AUTO DRIVE MODE. EE AUTO SEQUENCE IN PROGRESS WILL STOP.</p> <p>WORST CASE ----- UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES. (FOR CONTINUING OPERATIONS).</p> | <p>THE DESIGN UTILIZES PROVEN CIRCUIT TECHNIQUES AND IS IMPLEMENTED USING TTL LOGIC DEVICES.</p> <p>THE INTEL 8086 MICROPROCESSOR IS USED IN THIS DESIGN. THIS DEVICE, DESIGNED FOR USE IN CONJUNCTION WITH ITS CORRESPONDING HIGH RELIABILITY SUPPORT DEVICES, COMPRISES A PROCESSOR KERNEL PROVEN IN MANY HIGH RELIABILITY APPLICATIONS.</p> <p>READ ONLY MEMORY HAS BEEN IMPLEMENTED USING A 32K X 8 ARCHITECTURE NMOS EPROM; WHEREAS RANDOM ACCESS MEMORY HAS BEEN IMPLEMENTED USING A 16K X 1 ARCHITECTURE STATIC RAM.</p> <p>DESIGN, CONSTRUCTION, AND PHYSICAL DIMENSIONS ARE AS SPECIFIED IN MIL-M-38510 B. SAMPLING INSPECTION AND SCREENING ARE CONDUCTED ACCORDING TO MIL-STD-883 METHODS 5005 AND 5004.</p> | |

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 11 JUL 91

PREPARED BY: MFWG

SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED)
 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 |
|-----------|-----------|--|---|---|-------------------------------|---|
| 2045 | 0 | FAILURE DETECTOR QTY 1 SCHEMATIC 812797 ANALOG INTERFACE QTY 1 SCHEMATIC 812742 | TIMING CIRCUIT. ----- FAIL DETECTOR ----- 21) MCIU HARDWARE WATCHDOG TIMER OUTPUT FAILS HIGH. 22) HWI DRIVER FAILS HIGH. ----- ANALOG I/F 23) LOSS OF ANALOG DATA READY FLAG. | CPU WILL BE RE-INITIALIZED DUE TO HWI. MCIU FAILURE WARNING. LOSS OF COMMUNICATION WITH ABE, GPC AND DBC. GPC WILL STOP COMMUNICATIONS AFTER TWO GPC CYCLES. AUTOBRAKES. ARM COMES TO REST. LOSS OF ALL COMPUTER SUPPORTED MODES. MCIU SAFING MAY STILL BE AVAILABLE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. LOSS OF EE AUTO DRIVE MODE. EE AUTO SEQUENCE IN PROGRESS WILL STOP. WORST CASE ----- UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTOBRAKES. REDUNDANT PATHS REMAINING 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES. (FOR CONTINUING OPERATIONS). | | ACCEPTANCE TESTS ----- THE MCIU IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTING AS AN LRU. O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 3.2 O THERMAL: +40 DEGREES C TO -16 DEGREES C (2 CYCLES) QUALIFICATION TESTS ----- THE MCIU IS SUBJECTED TO THE FOLLOWING LRU QUALIFICATION ENVIRONMENTS: O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 3.2 O SHOCK: BY SIMILARITY TO -3 MCIU O THERMAL: +51 DEGREES C TO -27 DEGREES C (10 CYCLES) O HUMIDITY: BY SIMILARITY TO -3 MCIU O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TESTS CE01, CE03, CS01, CS02, CS06, RE02 (H/B), RS01, RS02) O LIFE: 630 OPERATING HOURS 1000 POWER ON/OFF CYCLES FLIGHT CHECKOUT ----- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987 |

