

**CRITICAL ITEMS LIST**

PROJECT: SRHS  
ASS'Y NOMENCLATURE: EECU

SYSTEM: ELECTRICAL SUBSYSTEM  
ASS'Y P/N: 5140PT174-14-5

SHEET: 1

ITEM REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOMR / FUNC. 2/IN CRITICALITY	RATIONALE FOR ACCEPTANCE
3240	5	COMMAND LOGIC QTY-1 REFERENCE SCHEMATIC 2563765	<p>MODE: LOSS OF DERIGID.</p> <p>CAUSE(S): (1) U3 FAILS H. (2) U10B FAILS H (3) U7C FAILS L.</p>	<p>IF CAPTURED AND RIGIDIZED CANNOT PERFORM ANOTHER CAPTURE.</p> <p>CAUSE (1) WHEN DERIGID COMMANDED, EECU PRODUCES A RIGID COMMANO. DURING DERIG SEQ. MOTOR WILL REVERSE DIRECTION. IF RIGIDIZED, MOTOR WILL STALL OR SLIP CLUTCH WITH DERIG CMD.</p> <p>CAUSE (2,3) WHEN DERIGID COMMANDED EECU WILL NOT ENABLE MOTOR OR CLUTCH/BRAKE.</p> <p>WORST CASE ----- LOSS OF MISSION LOSS OF CAPTURE CAPABILITY. UNANNUNCIATED.</p> <p>REDUNDANT PATHS REMAINING ----- EE MANUAL AND BACKUP RELEASE</p>	<p>DESIGN FEATURES -----</p> <p>COMPARATORS AND OPERATIONAL AMPLIFIERS ARE STANDARD LINEAR INTEGRATED CIRCUITS WITH MATURE MANUFACTURING TECHNOLOGY. APPLICATION CONSTRAINTS ARE IN ACCORDANCE WITH SPAR-RMS-PA.003.</p> <p>THE DESIGN UTILIZES PROVEN CIRCUIT TECHNIQUES AND IS IMPLEMENTED USING CMOS LOGIC DEVICES.</p> <p>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.</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>ALL EECU LOGIC FUNCTIONS ARE CONTAINED ON ONE BOARD WHERE CIRCUIT PATHS ARE MINIMIZED.</p>	

RMS/ELEC - 925

PREPARED BY: MEWG

SUPERSEDING DATE: 06 OCT 87

APPROVED BY:

FE: \_\_\_\_\_

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
ASS'Y NOMENCLATURE: EEU

SYSTEM: ELECTRICAL SUBSYSTEM  
ASS'Y P/N: 5174071174-10-5

SHEET: 2

PMA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE
3240	5	COMMAND LOGIC QTY-1 REFERENCE SCHEMATIC 2563765	<p>MODE: LOSS OF DERIGID.</p> <p>CAUSE(S): (1) U3 FAILS H. (2) U10B FAILS H (3) U7C FAILS L.</p>	<p>IF CAPTURED AND RIGIDIZED CANNOT PERFORM ANOTHER CAPTURE.</p> <p>CAUSE (1) WHEN DERIGID COMMANDED, EEEU PRODUCES A RIGID COMMAND. DURING DERIG SEQ. MOTOR WILL REVERSE DIRECTION. IF RIGIDIZED, MOTOR WILL STALL OR SLIP CLUTCH WITH DERIG CMD.</p> <p>CAUSE (2,3) WHEN DERIGID COMMANDED EEEU WILL NOT ENABLE MOTOR OR CLUTCH/BRAKE.</p> <p>WORST CASE LOSS OF MISSION LOSS OF CAPTURE CAPABILITY. UNANNUNCIATED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>EE MANUAL AND BACKUP RELEASE</p>		<p>ACCEPTANCE TESTS</p> <p>THE EEEU IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTING AS AN SRU.</p> <p>O VIBRATION: LEVEL AND DURATION REFERENCE TABLE 6</p> <p>O THERMAL: +70 DEGREES C TO -25 DEGREES C (1 1/2 CYCLES)</p> <p>THE EEEU IS INTEGRATED INTO THE END EFFECTOR AND IS FURTHER EXPOSED TO THE END EFFECTOR ACCEPTANCE TEST ENVIRONMENTS (VIBRATION AND THERMAL VACUUM).</p> <p>THE END EFFECTOR ASSEMBLY IS PART OF THE INTEGRATED RMS SYSTEM TESTS (TP518 RMS STRONGBACK TEST AND TP552 FLAT FLOOR TEST) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p>QUALIFICATION TESTS</p> <p>THE EEEU IS SUBJECTED TO THE FOLLOWING SRU QUALIFICATION TEST ENVIRONMENTS.</p> <p>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 6</p> <p>O SHOCK: 20G/11MS - 3 AXES (6 DIRECTIONS)</p> <p>O THERMAL: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1 X 10** 6 TORR</p> <p>O HUMIDITY: TESTED IN THE END EFFECTOR HUMIDITY TEST.</p> <p>O ENC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TESTS CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/O) RS01).</p> <p>FLIGHT CHECKOUT</p> <p>PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16907</p>

