CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED) SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y NOMENCLATURE: MOTOR MODULE ASS'Y P/N: 51140E1214 SHEET: 1

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
4115	0	BRAKE ASSEMBLY P/N 51140F688 -1,-3,-5 QTY-6	MODE: ALL BRAKES WILL NOT RELEASE. CAUSE(S): (1) SHORTED BRAKE WINDINGS. (2) DIODES SHORT.	FUSE IN "BRAKE BUS" LINE IN MCIU WILL OPEN CAUSING ALL BRAKES TO COME ON. THE FAILURE WILL CAUSE THE +28V SPA FUSE (AT THE SHOULDER) FOR THAT JOINT TO OPEN IF DIRECT DRIVE ON THAT JOINT IS USED. ALL OTHER JOINTS OPERATIVE. IF BACKUP MODE SELECTED WHEN FAILED JOINT SELECTED BOA FUSE WILL BLOW. BACKUP MODE LOST. IN ALL COMPUTER SUPPORTED MODES OF OPERATION THE ARM WILL COME TO REST. FAILED JOINT CANNOT BE DRIVEN IN ANY MODE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE --------- LOSS OF ALL MODES. FROZEN JOINT. ANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --------- RMS JETTISON	DESIGN FEATURES --------- THE JOINT BRAKE IS A MAJOR BOUGHT-OUT-PART WHICH IS SUPPLIED BY HONEYWELL SPERRY CORPORATION MEETS OR EXCEEDS THE REQUIREMENTS OF SPECIFICATION SPAR-SG.468. THE FOLLOWING IS A LIST OF DESIGN CHARACTERISTICS THAT LIMIT THE POSSIBILITY OF AN OPEN OR SHORT CIRCUIT IN THE UNIT WINDINGS: THE INSULATION SYSTEM IS CLASS 185 (185 DEGREES C) OR BETTER AND IS PROVEN THROUGH YEARS OF USE. THE WIRE USED IN THE UNITS IS HEAVY ML MAGNET WIRE WHICH HAS AN EXTRA COAT OF INSULATION ON THE MAGNET WIRE. THE WINDINGS ARE PREBAKED AFTER THE WINDINGS ARE FORMED BUT PRIOR TO IMPREGNATION. THIS IS A STRESS RELIEVING OPERATION OF BOTH THE COPPER WIRE AND THE INSULATION, PERFORMED TO MINIMIZE ANY DEGRADATION DURING PROCESSING. KAPTON TAPE IS APPLIED OVER THE BOBBIN AND WINDINGS O.D. TO PROTECT THE MAGNET WIRE DURING PROCESSING AND INSTALLATION. THE UNIT IS IMPREGNATED WITH 100% SOLID EPOXY THAT IMPROVES THE COIL MECHANICAL PROPERTIES ESPECIALLY DURING VIBRATION AND HELPS THE UNIT RUN COOLER BY INCREASING THE EFFECTIVE THERMAL CONDUCTION WITHIN THE WINDING MASS. IT SHOULD BE NOTED THAT THE MAGNET WIRE USED IN THE WINDINGS OF THESE UNITS IS SINGLE STRAND. DISCRETE SEMICONDUCTOR DEVICES SPECIFIED TO AT LEAST THE TX 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.

