

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: END EFFECTOR

SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140E1470

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
3670	1	COMMUTATION SCANNER QTY-1 P/N 51140E517	<p>MODE: ONE COMMUTATION OUTPUT FAILS HIGH OR LOW.</p> <p>CAUSE(S): (1) FAILURE OF ANY ONE PHOTOCCELL, VOLTAGE COMPARATOR OR OUTPUT BUFFER. (2) FIBRE OPTIC FAILURE.</p>	<p>DEGRADED MOTOR PERFORMANCE (I.E. REDUCED MOTOR TORQUE). MOTOR MAY CONTINUE TO RUN. IF STOPPED MOTOR MAY NOT START. ARM WILL STAY LIMP DURING AUTO CAPTURE SEQUENCE.</p> <p>WORST CASE ----- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING ----- BACKUP EE RELEASE.</p>	<p>DESIGN FEATURES -----</p> <p>THE END EFFECTOR COMMUTATION SCANNER ASSEMBLY (CSA) IS A MAJOR BOUGHT-OUT-PART WHICH IS SUPPLIED BY BEI MOTION SYSTEMS AND MEETS OR EXCEEDS THE REQUIREMENTS OF SPAR-SG.454.</p> <p>THE CURRENT CONFIGURATION PHOTOCCELL IS ASSEMBLED AT BEI USING SPAR-APPROVED PROCEDURES. IT IS SCREENED AND QUALIFIED PER A BEI SCD (905-16816) TO STRESS LEVELS FAR IN EXCESS OF MISSION LIMITS.</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>ALL EEE PARTS ARE PROCURED TO MILITARY SPECIFICATIONS OR EQUIVALENT. THE CIRCUITS EMBODY THE USE OF MHB5300.4 (3A) SOLDERING, WITH NO PLATED-THRU HOLES (2 WIRES ARE USED WHERE NECESSARY) AND ALL LAP SOLDER JOINTS. THE EMI FILTER IS PURCHASED TO AN SCD (905-15181), WHICH INCORPORATES RESCREENING INCLUDING THERMAL SHOCK, BURN-IN, AND HERMETICITY TESTING, AS WELL AS X-RAY OF ALL UNITS.</p> <p>CERAMIC CAPACITORS ARE USED THROUGHOUT. THE BUS CAPACITORS ARE S LEVEL M39014.</p> <p>THE CURRENT LIMIT RESISTOR (LED 50MA) IS A TWO WATT RATING RW80S TYPE DEVICE, OPERATING AT A STRESS LEVEL OF LESS THAN 0.1 TO GIVE A VERY LOW PROBABILITY OF FAILURE.</p> <p>THE FIBER OPTICS USED ON THE RMS COMM SCANNERS ARE A CUSTOM DESIGN, MANUFACTURED BY GALILEO ELECTRO-OPTICS CORPORATION.</p> <p>THE FIBRE OPTIC BUNDLES ARE SECURED AT EACH END BY METAL RINGS AND EPOXY. THE BUNDLE LENGTHS ARE SUPPORTED BY A FLEXIBLE WOVEN GLASS TUBE AND A STAINLESS STEEL SPRING. STRESS RELIEF ARE USED AT THE ANCHOR POINTS.</p>

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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
3670	1	COMMUTATION SCANNER QTY-1 P/N 51140E517	MODE: ONE COMMUTATION OUTPUT FAILS HIGH OR LOW. CAUSE(S): (1) FAILURE OF ANY ONE PHOTOCCELL, VOLTAGE COMPARATOR OR OUTPUT BUFFER. (2) FIBRE OPTIC FAILURE.	DEGRADED MOTOR PERFORMANCE (I.E. REDUCED MOTOR TORQUE). MOTOR MAY CONTINUE TO RUN. IF STOPPED MOTOR MAY NOT START. ARM WILL STAY LIMP DURING AUTO CAPTURE SEQUENCE. WORST CASE UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING ----- BACKUP EE RELEASE.	ACCEPTANCE TESTS ----- THE EE ASSEMBLY IS TESTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTS: O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 7 O THERMAL VACUUM: +70 DEGREES C TO -25 DEGREES C (1 1/2 CYCLES) 1 X 10**6 TORR THE EE ASSEMBLY IS FURTHER TESTED IN THE IN THE RMS SYSTEM TEST (TP518 RMS STRONGBACK AND TP552 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE. QUALIFICATION TESTS ----- THE EE ASSEMBLY QUALIFICATION TESTING CONSISTED OF THE FOLLOWING ENVIRONMENTS: O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 7 O SHOCK: 20G/11 MS - 3 AXES (6 DIRECTIONS) O THERMAL VACUUM: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1 X 10**6 TORR O HUMIDITY: 95% RH (65 DEGREES C MAINTAINED FOR 6 HRS) (65 DEGREES C TO 30 DEGREES C IN 16 HRS) 10 CYCLES 240 HRS. O EMC: MIL-STD-461A AS MODIFIED BY SL-E-0002 (TEST CE01, CE03, CS01, CS02, CS06, RE02 (W/B)) O STRUCTURAL STIFFNESS AND LOAD TEST FLIGHT CHECKOUT ----- PDORS OPS CHECKLIST (ALL VEHICLES) JSC 16987