RMS/ELEC - 926

PREPARED BY: MEMG

SUPERSEDING DATE: 06 OCT 87

APPROVED BY: \_\_\_\_\_

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
ASS'Y NOMENCLATURE: EECU

SYSTEM: ELECTRICAL SUBSYSTEM  
ASS'Y P/N: 51140F1174-7B-5

SHEET: 3

P/N REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWMN / FUNC. 2/IR CRITICALITY	RATIONALE FOR ACCEPTANCE
3240	5	COMMAND LOGIC QTY-1 REFERENCE SCHEMATIC 2561765	<p>MODE: LOSS OF DERIGID.</p> <p>CAUSE(S): (1) U3 FAILS H.</p> <p>(2) U10B FAILS H</p> <p>(3) U7C FAILS L.</p>	<p>IF CAPTURED AND RIGIDIZED CANNOT PERFORM ANOTHER CAPTURE.</p> <p>CAUSE (1) WHEN DERIGID COMMANDED, EECU PRODUCES A RIGID COMMAND. DURING DERIG SEQ. MOTOR WILL REVERSE DIRECTION. IF RIGIDIZED, MOTOR WILL STALL OR SLIP CLUTCH WITH DERIG CMD.</p> <p>CAUSE (2, 3) WHEN DERIGID COMMANDED EECU WILL NOT ENABLE MOTOR OR CLUTCH/BRAKE.</p> <p>WORST CASE LOSS OF MISSION LOSS OF CAPTURE CAPABILITY. UNANNUNCIATED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>EE MANUAL AND BACKUP RELEASE</p>	<p>QA/INSPECTIONS</p>	<p>UNITS ARE MANUFACTURED UNDER DOCUMENTED QUALITY CONTROLS. THESE CONTROLS ARE EXERCISED THROUGHOUT DESIGN PROCUREMENT, PLANNING, RECEIVING, PROCESSING, FABRICATION, ASSEMBLY, TESTING AND SHIPPING OF THE UNITS. MANDATORY INSPECTION POINTS ARE EMPLOYED AT VARIOUS STAGES OF FABRICATION ASSEMBLY AND TEST. GOVERNMENT SOURCE INSPECTION IS INVOKED AT VARIOUS CONTROL LEVELS.</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 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.</p> <p>WIRE IS PROCURED TO SPECIFICATION MIL-W-22759 OR MIL-W-81381 AND INSPECTED AND TESTED TO NASA JSC8000 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 MHD 5300.4(3-1) STANDARD.</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-CLOSURE INSPECTION, WORKMANSHIP AND CLEANLINESS (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p> <p>PRE-ACCEPTANCE TEST INSPECTION, WHICH INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC. (MANDATORY INSPECTION POINT).</p>

RMS/ELEC - 927

PREPARED BY: HWG

SUPERSEDING DATE: 06 OCT 87

APPROVED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
ASS'Y NOMENCLATURE: EEEU

SYSTEM: ELECTRICAL SUBSYSTEM  
ASS'Y P/N: 511401174-10 5

SHEET: 4

PRA REF.	REV.	PART QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWB / FUNC. 2/IR CRITICALITY	RATIONALE FOR ACCEPTANCE
3240	5	COMMAND LOGIC QTY-1 REFERENCE SCHEMATIC 2561765	<p>MODE: LOSS OF DERIGID.</p> <p>CAUSE(S): (1) U3 FAILS H. (2) U10B FAILS H (3) U7C FAILS L.</p>	<p>IF CAPTURED AND RIGIDIZED CANNOT PERFORM ANOTHER CAPTURE.</p> <p>CAUSE (1) WHEN DERIGID COMMANDED, EEEU PRODUCES A RIGID COMMAN. DURING DERIG SEQ. ROTOR WILL REVERSE DIRECTION. IF RIGIDIZED, ROTOR WILL STALL OR SLIP CLUTCH WITH DERIG CMD.</p> <p>CAUSE (2,3) WHEN DERIGID COMMANDED EEEU WILL NOT ENABLE ROTOR OR CLUTCH/BRAKE.</p> <p>WORST CASE ----- LOSS OF MISSION LOSS OF CAPTURE CAPABILITY. UNANNUNCIATED.</p> <p>REUNDANT PATHS REMAINING ----- EE MANUAL AND BACKUP RELEASE</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 FORMAL TESTING (ACCEPTANCE OR QUALIFICATION).</p> <p>ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT PERFORMANCE, THERMAL AND VIBRATION TESTING. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).</p> <p>INTEGRATION OF UNIT TO END EFFECTOR ASSY - INSPECTIONS INCLUDE GROUNDING CHECKS, CONNECTORS FOR BENT OF PUSHBACK CONTACTS, VISUAL, CLEANLINESS, INTERCONNECT WIRING ETC. AND POWER-UP TEST TO SPAR INSPECTION TEST PROCEDURE ITP-2510.</p> <p>PRE-ACCEPTANCE TEST INSPECTION, WHICH INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC. (MANDATORY INSPECTION POINT).</p> <p>ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT, VIBRATION AND THERMAL-VAC TESTING. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p> <p>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.</p> <p>SRMS SYSTEMS TESTING - STRONGBACK AND FLAT FLOOR AMBIENT PERFORMANCE TEST. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p>