PREPARED BY: MFWG SUPERCEDING DATE: NONE DATE: 11 JUL 91 CIL REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED) SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y NOMENCLATURE: MOTOR MODULE ASS'Y P/N: 51140E1214 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
4115	0	BRAKE ASSEMBLY P/N 51140F688 -1,-3,-5 QTY-6	MODE: ALL BRAKES WILL NOT RELEASE. CAUSE(S): (1) SHORTED BRAKE WINDINGS. (2) DIODES SHORT.	FUSE IN "BRAKE BUS" LINE IN MCIU WILL OPEN CAUSING ALL BRAKES TO COME ON. THE FAILURE WILL CAUSE THE +28V SPA FUSE (AT THE SHOULDER) FOR THAT JOINT TO OPEN IF DIRECT DRIVE ON THAT JOINT IS USED. ALL OTHER JOINTS OPERATIVE. IF BACKUP MODE SELECTED WHEN FAILED JOINT SELECTED BDA FUSE WILL BLOW. BACKUP MODE LOST. IN ALL COMPUTER SUPPORTED MODES OF OPERATION THE ARM WILL COME TO REST. FAILED JOINT CANNOT BE DRIVEN IN ANY MODE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE --- LOSS OF ALL MODES. FROZEN JOINT. ANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- RMS JETTISON	ACCEPTANCE TESTS --- THE JOINTS MOTOR MODULE ASSEMBLY CONSIST OF THE BRAKE ASSEMBLY, MOTOR ASSEMBLY, TACHOMETER , COMM. SCANNER AND SCU ALL OF WHICH ARE EXPOSED TO AN ACCEPTANCE TEST BY THE VENDOR PRIOR TO ACCEPTANCE BY SPAR. THE MOTOR MODULE ASSEMBLY IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENT: O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE B O THERMAL VACUUM: +85 DEGREES C TO -25 DEGREES C (1.5 CYCLES) 1 X 10**5 TORR THE MOTOR MODULE IS INSTALLED IN THE JOINTS ASSEMBLY AND AGAIN IS EXPOSED TO ANOTHER ACCEPTANCE TEST, WHICH INCLUDES VIBRATION AND THERMAL VACUUM OF THE SAME APPROXIMATE LEVEL AND DURATION. QUALIFICATION TESTS --- A TYPICAL MOTOR MODULE ASSEMBLY WAS TOTALLY QUALIFIED BY SPAR FOR THE LISTED BELOW ENVIRONMENTS. FURTHER, THE BRAKE ASSEMBLY, MOTOR ASSEMBLY, TACHOMETER AND COMM. SCANNER, ARE SUBJECTED TO SOME DEGREE OF QUALIFICATION TESTING BY THE VENDOR. THE MOTOR MODULE TESTS: O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE B O THERMAL VACUUM: +96 DEGREE C TO -36 DEGREE C (8 CYCLES) 1 X 10**6 TORR O SHOCK: 20G/11 MS - 3 AXES (6 DIRECTIONS) O HUMIDITY: TESTED IN SHOULDER JOINT HUMIDITY TEST O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TESTS CS01, CS02, CS06, CE01, RE02(N/B), RS03, RS04) FLIGHT CHECKOUT --- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987

PREPARED BY: MFWG SUPERCEDING DATE: NONE DATE: 11 JUL 91 C4L REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED) SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y NOMENCLATURE: MOTOR MODULE ASS'Y P/N: 51T40E1214 SHEET: 3