PREPARED BY: MFVG SUPERCEDING DATE: 11 SEP 86 APPROVED BY: _____ DATE: 24 JUL 91 CIL REV: 1

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ASS'Y P/N: 51140E1470

SHEET: 3

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HMWR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3670	1	COMPUTATION SCANNER QTY-1 P/N 51140E517	<p>MODE: ONE COMPUTATION OUTPUT FAILS HIGH OR LOW.</p> <p>CAUSE(S): (1) FAILURE OF ANY ONE PHOTOCCELL, VOLTAGE COMPARATOR OR OUTPUT BUFFER. (2) FIBRE OPTIC FAILURE.</p>	<p>DEGRADED MOTOR PERFORMANCE (I.E. REDUCED MOTOR TORQUE). MOTOR MAY CONTINUE TO RUN. IF STOPPED MOTOR MAY NOT START. ARM WILL STAY LIMP DURING AUTO CAPTURE SEQUENCE.</p> <p>WORST CASE ----- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING ----- BACKUP EE RELEASE.</p>	<p>QA/INSPECTIONS -----</p> <p>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 ENVOCKED ON THE SUPPLIER.</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 JSCM8080 STANDARD NUMBER 95A.</p> <p>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.</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, DAMAGED OR LIFTING CIRCUIT PADS, CLEANLNESS ETC.</p> <p>COMPONENT MOUNTING INSPECTION FOR CORRECT SOLDERING, WIRE LOOPING, STRAPPING, ETC. OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA WMB 5300.4(3A) STANDARD, AS MODIFIED BY JSC 08800A.</p> <p>CONFORMAL COATING INSPECTION FOR ADEQUATE PROCESSING IS PERFORMED USING ULTRAVIOLET LIGHT TECHNIQUES.</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 CLEANLNESS (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> <p>A TEST READINESS REVIEW (TRR) WHICH INCLUDES VERIFICATION OF</p>

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SHEET: 4

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/TR CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3670	1	COMMUTATION SCANNER QTY-1 P/N 51140E517	<p>MODE: ONE COMMUTATION OUTPUT FAILS HIGH OR LOW.</p> <p>CAUSE(S): (1) FAILURE OF ANY ONE PHOTOCELL, VOLTAGE COMPARATOR OR OUTPUT BUFFER. (2) FIBRE OPTIC FAILURE.</p>	<p>DEGRADED MOTOR PERFORMANCE (I.E. REDUCED MOTOR TORQUE). MOTOR MAY CONTINUE TO RUN. IF STOPPED MOTOR MAY NOT START. ARM WILL STAY LIMP DURING AUTO CAPTURE SEQUENCE.</p> <p>WORST CASE ----- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING ----- BACKUP EE RELEASE.</p>	<p>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, VIBRATION AND THERMAL-VAC TESTING, (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p> <p>INTEGRATION OF UNIT TO MOTOR MODULE - INSPECTIONS INCLUDE GROUNDING CHECKS, CONNECTOR FOR BENT PINS, VISUAL, CLEANLINESS, INTERCONNECT WIRING ETC.</p> <p>MOTOR MODULES ARE TESTED TO THE REQUIREMENTS OF SPAR-TM.1624 WHICH INCLUDES, CONTINUITY AND ISOLATION CHECKS, STICTION, COMMUTATOR TIMING, AMBIENT AND THERMAL TESTING. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).</p> <p>INTEGRATION OF MOTOR MODULE TO END EFFECTOR LRU - INSPECTIONS INCLUDE GROUNDING CHECKS, CONNECTORS FOR BENT OR PUSHBACK CONTACTS, INCONNECT WIRING ETC.</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>

PREPARED BY:

MFVG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY: _____

DATE: 24 JUL 91

CIL REV: 1

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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
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PREPARED BY:

MFWG

SUPERCEDING DATE: 11 SEP 86

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SHEET: 7

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
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