CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: EECU

SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 51140F1178-5
SHEET

FMEA REF.	REV.	NAME, QTY. & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDW / FUNC. 2/1R0 CRITICALITY	RATIONALE FOR ACCEPTANCE
1571	0	BRAKE/CLUTCH ENABLE QTY-1 SCHEMATIC 2563784	MODE: CONTINUOUS HIGH ON (BR/CR) RIGIDIZE/DERIGIDIZE ACTIVATE OR ENABLE OUTPUT. CAUSE(S): (1) Q14 S/C Q15 S/C	RIGIDIZE BRAKE AND CLUTCH BUS WILL NOT BE POWERED UNTIL THE ENABLE OR ACTIVATE PULSE IS RECEIVED, THEN SYSTEM WILL OPERATE AS COMMANDED. WORST CASE LOSS OF MISSION. SUBSEQUENT FAILURE COULD GIVE UNCOMMANDED DERIGIDIZE. REDUNDANT PATHS REMAINING REMAINING ACTIVE OR ENABLE.		DESIGN FEATURES DISCRETE SEMICONDUCTOR DEVICES SPECIFIED TO AT LEAST THE TX LEVEL OF MIL-S-19500. ALL DEVICES ARE SUBJECTED TO RE-SCREENING BY AN INDEPENDENT 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. 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. THE POWER DISSIPATING COMPONENTS ARE BASE MOUNTED AND STRAPPED.

PREPARED BY: NEWG SUPERCEDING DATE: 06 OCT 87 APPROVED BY:

RMS/ELEC - 1055

RMS/ELEC - 1056

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: EEEU

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

SHEET 1

ITEM REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDW / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE
3521	0	BRAKE/CLUTCH ENABLE QTY-1 SCHEMATIC 2563164	MODE: CONTINUOUS HIGH OR (OR/ CB) RIGIDIZE/ DERIGIDIZE ACTIVATE OR ENABLE OUTPUT. CAUSE(S): (1) DIS S/C DIS S/C	RIGIDIZE BRAKE AND CLUTCH BUS WILL NOT BE POWERED UNTIL THE ENABLE OR ACTIVATE PULSE IS RECEIVED, THEN SYSTEM WILL OPERATE AS COMMANDED. WORST CASE LOSS OF MISSION. SUBSEQUENT FAILURE COULD GIVE UNCOMMANDED DERIGIDIZE. REDUNDANT PATHS REMAINING REMAINING ACTIVE OR ENABLE.		See below

ACCEPTANCE TESTS

THE EEEU IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTING AS AN SRU.

O VIBRATION: LEVEL AND DURATION REFERENCE TABLE 4

O THERMAL: +30 DEGREES C TO -25 DEGREES C (1 1/2 CYCLES)

THE EEEU IS INTEGRATED INTO THE END EFFECTOR AND IS FURTHER EXPOSED TO THE END EFFECTOR ACCEPTANCE TEST ENVIRONMENTS (VIBRATION AND THERMAL VACUUM).

THE END EFFECTOR ASSEMBLY IS PART OF THE INTEGRATED RMS SYSTEM TESTS (TPSIM RMS STRONGBACK TEST AND FPS57 FLAT FLOOR TEST) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.

QUALIFICATION TESTS

THE EEEU IS SUBJECTED TO THE FOLLOWING SRU QUALIFICATION TEST ENVIRONMENTS.

O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 6

O SHOCK: 20G/11MS - 3 AXES (6 DIRECTIONS)

O THERMAL: +80 DEGREES C TO -36 DEGREES C (6 CYCLES) @ 1 10** -6 TORR

O HUMIDITY: TESTED IN THE END EFFECTOR HUMIDITY TEST.

O EMC: MIL STD 461 AS MODIFIED BY SL-E-0002 (TESTS CE01, CE03, CS01, CS02, CS06, RE01 RE02 (M/B) RS01).

FLIGHT CHECKOUT

PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987

PREPARED BY: MEW   SUPERCEDING DATE: 06 OCT 87   APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: EECU

SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: [illegible]
SHEET: 1

FMEA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDW / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE
3521	0	BRAKE/CLUTCH ENABLE QTY-1 SCHEMATIC 2561764	MODE: CONTINUOUS HIGH ON (BA/CA) RIGIDIZE/DERIGIDIZE ACTIVATE OR ENABLE OUTPUT. CAUSE(S): (1) Q11 S/C Q15 S/C	RIGIDIZE BRAKE AND CLUTCH BUS WILL NOT BE POWERED UNTIL THE ENABLE OR ACTIVATE PULSE IS RECEIVED. THEN SYSTEM WILL OPERATE AS COMMANDED. WORST CASE LOSS OF MISSION. SUBSEQUENT FAILURE COULD GIVE UNCOMMANDED DERIGIDIZE. REDUNDANT PATHS REMAINING REMAINING ACTIVE OR ENABLE.		QA/INSPECTIONS 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. 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 JSC8080 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(3-1) 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).