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
4115	0	BRAKE ASSEMBLY P/N 51T40F688 -1,-3,-5 QTY-6	MODE: ALL BRAKES WILL NOT RELEASE. CAUSE(S): (1) SHORTED BRAKE WINDINGS. (2) DIODES SHORT.	FUSE IN "BRAKE BUS" LINE IN MCIU WILL OPEN CAUSING ALL BRAKES TO COME ON. THE FAILURE WILL CAUSE THE +28V SPA FUSE (AT THE SHOULDER) FOR THAT JOINT TO OPEN IF DIRECT DRIVE ON THAT JOINT IS USED. ALL OTHER JOINTS OPERATIVE. IF BACKUP MODE SELECTED WHEN FAILED JOINT SELECTED BDA FUSE WILL BLOW. BACKUP MODE LOST. IN ALL COMPUTER SUPPORTED MODES OF OPERATION THE ARM WILL COME TO REST. FAILED JOINT CANNOT BE DRIVEN IN ANY MODE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE ---------- LOSS OF ALL MODES. FROZEN JOINT. ANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING ---------- RMS JETTISON	QA/INSPECTIONS ---------- UNITS ARE MAJOR BOUGHT OUT PARTS, MANUFACTURED, ASSEMBLED AND TESTED TO SPAR DRAWINGS AND SPECIFICATIONS UNDER DOCUMENTED QUALITY CONTROLS. THESE CONTROLS ARE EXERCISED THROUGHOUT DESIGN PROCUREMENT, PLANNING, PROCESSING, FABRICATION, ASSEMBLY QUALIFICATION AND ACCEPTANCE TESTING. MANDATORY INSPECTION POINTS ARE EMPLOYED AS APPROPRIATE AT VARIOUS LEVELS OF ASSEMBLY AND TEST. SPAR/GOVERNMENT SOURCE INSPECTION IS ENVOKED ON THE SUPPLIER. 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 JSCM8080 STANDARD NUMBER 95A. RECEIVING INSPECTION VERIFIES THAT THE HARDWARE RECEIVED IS AS IDENTIFIED IN THE PROCUREMENT DOCUMENTS, THAT NO DAMAGE HAS OCCURRED DURING SHIPMENT, AND THAT APPROPRIATE DATA HAS BEEN RECEIVED WHICH PROVIDES ADEQUATE TRACEABILITY INFORMATION AND IDENTIFIES ACCEPTABLE PARTS. PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE, MAGNET WIRE IS PROCURED TO MIL-W-583 AND CHECKED AT INCOMING INSPECTION PER FEDERAL STANDARD J-W-1177 WHICH INCLUDES DIELECTIC, PIN HOLES, BUBBLES, BLISTERS, AND CRACKS IN THE INSULATION. ALL SOLDERING IS ACCOMPLISHED BY OPERATORS, WHO ARE TRAINED AND CERTIFIED TO NASA NHB5300.4(3A) STANDARD, AS MODIFIED BY JSC 08800A. UNITS ARE INSPECTED TO THE APPLICABLE SPAR INSPECTION TEST PROCURE (ITP). PRIOR TO M/M INTEGRATION, INSPECTIONS INCLUDE CLEANLINESS USING U.V, GENERAL WORKMANSHIP, DIMENSIONAL, SPLINE FOR DRY LUBRICATION, CORRECT INSTALLATION OF BEARING, WIRE LEADS FOR DAMAGE, IDENTIFICATION AND FUNCTIONAL TEST TO VERIFY BRAKE SLIP TORQUE, STICTION, DROPOUT VOLTAGE, PULL-IN VOLTAGE ETC. INTEGRATION OF UNIT TO MOTOR MODULE - INSPECTIONS INCLUDE GROUNDING CHECKS, CONNECTOR FOR BENT PINS, VISUAL, CLEANLINESS, INTERCONNECT WIRING ETC. PRE-ACCEPTANCE TEST INSPECTION, WHICH INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION

PREPARED BY: MFWG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED) SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y NOMENCLATURE: MOTOR MODULE ASS'Y P/N: 51140E1214 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
4115	0	BRAKE ASSEMBLY P/N 51140F688 -1,-3,-5 QTY-6	MODE: ALL BRAKES WILL NOT RELEASE. CAUSE(S): (1) SHORTED BRAKE WINDINGS. (2) DIODES SHORT.	FUSE IN "BRAKE BUS" LINE IN MCIU WILL OPEN CAUSING ALL BRAKES TO COME ON. THE FAILURE WILL CAUSE THE +28V SPA FUSE (AT THE SHOULDER) FOR THAT JOINT TO OPEN IF DIRECT DRIVE ON THAT JOINT IS USED. ALL OTHER JOINTS OPERATIVE. IF BACKUP MODE SELECTED WHEN FAILED JOINT SELECTED BDA FUSE WILL BLOW. BACKUP MODE LOST. IN ALL COMPUTER SUPPORTED MODES OF OPERATION THE ARM WILL COME TO REST. FAILED JOINT CANNOT BE DRIVEN IN ANY MODE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE --- LOSS OF ALL MODES. FROZEN JOINT. ANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- RMS JETTISON	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 QUALITY ASSURANCE IN CONJUNCTION WITH ENGINEERING, RELIABILITY, CONFIGURATION CONTROL, SUPPLIER AS APPLICABLE, AND THE GOVENMENT REPRESENTATIVE, PRIOR TO THE START OF ANY FORMAL TESTING (ACCEPTANCE OR QUALIFICATION). ACCEPTANCE TESTING (ATP) INCLUDES, AMBIENT, VIBRATION AND THERMAL-VAC 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)

