

**CRITICAL ITEMS LIST**

PROJECT: SRMS (-5 MCIU INSTALLED)  
 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51140E301

SHEET: 1

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
105	0	BRAKE ON/OFF SWITCH Q1Y-1, P/M CAE 07036 ME452-0102 TYPE VII ED 92020 SHEET 1	MODE: INABILITY TO PUT BRAKES ON.  CAUSE(S): (1) SWITCH FAILS TO OFF POSITION.  (2) 28V POLE FAILS TO OFF POSITION (GND TO MCIU).	FOR ALL CAUSES: BRAKES CANNOT BE PUT ON USING BRAKES SWITCH. AUTOBRAKES ARE OPERATIVE. DIRECT DRIVE LOST. LOSS OF MCIU HARDWARE WATCHDOG TIMER/MICROPROCESSOR FAIL GITE VERIFICATION. IF AUTO-BRAKES AND/OR MCIU FAILURE WARNING SET BY MCIU DUE TO A FAILURE THEY CANNOT BE CLEARED BY THE BRAKE SWITCH. IF "MCIU" FAILURE WARNING ANNUNCIATED DUE TO MCIU HARDWARE WATCHDOG TIMER/MICROPROCESSOR FAILURE, CANNOT RESET EE AUTO MODE COMMAND CLEARING WITH BRAKE SWITCH.  FOR CAUSE 1): IF CONSISTENCY CHECK AND/OR GPC APPLIED AUTOBRAKES ANNUNCIATED, CANNOT BE RESET WITH BRAKE SWITCH.  FOR CAUSE 2): BRAKE SWITCH WILL RESET CONSISTENCY CHECK AND/OR GPC APPLIED AUTOBRAKES.  WORST CASE ----- UNEXPECTED MOTION. LOSS OF MANUAL BRAKES.	DESIGN FEATURES ----- TOGGLE SWITCHES USED ON THE D&C PANEL ARE HERMETICALLY SEALED, AND OF A MATURE AND PROVEN DESIGN. THESE SWITCHES ARE IN COMMON USE ON THE ORBITER VEHICLE.  THE SWITCHES ARE CONTROLLED BY ROCKWELL INTERNATIONAL SPECIFICATION MC 452-0102 AND HAVE BEEN QUALIFIED TO THE REQUIREMENTS OF THIS SPECIFICATION.  ELECTRICAL CONNECTIONS TO THE SWITCH ARE ACHIEVED BY MEANS OF SOLDERABLE TERMINALS.  WIRING TO SWITCH TERMINALS UTILIZES NICKEL PLATED CONDUCTORS WITH A POLYANIL INSULATION. SOLDERING OF THE NICKEL PLATED WIRE TO THE SWITCH TERMINALS IS CONTROLLED BY CAE PROCESS SPECIFICATION PD 91059.  THE WIRING HARNESS IS DESIGNED TO BE CAPABLE OF SEPARATE TESTING (FOR INSULATION RESISTANCE, DIELECTRIC STRENGTH, AND CONTINUITY).  MOUNTING OF THE SWITCH TO THE D&C PANEL IS BY MEANS OF A 15/32 NUT WHICH ENGAGES A THREADED BUSHING ON THE SWITCH. A KEYED WASHER PROVIDES ROTATION RESTRAINT. AFTER INSTALLATION AND TORQUING, THE NUT IS STAKED TO THE PANEL BY A BLOB OF EPOXY ADHESIVE. A STAINLESS STEEL GUARD PROTECTS THE SWITCH LEVER AGAINST DAMAGE OR INADVERTENT OPERATION.  ANALYSIS OF THE BASIC PANEL STRUCTURE HAS DEMONSTRATED THAT THERE ARE NO RESONANCES IN THE RELEVANT VIBRATION FREQUENCY SPECTRUM. THIS ANALYSIS HAS BEEN VERIFIED BY VIBRATION TESTING OF THE D&C PANEL ASSEMBLY.  APPLICATION ANALYSIS HAS CONFIRMED THAT ADEQUATE ELECTRICAL STRESS MARGINS ARE ACHIEVED.  AT THE PART LEVEL, QUALIFICATION/CERTIFICATION TESTING IS DEFINED BY ROCKWELL INTERNATIONAL SPECIFICATION MC452-0102. THIS TEST REQUIREMENT INCLUDES: INSULATION RESISTANCE, DIELECTRIC STRENGTH, CONTACT RESISTANCE, RANDOM VIBRATION (40 MINUTES PER AXIS), LEAKAGE AT ONE ATMOSPHERE DIFFERENTIAL PRESSURE, TOGGLE STRENGTH. FOR SWITCH OPERATIONAL CYCLES REFER TO TABLE 13.  ALL UNITS ARE SUBJECTED TO ACCEPTANCE TESTS WHICH INCLUDE PRE-ACCEPTANCE RUN-IN, DIELECTRIC STRENGTH, INSTALLATION RESISTANCE, CONTACT RESISTANCE, ACCEPTANCE VIBRATION, SEAL TEST, VISUAL EXAMINATION, AND RADIOGRAPHIC INSPECTION.	