PREPARED BY: MDM   SUPERCEDING DATE: 04 OCT 87   APPROVED BY: ______   DATE: ______

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: EECU

SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: [illegible]

ITEM REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDW / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE
3521	0	BRAKE/CLUTCH ENABLE QTY-1 SCHEMATIC 2563784	MODE: CONTINUOUS HIGH ON (RR/CR) RIGIDIZE/DERIGIDIZE ACTIVATE OR ENABLE OUTPUT. CAUSE(S): (1) Q16 S/C Q15 S/C	RIGIDIZE BRAKE AND CLUTCH BUS WILL NOT BE POWERED UNTIL THE ENABLE OR ACTIVATE PULSE IS RECEIVED, THEN SYSTEM WILL OPERATE AS COMMANDED. WORST CASE ---------- LOSS OF MISSION. SUBSEQUENT FAILURE COULD GIVE UNCOMMANDED DERIGIDIZE. REDUNDANT PATHS REMAINING ---------- REMAINING ACTIVE OR ENABLE.	[illegible]	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, THERMAL AND VIBRATION TESTING. (SPAR/GOVERNMENT REP - MANDATORY INSPECTION POINT) INTEGRATION OF UNIT TO END EFFECTOR ASSY - INSPECTIONS INCLUDE GROUNDING CHECKS, CONNECTORS FOR BENT OR PUSHBACK CONTACTS, VISUAL, CLEANLINESS, INTERCONNECT WIRING ETC. AND POWER UP TEST TO SPAR INSPECTION TEST PROCEDURE IIP-2540. ACCEPTANCE TESTING (ATP) INCLUDES, AMBIENT, VIBRATION AND THERMAL-VAC TESTING. (SPAR/GOVERNMENT REP. - 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: NEWS   SUPERCEDING DATE: 06 OCT 87   APPROVED BY: ______

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: [illegible]

SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: [illegible]

SHEET: 5

FMEA REF.	REV.	NAME, QTY. & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDW / FUNC. 2/1RB CRITICALITY	RATIONALE FOR ACCEPTANCE
3521	D	BRAKE/CLUTCH ENABLE [illegible] SCHEMATIC 2563754	MODE: CONTINUOUS HIGH ON (ON/ON) RIGIDIZE/ DERIGIDIZE ACTIVATE OR ENABLE OUTPUT. CAUSE(S): (P) Q16 S/C Q15 S/C	RIGIDIZE BRAKE AND CLUTCH BUS WILL NOT BE POWERED UNTIL THE ENABLE OR ACTIVATE PULSE IS RECEIVED, THEN SYSTEM WILL OPERATE AS COMMANDED. WORST CASE LOSS OF MISSION. SUBSEQUENT FAILURE COULD GIVE UNCOMMANDED DERIGIDIZE. REDUNDANT PATHS REMAINING REMAINING ACTIVE OR ENABLE.		FAILURE HISTORY THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM

PREPARED BY: [illegible] SUPERSEDING DATE: 06 OCT 87 APPROVED BY: DATE:

RMS/ELEC - 1059

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: EEEU

SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: [illegible]

SHEET: 6

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDW / FUNC. 2/1RB CRITICALITY	RATIONALE FOR ACCEPTANCE
1521	0	BRAKE/CLUTCH ENABLE QTY-1 SCHEMATIC 2561761	MODE: CONTINUOUS HIGH ON (BR/CR) RIGIDIZE/DERIGIDIZE ACTIVATE OR ENABLE OUTPUT. CAUSE(S): (1) Q16 S/C Q15 S/C	RIGIDIZE BRAKE AND CLUTCH BUS WILL NOT BE POWERED UNTIL THE ENABLE OR ACTIVATE PULSE IS RECEIVED, THEN SYSTEM WILL OPERATE AS COMMANDED. WORST CASE ---------- LOSS OF MISSION. SUBSEQUENT FAILURE COULD GIVE UNCOMMANDED DERIGIDIZE. REDUNDANT PATHS REMAINING ---------------- REMAINING ACTIVE OR ENABLE.		OPERATIONAL EFFECTS ------------------ NONE. THE CARRIAGE WILL DERIGIDIZE WITH NO OPERATOR COMMAND OR ANNUNCIATION IF PREVIOUS FAILURE HAS OCCURRED. THE GRAPPLE FIXTURE/EE INTERFACE MAY BE PARTIALLY RIGID. THE CARRIAGE COULD BE COMPLETELY EXTENDED. IF THIS OCCURS WHILE THE ARM IS BEING DRIVEN, THE PAYLOAD MIGHT TAKE AN UNEXPECTED TRAJECTORY CREW ACTION ----------- NONE. FOR SUBSEQUENT FAILURE ACTION REQUIRED TO PREVENT PAYLOAD/ORBITER CONTACT. STOP ARM OPERATIONS. RE-RIGIDIZE THE CARRIAGE IF POSSIBLE. IF CARRIAGE DOESN'T RE-RIGIDIZE AND PAYLOAD IS ROTATING IN SUCH A WAY THAT IT COULD CONTACT STRUCTURE, THEN RELEASE THE PAYLOAD AND MANEUVER THE ARM AWAY. MANEUVER ORBITER AWAY FROM PAYLOAD. CREW TRAINING ------------- CREW WILL BE TRAINED TO RECOGNIZE OFF NOMINAL EE OPERATIONS AND TO MANEUVER THE ORBITER AWAY FROM A FREE PAYLOAD AT ANY TIME DURING ARM OPERATIONS. 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 --------------- B:SERIES PATHS NOT INSTRUMENTED OMRSD OFFLINE ------------- IN THE EE STANDBY MODE MONITOR CAPTURE BRAKE/CLUTCH TEST POINTS. OMRSD ONLINE INSTALLATION ------------------------- NONE OMRSD ONLINE TURNAROUND ----------------------- IN THE EE STANDBY MODE MONITOR CAPTURE BRAKE/CLUTCH TEST POINTS.

PREPARED BY: [illegible] SUPERCEDING DATE: [illegible] OCT [illegible] APPROVED BY: ______

RMS/ELEC - 1060