RMS/ELEC - 928

PREPARED BY: RLG

SUPERSEDING DATE: 06 OCT 87

APPROVED BY: \_\_\_\_\_

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: EECU

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51700FT174-3E-5

SHEET: 5

P/N & REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/IN CRITICALITY	RATIONALE FOR ACCEPTANCE
3240	5	COMMAND LOGIC QTY-1 REFERENCE SCHEMATIC 2563765	MODE: LOSS OF DERIGID.  CAUSE(S): (1) U3 FAILS H.  (2) U10B FAILS H  (3) U7C FAILS L.	IF CAPTURED AND RIGIDIZED CANNOT PERFORM ANOTHER CAPTURE.           CAUSE (1) WHEN DERIGID COMMANDED, EECU PRODUCES A RIGID COMMAND. DURING DERIG SEQ. MOTOR WILL REVERSE DIRECTION. IF RIGIDIZED, MOTOR WILL STALL OR SLIP CLUTCH WITH DERIG CMD.  CAUSE (2, 3) WHEN DERIGID COMMANDED EECU WILL NOT ENABLE MOTOR OR CLUTCH/BRAKE.  WORST CASE ----- LOSS OF MISSION LOSS OF CAPTURE CAPABILITY. UNANNUNCIATED.   REDUNDANT PATHS REMAINING ----- EE MANUAL AND BACKUP RELEASE		FAILURE HISTORY ----- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

RMS/ELEC - 929

**CRITICAL ITEMS LIST**

PROJECT: SAMS  
 ASS'Y NOMENCLATURE: EEEU

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51740FT174-3E 5

SHEET: 6

AREA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE
3240	5	COMMAND LOGIC QTY-1 REFERENCE SCHEMATIC 2563765	<p>MODE: LOSS OF DERIGID.</p> <p>CAUSE(S):                      (1) U3 FAILS N.                      (2) U10B FAILS H                      (3) U7C FAILS L.</p>	<p>IF CAPTURED AND RIGIDIZED CANNOT PERFORM ANOTHER CAPTURE.</p> <p>CAUSE (1)                      WHEN DERIGID COMMANDED, EEEU PRODUCES A RIGID COMMAND. DURING DERIG SEQ. MOTOR WILL REVERSE DIRECTION. IF RIGIDIZED, MOTOR WILL STALL OR SLIP CLUTCH WITH DERIG CMD.</p> <p>CAUSE (2,3)                      WHEN DERIGID COMMANDED EEEU WILL NOT ENABLE MOTOR OR CLUTCH/BRAKE.</p> <p>WORST CASE                      LOSS OF MISSION                      LOSS OF CAPTURE CAPABILITY.                      UNANNUNCIATED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>EE MANUAL AND BACKUP RELEASE</p>		<p>OPERATIONAL EFFECTS</p> <p>CREW WILL DETECT OFF NOMINAL EE OPERATION. IF COMMAND NOT REMOVED MOTOR BURNOUT MAY OCCUR RESULTING IN LOSS OF ALL EE PRIMARY MODES.                      THE PAYLOAD CANNOT BE RELEASED IN EE AUTO MODE. LOSS OF NEXT REDUNDANT PATH RESULTS IN BEING ONE FAILURE AWAY FROM INABILITY TO RELEASE PAYLOAD. WITH THE SUBSEQUENT LOSS OF ALL REDUNDANCY THE PAYLOAD CANNOT BE RELEASED. AN EVA MAY BE PERFORMED OR THE ARM CAN BE JETTISONED.</p> <p>CREW ACTION</p> <p>EE MODE SW TO OFF TO PREVENT MOTOR BURN OUT. RELEASE PAYLOAD FROM RIGID POSITION.</p> <p>CREW TRAINING</p> <p>CREW TO BE TRAINED TO DETECT ANY OFF NOMINAL EE OPERATIONS.</p> <p>MISSION CONSTRAINT</p> <p>NONE</p> <p>SCREEN FAILURES</p> <p>N/A</p> <p>ONRSD OFFLINE</p> <p>PERFORM MANUAL EE DERIGIDIZE.                      VERIFY CORRECT TIME FOR EXTEND FLAG TO CHANGE STATE.</p> <p>ONRSD ONLINE INSTALLATION</p> <p>NONE</p> <p>ONRSD ONLINE TURNAROUND</p> <p>PERFORM MANUAL EE DERIGIDIZE.                      VERIFY CORRECT TIME FOR EXTEND FLAG TO CHANGE TO GREY.</p>

RMS/ELEC - 930

PREPARED BY: HWG

SUPERCEDING DATE: 06 OCT 07

APPROVED BY: \_\_\_\_\_

TE: \_\_\_\_\_