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PREPARED BY: MFWG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED)
 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 |
|-----------|-----------|---|--|---|---|---|
| 2045 | 0 | MICRO-COMPUTER QTY. 1. CPU - SCHEMATIC 812806 RAM AND PARITY - SCHEMATIC 812804 EPROM - SCHEMATIC 813357 | MODE: CORRUPT PROCESSING AND DATA TRANSFER TO/FROM CPU-- CPU RE-INITIALIZED CAUSE(S): MICRO COMP. ----- 1) CONSTANT "0" OR "1" ON ONE OR MORE INSTRUCTION/ DATA LINES OF MAIN DATA BUS. 2) CONSTANT 0 OR 1 ON 1 OR MORE ADDRESS LINES. 3) INCORRECT INPUTS/ OUTPUTS OF BUS CONTROLLER 4) CLOCK GENERATOR FAILS. 5) PERMANENT CPU RESET OR CPU FAILURE. 6) I/O WRITE OR READ ADDRESS DECODER CIRCUIT FAILS. 7) READY SIGNAL FAILS HIGH OR LOW. 8) INTERRUPT CONTROLLER FAILS. 9) ABE READY OR D&C READY INTERRUPT FAILS HIGH | CPU WILL BE RE-INITIALIZED DUE TO MMU, MCIU FAILURE WARNING. LOSS OF COMMUNICATION WITH ABE, GPC AND D&C. GPC WILL STOP COMMUNICATIONS AFTER TWO GPC CYCLES. AUTOBRAKES. ARM COMES TO REST. LOSS OF ALL COMPUTER SUPPORTED MODES. MCIU SAFING MAY STILL BE AVAILABLE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. LOSS OF EE AUTO DRIVE MODE. EE AUTO SEQUENCE IN PROGRESS WILL STOP. WORST CASE ----- UNEXPECTED MOTION, SIX JOINT RUNAWAY. AUTOBRAKES. REDUNDANT PATHS REMAINING ----- 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES. (FOR CONTINUING OPERATIONS). | 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 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, 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 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-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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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 | HWWR / FUNC. 2/1R CRITICALITY | RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS |
|-----------|-----------|--|--|--|---|---|
| 2045 | 0 | <p>COMPUTER I/F QTY. 1. SCHEMATIC 812753</p> <p>DIGITAL I/F QTY. 1. SCHEMATIC 812796</p> | <p>OR LOW. 10) RAM CHIP OR SELECT SIGNALS, OR RAM PARITY BIT FAILS HIGH OR LOW. 11) EPROM CHIPS OR SELECT SIGNAL OR EPROM PARITY BIT FAILS HIGH OR LOW. 12) DMA CONTROLLER FAILS SUCH THAT ACCESS TO CPU MEMORY CANNOT BE PERFORMED. 13) LOSS OF FRAME SYNC TO CPU 14) ERROR DETECTION CIRCUIT FAILS HIGH. 15) EPROM WRITE DETECTION FAILS HIGH.</p> <p>----- COMPUTER I/F ----- 16) LOSS OF 62.5 KHZ CLOCK. 17) LOSS OF 50 KHZ CLOCK</p> <p>----- DIGITAL I/F ----- 18) LOSS OF WRITE ENABLE PULSES TO TIMING CIRCUIT. 19) ABE OR D&C READY SIGNAL OUTPUT FAILS. 20) LOSS OF READ ENABLE PULSES TO</p> | <p>CPU WILL BE RE-INITIALIZED DUE TO NMI. MCIU FAILURE WARNING. LOSS OF COMMUNICATION WITH ABE, GPC AND D&C. GPC WILL STOP COMMUNICATIONS AFTER TWO GPC CYCLES. AUTOBRAKES. ARM COMES TO REST. LOSS OF ALL COMPUTER SUPPORTED MODES. MCIU SAFING MAY STILL BE AVAILABLE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. LOSS OF EE AUTO DRIVE MODE. EE AUTO SEQUENCE IN PROGRESS WILL STOP.</p> <p>WORST CASE</p> <p>----- UNEXPECTED MOTION, SIX JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING</p> <p>----- 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES. (FOR CONTINUING OPERATIONS).</p> | <p>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).</p> <p>ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT, VIBRATION, AND THERMAL TESTING (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).</p> | |