PREPARED BY: MFWG SUPERCEDING DATE: NONE DATE: 11 JUL 91 CIL REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED) SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y NOMENCLATURE: MOTOR MODULE ASS'Y P/N: 51140E1214 SHEET: 5

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
4115	0	BRAKE ASSEMBLY P/N 51140F688 -1,-3,-5 QTY-6	MODE: ALL BRAKES WILL NOT RELEASE. CAUSE(S): (1) SHORTED BRAKE WINDINGS. (2) DIODES SHORT.	FUSE IN "BRAKE BUS" LINE IN MCIU WILL OPEN CAUSING ALL BRAKES TO COME ON. THE FAILURE WILL CAUSE THE +28V SPA FUSE (AT THE SHOULDER) FOR THAT JOINT TO OPEN IF DIRECT DRIVE ON THAT JOINT IS USED. ALL OTHER JOINTS OPERATIVE. IF BACKUP MODE SELECTED WHEN FAILED JOINT SELECTED BDA FUSE WILL BLOW. BACKUP MODE LOST. IN ALL COMPUTER SUPPORTED MODES OF OPERATION THE ARM WILL COME TO REST. FAILED JOINT CANNOT BE DRIVEN IN ANY MODE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE ---------- LOSS OF ALL MODES. FROZEN JOINT. ANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING ---------- RMS JETTISON	FAILURE HISTORY ---------- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

PREPARED BY: MFWG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

CRITICAL ITEMS LIST

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

SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140E1214

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
4115	0	BRAKE ASSEMBLY P/N 51140F688 -1,-3,-5 QTY-6	MODE: ALL BRAKES WILL NOT RELEASE. CAUSE(S): (1) SHORTED BRAKE WINDINGS. (2) DIODES SHORT.	FUSE IN "BRAKE BUS" LINE IN MCIU WILL OPEN CAUSING ALL BRAKES TO COME ON. THE FAILURE WILL CAUSE THE +28V SPA FUSE (AT THE SHOULDER) FOR THAT JOINT TO OPEN IF DIRECT DRIVE ON THAT JOINT IS USED. ALL OTHER JOINTS OPERATIVE. IF BACKUP MODE SELECTED WHEN FAILED JOINT SELECTED BDA FUSE WILL BLOW. BACKUP MODE LOST. IN ALL COMPUTER SUPPORTED MODES OF OPERATION THE ARM WILL COME TO REST. FAILED JOINT CANNOT BE DRIVEN IN ANY MODE. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE ---------- LOSS OF ALL MODES. FROZEN JOINT. ANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --------------- RMS JETTISON	OPERATIONAL EFFECTS ------------------ IF IN COMPUTER MODES ARM WILL STOP, DIRECT DRIVE CAN BE USED ON ALL BUT FAILED JOINT. IF FAILED JOINT SELECTED, SPA FUSE WILL BLOW. IF FAILED JOINT SELECTED IN BACKUP BDA FUSE WILL BLOW. CREW ACTION ----------- SELECT DIRECT DRIVE TO POSITION FOR JETTISON. CREW TRAINING ------------- CREW MUST BE TRAINED TO DETERMINE FAILED JOINT. MISSION CONSTRAINT ------------------ ARM SHOULD NOT BE MANEUVERED TO POSITION WHERE JETTISON CANNOT BE SAFELY PERFORMED. OMRSD OFFLINE ------------- IN DIRECT DRIVE WITH ELBOW DEMATED VERIFY RATES FOR ALL JOINTS OMRSD ONLINE INSTALLATION ------------------------- NONE OMRSD ONLINE TURNAROUND ---------------------- DRIVE EACH JOINT IN SINGLE VERIFY TACHOMETER SIGNATURE

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ATTACHMENT -
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