CRITICAL ITEMS LIST

PROJECT: SAMS
ASS'Y NOMENCLATURE: BACK-UP
SYSTEM: BACK-UP
ASS'Y P/N:
SHEET: 1

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
4560	0	PULSE WIDTH MODULATOR SCHEMATIC 2559039 QTY-1	MODE: INCORRECT OUTPUT FROM PWM. CAUSE(S): (1) PARTS FAILURE.	THE OUTPUT TO THE MOTOR WILL NOT BE AS DEMANDED AND MAY RESULT IN MOTOR DRIVING IN OPPOSITE DIRECTION TO COMMAND. WORST CASE --- UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A		DESIGN FEATURES --- COMPARATORS AND OPERATIONAL AMPLIFIERS ARE STANDARD LINEAR INTEGRATED CIRCUITS WITH MATURE MANUFACTURING TECHNOLOGY. APPLICATION CONSTRAINTS ARE 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. THE DESIGN UTILIZES PROVEN CIRCUIT TECHNIQUES AND IS IMPLEMENTED USING CMOS LOGIC DEVICES. 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.

PREPARED BY: MFWG
SUPERCEDING DATE: 11 SEP 86
APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: BACK-UP
SYSTEM: BACK-UP
ASS'Y P/N: _____
SHEET: 2

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
4560	0	PULSE WIDTH MODULATOR SCHEMATIC 2559039 QTY-1	MODE: INCORRECT OUTPUT FROM PWM. CAUSE(S): (1) PARTS FAILURE.	THE OUTPUT TO THE MOTOR WILL NOT BE AS DEMANDED AND MAY RESULT IN MOTOR DRIVING IN OPPOSITE DIRECTION TO COMMAND. WORST CASE --- UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A		ACCEPTANCE TESTS --- THE BDA IS ACCEPTANCE TESTED FOR THE FOLLOWING ENVIRONMENTS AS AN SRU. O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4 O THERMAL: +70 DEGREES C TO - 25 DEGREES C (1 1/2 CYCLES) THE BDA IS INTEGRATED INTO THE SHOULDER JOINT AND EXPOSED TO THE JOINT ACCEPTANCE ENVIRONMENTS (VIBRATION AND THERMAL VACUUM). THE SHOULDER JOINT IS THEREAFTER TESTED AS PART OF THE RMS SYSTEM TESTS (TP518 RMS STRONGBACK AND TP552 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE. QUALIFICATION TESTS --- THE BDA HAS BEEN QUALIFICATION TESTED TO THE FOLLOWING ENVIRONMENTS AS AN SRU. THE BDA IS FURTHER TESTED ON THE SHOULDER JOINT QUALIFICATION TESTING. O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4 O SHOCK: 20G/11MS - 3 AXES (6 DIRECTIONS) O THERMAL: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1 X 10**6 TORR. O HUMIDITY: TEST IN SHOULDER JOINT HUMIDITY TEST O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TESTS CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/B), RS01) FLIGHT CHECKOUT --- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987

PREPARED BY: MFWG SUPERCEDING DATE: 11 SEP 86 APPROVED BY: _____ DATE: _____

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: BACK-UP
SYSTEM: BACK-UP
ASS'Y P/N:
SHEET: 3

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
4560	0	PULSE WIDTH MODULATOR SCHEMATIC 2559039 QTY-1	MODE: INCORRECT OUTPUT FROM PWM. CAUSE(S): (1) PARTS FAILURE.	THE OUTPUT TO THE MOTOR WILL NOT BE AS DEMANDED AND MAY RESULT IN MOTOR DRIVING IN OPPOSITE DIRECTION TO COMMAND. WORST CASE ---------- UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING ---------- N/A		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. QPA 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-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: MFWG
SUPERCEDING DATE: 11 SEP 86
APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: BACK-UP
SYSTEM: BACK-UP
ASS'Y P/N:
SHEET: 4

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
4560	0	PULSE WIDTH MODULATOR SCHEMATIC 2559039 QTY-1	MODE: INCORRECT OUTPUT FROM PWM. CAUSE(S): (1) PARTS FAILURE.	THE OUTPUT TO THE MOTOR WILL NOT BE AS DEMANDED AND MAY RESULT IN MOTOR DRIVING IN OPPOSITE DIRECTION TO COMMAND. WORST CASE --- UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A		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 JOINT SRU - INSPECTIONS INCLUDE GROUNDING CHECKS, CONNECTORS FOR BENT OR PUSHBACK CONTACTS, VISUAL, CLEANLINESS, INTERCONNECT WIRING AND POWER UP TEST TO THE APPROPRIATE JOINT INSPECTION TEST PROCEDURE (ITP) ETC. JOINT LEVEL PRE-ACCEPTANCE TEST INSPECTION, INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC. JOINT LEVEL ACCEPTANCE TESTING (ATP) INCLUDES AMBINET, 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)

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CRITICAL ITEMS LIST

PROJECT: SRMS
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SYSTEM: BACK-UP
ASS'Y P/N: _____
SHEET: 5

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
4560	D	PULSE WIDTH MODULATOR SCHEMATIC 2559039 QTY-1	MODE: INCORRECT OUTPUT FROM PWM. CAUSE(S): (1) PARTS FAILURE.	THE OUTPUT TO THE MOTOR WILL NOT BE AS DEMANDED AND MAY RESULT IN MOTOR DRIVING IN OPPOSITE DIRECTION TO COMMAND. WORST CASE --- UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A		FAILURE HISTORY --- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

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APPROVED BY: _____

CRITICAL ITEMS LIST

PROJECT: SRMS
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SYSTEM: BACK-UP
ASS'Y P/N:
SHEET: 6

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
4560	0	PULSE WIDTH MODULATOR SCHEMATIC 2559039 QTY-1	MODE: INCORRECT OUTPUT FROM PWM. CAUSE(S): (1) PARTS FAILURE.	THE OUTPUT TO THE MOTOR WILL NOT BE AS DEMANDED AND MAY RESULT IN MOTOR DRIVING IN OPPOSITE DIRECTION TO COMMAND. WORST CASE --- UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A		OPERATIONAL EFFECTS --- WHEN ATTEMPTING TO DRIVE A JOINT IN BACKUP, THE JOINT DRIVE DIRECTION IS OPPOSITE FROM WHAT IS COMMANDED. CREW ACTION --- REMOVE THE DRIVE COMMAND. CREW TRAINING --- THE CREW WILL BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, THE COMMAND SHOULD BE REMOVED. MISSION CONSTRAINT --- THE OPERATOR MUST BE ABLE TO DETECT THAT THE ARM IS RESPONDING PROPERLY TO COMMANDS VIA WINDOW AND/OR CCTV VIEWS DURING ALL ARM OPERATIONS. SCREEN FAILURES --- N/A OMRSD OFFLINE --- DRIVE WRIST ROLL IN BACKUP. VERIFY THAT THE JOINT DRIVES AT CORRECT RATE. OMRSD ONLINE INSTALLATION --- NONE OMRSD ONLINE TURNAROUND --- DRIVE WRIST ROLL IN BACKUP. VERIFY THAT JOINT DRIVES AT CORRECT RATE.

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