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DATE
 11 JUL 91

PREPARED BY: MFWG

SUPERSEDING DATE: NONE

DATE: 11 JUL 91

CIL REV: 0

CRITICAL ITEMS LIST

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

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 | HDWR / FUNC. 2/1R CRITICALITY | RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS |
|-----------|-----------|--|---|---|-------------------------------|--|
| 2045 | 0 | FAILURE DETECTOR QTY 1 SCHEMATIC 812797 ANALOG INTERFACE QTY 1 SCHEMATIC 812742 | TIMING CIRCUIT. ----- FAIL DETECTOR ----- 21) MCIU HARDWARE WATCHDOG TIMER OUTPUT FAILS HIGH. 22) MMI DRIVER FAILS HIGH. ----- ANALOG I/F 23) LOSS OF ANALOG DATA READY FLAG. | CPU WILL BE RE-INITIALIZED DUE TO MMI. MCIU FAILURE WARNING. LOSS OF COMMUNICATION WITH ABE, GPC AND DAC. GPC WILL STOP COMMUNICATIONS AFTER TWO GPC CYCLES. AUTOBRAKES. ARM COMES TO REST. LOSS OF ALL COMPUTER SUPPORTED MODES. MCIU SAFING MAY STILL BE AVAILABLE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. LOSS OF EE AUTO DRIVE MODE. EE AUTO SEQUENCE IN PROGRESS WILL STOP. WORST CASE ----- UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTOBRAKES. REDUNDANT PATHS REMAINING ----- 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES. (FOR CONTINUING OPERATIONS). | | FAILURE HISTORY ----- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM. |

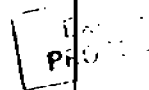
PREPARED BY: NFWG

SUPERCEDING DATE: NONE

DATE: 11 JUL 91

CIL REV: 0

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CRITICAL ITEMS LIST

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

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 51155160-5

SHEET: 7

| 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 |
|-----------|-----------|---|--|--|-------------------------------|--|
| 2045 | 0 | MICRO-COMPUTER QTY. 1. CPU - SCHEMATIC 812806 RAM AND PARITY - SCHEMATIC 812804 EPROM - SCHEMATIC 813357 | MODE: CORRUPT PROCESSING AND DATA TRANSFER TO/FROM CPU-- CPU RE-INITIALIZED CAUSE(S): MICRO COMP. ----- 1) CONSTANT "0" OR "1" ON ONE OR MORE INSTRUCTION/ DATA LINES OF MAIN DATA BUS. 2) CONSTANT 0 OR 1 ON 1 OR MORE ADDRESS LINES. 3) INCORRECT INPUTS/ OUTPUTS OF BUS CONTROLLER 4) CLOCK GENERATOR FAILS. 5) PERMANENT CPU RESET OR CPU FAILURE. 6) I/O WRITE OR READ ADDRESS DECODER CIRCUIT FAILS. 7) READY SIGNAL FAILS HIGH OR LOW. 8) INTERRUPT CONTROLLER FAILS. 9) ABE READY OR D&C READY INTERRUPT FAILS HIGH | CPU WILL BE RE-INITIALIZED DUE TO MMI. MCIU FAILURE WARNING. LOSS OF COMMUNICATION WITH ABE, GPC AND D&C. GPC WILL STOP COMMUNICATIONS AFTER TWO GPC CYCLES. AUTOBRAKES. ARM COMES TO REST. LOSS OF ALL COMPUTER SUPPORTED MODES. MCIU SAFING MAY STILL BE AVAILABLE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. LOSS OF EE AUTO DRIVE MODE. EE AUTO SEQUENCE IN PROGRESS WILL STOP. WORST CASE UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTOBRAKES. REDUNDANT PATHS REMAINING ----- 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES. (FOR CONTINUING OPERATIONS). | | OPERATIONAL EFFECT ----- LOSS OF DATA. AUTOBRAKES. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING. LOSS OF EE AUTO MODES. D&C DATA WILL BE INVALID. DIRECT DRIVE AND BACKUP AVAILABLE. EE MODE MANUAL AVAILABLE WITHOUT TALKBACKS. CREW ACTION ----- SELECT DIRECT DRIVE. USE EE MODE MANUAL. SINGLE/DIRECT DRIVE SWITCH SHOULD BE PULSED TO MAINTAIN PROPER RATES. CREW TRAINING ----- CREW IS TRAINED: TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES. TO RECOGNIZE AND RESPOND TO ALL OFF-NOMINAL OPERATIONS OF THE END EFFECTOR. MISSION CONSTRAINT ----- OPERATE UNDER VERNIER RATES WITHIN 10 FT OF STRUCTURE. THE OPERATOR MUST BE ABLE TO DETECT THAT THE ARM/PAYLOAD IS RESPONDING PROPERLY TO COMMANDS VIA WINDOW AND/OR CCTV VIEWS DURING ALL ARM OPERATIONS. SCREEN FAILURES ----- N/A OMRSD OFFLINE ----- EXERCISE THE MCIU. VERIFY ABSENCE OF FAILURE WARNINGS. OMRSD ONLINE INSTALLATION ----- NONE OMRSD ONLINE TURNAROUND ----- EXERCISE THE MCIU. VERIFY THE ABSENCE OF FAILURE WARNINGS. |

