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. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
4175	0	COMMUTATION SCANNER QTY-6 P/N 51140E1295	MODE: ERRATIC COMMUTATION IN PRIME AND BACKUP MODES. CAUSE(S): (1) LOSS OF PLATING ON CODE WHEEL.	AUTOBRAKES ARE APPLIED. ARM COMES TO REST. LOSS OF REGULAR COMMUTATION. ABILITY TO START THE JOINT IN PRIME AND BACK-UP MAY BE LOST. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. LOSS OF ALL MODES. WORST CASE --- UNEXPECTED MOTION. ELECTRICALLY FROZEN. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A	DESIGN FEATURES --- THE JOINT COMMUTATION SCANNER ASSEMBLY (CSA) IS A MAJOR BOUGHT-OUT-PART WHICH IS SUPPLIED BY BEI MOTION SYSTEMS AND MEETS OR EXCEEDS THE REQUIREMENTS OF SPECIFICATION SPAR-SG.467. CODE WHEELS ARE MANUFACTURED PER BEI PROCEDURE 905A12224. THE BASE METAL WHEEL IS CHROME-PLATED BY AN OUTSIDE VENDOR, AND RETURNED TO BEI. PHOTO-RESIST IS USED TO MASK AREAS WHICH WILL REMAIN BLACK, WHILE AREAS WHICH ARE TO BE REFLECTIVE ARE STRIPPED OF BLACK CHROME TO EXPOSE THE GOLD SURFACE. THIS PROCESS INSURES GOOD ADHESION.

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. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
4175	0	COMMUTATION SCANNER QTY-6 P/N 51140E1295	MODE: ERRATIC COMMUTATION IN PRIME AND BACKUP MODES. CAUSE(S): (1) LOSS OF PLATING ON CODE WHEEL.	AUTOBRAKES ARE APPLIED. ARM COMES TO REST. LOSS OF REGULAR COMMUTATION. ABILITY TO START THE JOINT IN PRIME AND BACK-UP MAY BE LOST. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. LOSS OF ALL MODES. WORST CASE --- UNEXPECTED MOTION. ELECTRICALLY FROZEN. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A		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 8 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 8 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 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: 3

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: N/A
4175	0	COMMUTATION SCANNER QTY-6 P/N 51140E1295	MODE: ERRATIC COMMUTATION IN PRIME AND BACKUP MODES. CAUSE(S): (1) LOSS OF PLATING ON CODE WHEEL.	AUTOBRAKES ARE APPLIED. ARM COMES TO REST. LOSS OF REGULAR COMMUTATION. ABILITY TO START THE JOINT IN PRIME AND BACK-UP MAY BE LOST. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. LOSS OF ALL MODES. WORST CASE --- UNEXPECTED MOTION. ELECTRICALLY FROZEN. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A	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. 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, INSPECTION VERIFIES THAT KITTED PARTS ARE CORRECT PRIOR TO ASSEMBLY AND TRACEABILITY INFORMATION RECORDED.. UNITS ARE INSPECTED TO THE APPLICABLE SPAR INSPECTION TEST PROCEDURE (ITP) PRIOR TO MOTOR MODULE INTEGRATION. INSPECTIONS INCLUDE WORKMANSHIP, CLEANLINESS, DIMENSIONAL 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 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

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: 51T40E1214 SHEET: 4

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
4175	0	COMMUTATION SCANNER QTY-6 P/N 51140E1295	MODE: ERRATIC COMMUTATION IN PRIME AND BACKUP MODES. CAUSE(S): (1) LOSS OF PLATING ON CODE WHEEL.	AUTOBRAKES ARE APPLIED. ARM COMES TO REST. LOSS OF REGULAR COMMUTATION. ABILITY TO START THE JOINT IN PRIME AND BACK-UP MAY BE LOST. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. LOSS OF ALL MODES. WORST CASE --- UNEXPECTED MOTION. ELECTRICALLY FROZEN. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A	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: 5114DE1214 SHEET: 5

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
4175	0	COMMUTATION SCANNER QTY-6 P/N 5114DE1295	MODE: ERRATIC COMMUTATION IN PRIME AND BACKUP MODES. CAUSE(S): (1) LOSS OF PLATING ON CODE WHEEL.	AUTOBRAKES ARE APPLIED. ARM COMES TO REST. LOSS OF REGULAR COMMUTATION. ABILITY TO START THE JOINT IN PRIME AND BACK-UP MAY BE LOST. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. LOSS OF ALL MODES. WORST CASE --- UNEXPECTED MOTION. ELECTRICALLY FROZEN. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A		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) SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y NOMENCLATURE: MOTOR MODULE 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. 1/1 CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: N/A
4175	0	COMMUTATION SCANNER QTY-6 P/N 51140E1295	MODE: ERRATIC COMMUTATION IN PRIME AND BACKUP MODES. CAUSE(S): (1) LOSS OF PLATING ON CODE WHEEL.	AUTOBRAKES ARE APPLIED. ARM COMES TO REST. LOSS OF REGULAR COMMUTATION. ABILITY TO START THE JOINT IN PRIME AND BACK-UP MAY BE LOST. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. LOSS OF ALL MODES. WORST CASE --- UNEXPECTED MOTION. ELECTRICALLY FROZEN. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A	OPERATIONAL EFFECTS --- COMPUTER SUPPORTED MODES CANNOT BE USED TO COMPLETE THE MISSION. DIRECT DRIVE AND BACK-UP MODES REMAIN. IF PAYLOAD IS ATTACHED, THE ARM SHOULD BE MANOUVERED TO A SAFE POSITION FOR PAYLOAD RELEASE.. LOSS OF NEXT REDUNDANT PATH RESULTS IN BEING ONE FAILURE AWAY FROM INABILITY TO CRADLE ARM. IF WITH SUBSEQUENT FAILURES ALL DRIVE MODES ARE LOST, THE ARM MAY BE JETTISONED. CREW HAS ABILITY TO OVERRIDE A SINGLE FAILURE. CREW ACTION --- USE SINGLE MODE ON OTHER JOINTS TO POSITION ARM FOR JETTISON. CREW TRAINING --- THE CREW WILL BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. MISSION CONSTRAINT --- OPERATE UNDER VERNIER RATES WITHIN 10 FT OF STRUCTURE. AUTO TRAJECTORIES MUST BE DESIGNED TO COME NO CLOSER THAN 5 FT FROM STRUCTURE. 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. ARM SHOULD NOT BE MANEUVERED TO POSITION WHERE JETTISON CANNOT BE SAFETY PERFORMED. OMRSD OFFLINE --- IN COMPUTER SUPPORTED MODE WITH ELBOW DEMATED DRIVE ALL JOINTS. VERIFY JOINT MOTION OMRSD ONLINE INSTALLATION --- NONE OMRSD ONLINE TURNAROUND --- IN SINGLE MODE DRIVE ALL JOINTS VERIFY LACK OF COMMSCANNER BITE.

PREPARED BY: MFWG SUPERCEDING DATE: NONE APPROVED BY: _____ DATE: 11 JUL 91 CHG REV: 0