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PREPARED BY:

MFWG

SUPERCEDING DATE: NONE

DATE: 11 JUL 91

CIL REV: 0

EXERCISE FROM 1991

CRITICAL ITEMS LIST

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

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 511557160-5

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 |
|-----------|-----------|--|---|--|-------------------------------|---|
| 2045 | 0 | <p>COMPUTER I/F QTY. 1. SCHEMATIC 612753</p> <p>DIGITAL I/F QTY. 1. SCHEMATIC 612796</p> | <p>OR LOW. 10) RAM CHIP OR SELECT SIGNALS, OR RAM PARITY BIT FAILS HIGH OR LOW. 11) EPROM CHIPS OR SELECT SIGNAL, OR EPROM PARITY BIT FAILS HIGH OR LOW. 12) DMA CONTROLLER FAILS SUCH THAT ACCESS TO CPU MEMORY CANNOT BE PERFORMED. 13) LOSS OF FRAME SYNC TO CPU 14) ERROR DETECTION CIRCUIT FAILS HIGH. 15) EPROM WRITE DETECTION FAILS HIGH.</p> <p>----- COMPUTER I/F ----- 16) LOSS OF 62.5 KHZ CLOCK. 17) LOSS OF 50 KHZ CLOCK</p> <p>----- DIGITAL I/F ----- 18) LOSS OF WRITE ENABLE PULSES TO TIMING CIRCUIT. 19) ABE OR D&C READY SIGNAL OUTPUT FAILS. 20) LOSS OF READ ENABLE PULSES TO</p> | <p>CPU WILL BE RE-INITIALIZED DUE TO NM1. MCIU FAILURE WARNING. LOSS OF COMMUNICATION WITH ABE, GPC AND D&C. GPC WILL STOP COMMUNICATIONS AFTER TWO GPC CYCLES. AUTOBRAKES. ARM COMES TO REST. LOSS OF ALL COMPUTER SUPPORTED MODES. MCIU SAFING MAY STILL BE AVAILABLE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. LOSS OF EE AUTO DRIVE MODE. EE AUTO SEQUENCE IN PROGRESS WILL STOP.</p> <p>WORST CASE</p> <p>----- UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING</p> <p>----- 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES. (FOR CONTINUING OPERATIONS).</p> | | |

PREPARED BY: MFWG

SUPERCEDING DATE: NONE

RMS/ELEC - 94

DATE: 11 JUL 91

CIL REV: 0

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CRITICAL ITEMS LIST

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

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

SHEET: 9

| 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 |
|-----------|-----------|--|--|---|-------------------------------|---|
| 2045 | 0 | FAILURE DETECTOR QTY 1 SCHEMATIC 812797 ANALOG INTERFACE QTY 1 SCHEMATIC 812742 | TIMING CIRCUIT. ----- FAIL DETECTOR ----- 21) MCIU HARDWARE WATCHDOG TIMER OUTPUT FAILS HIGH. 22) NMI DRIVER FAILS HIGH. ----- ANALOG I/F ----- 23) LOSS OF ANALOG DATA READY FLAG. | CPU WILL BE RE-INITIALIZED DUE TO NMI. MCIU FAILURE WARNING. LOSS OF COMMUNICATION WITH ABE, GPC AND D&C. GPC WILL STOP COMMUNICATIONS AFTER TWO GPC CYCLES. AUTOBRAKES. ARM COMES TO REST. LOSS OF ALL COMPUTER SUPPORTED MODES. MCIU SAFING MAY STILL BE AVAILABLE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. LOSS OF EE AUTO DRIVE MODE. EE AUTO SEQUENCE IN PROGRESS WILL STOP. WORST CASE ----- UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTOBRAKES. REDUNDANT PATHS REMAINING ----- 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES. (FOR CONTINUING OPERATIONS). | | |

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EXPT FROM

PREPARED BY: MFWG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0