PREPARED BY: MFUG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

**CRITICAL ITEMS LIST**

PROJECT: SRMS (-5 MCIU INSTALLED)  
 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51140E301

SHEET: 2

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR EMO ITEM	HOWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
105	0	BRAKE ON/OFF SWITCH QTY-1. P/M CAE 87836 MC452- 0102 TYPE VII ED 92020 SHEET 1	MODE: INABILITY TO PUT BRAKES ON.  CAUSE(S): (1) SWITCH FAILS TO OFF POSITION.  (2) 28V POLE FAILS TO OFF POSITION (GND TO MCIU).	REDUNDANT PATHS REMAINING  FAILED FREE JOINT	ACCEPTANCE TESTS ----- THE HARDWARE ITEM IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTS AS PART OF THE D&C PANEL ASSEMBLY.  O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1  O THERMAL: +110 DEGREES F TO PLUS 10 DEGREES F (2 CYCLES - 9.5 HRS/CYCLE.)  THE D&C PANEL ASSEMBLY IS FURTHER TESTED AS PART OF THE RMS SYSTEM TESTS (TP518 RMS STRONGBACK TEST AND TP552 FLAT FLOOR TEST) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.  QUALIFICATION TESTS ----- THE SWITCH ITEM HAS BEEN QUALIFIED FOR ORBITER USE. THE D&C PANEL ASSEMBLY HAS BEEN SUBJECTED TO THE FOLLOWING QUALIFICATION TEST ENVIRONMENTS.  O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1  O SHOCK: 20G/11 MS - 3 AXES (6 DIRECTIONS)  O THERMAL: 130 DEGREES F TO -23 DEGREES F (12 HRS PER CYCLE) (6 CYCLES)  O HUMIDITY: 95% (120 DEGREES F TO 82 DEGREES F CYCLE IN 16 HRS) 10 CYCLES TOTAL.  O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TEST CE01, CE02, CE03, CS01 (DC/AC), CE03, CS01 (DC/AC), CS02, CS06, RE02 (B/N), RS02, RS03, RS04)  FLIGHT CHECKOUT ----- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987	

PREPARED BY: MFNG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

EXPEDITED PROJECT

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 ATTACHMENT  
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**CRITICAL ITEMS LIST**

PROJECT: SRMS (-5 MCIU INSTALLED)  
 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51720E391

SHEET: 3

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
105	0	BRAKE ON/OFF SWITCH QTY-1, P/N CAE 87836 ME452-0102 TYPE VII ED 92020 SHEET 1	<p>MODE: INABILITY TO PUT BRAKES ON.</p> <p>CAUSE(S):                      (1) SWITCH FAILS TO OFF POSITION.                      (2) 28V POLE FAILS TO OFF POSITION (GND TO MCIU).</p>	<p>FOR ALL CAUSES: BRAKES CANNOT BE PUT ON USING BRAKES SWITCH. AUTOBRAKES ARE OPERATIVE. DIRECT DRIVE LOST. LOSS OF MCIU HARDWARE WATCHDOG TIMER/MICROPROCESSOR FAIL BIT VERIFICATION. IF AUTO-BRAKES AND/OR MCIU FAILURE WARNING SET BY MCIU DUE TO A FAILURE, THEY CANNOT BE CLEARED BY THE BRAKE SWITCH. IF "MCIU" FAILURE WARNING ANNUNCIATED DUE TO MCIU HARDWARE WATCHDOG TIMER/MICROPROCESSOR FAILURE, CANNOT RESET EE AUTO MODE COMMAND CLEARING WITH BRAKE SWITCH.</p> <p>FOR CAUSE 1): IF CONSISTENCY CHECK AND/OR GPC APPLIED AUTOBRAKES ANNUNCIATED, CANNOT BE RESET WITH BRAKE SWITCH.</p> <p>FOR CAUSE 2): BRAKE SWITCH WILL RESET CONSISTENCY CHECK AND/OR GPC APPLIED AUTOBRAKES.</p> <p>WORST CASE                      -----                      UNEXPECTED MOTION. LOSS OF MANUAL BRAKES.</p>	<p>QA/INSPECTIONS                      -----</p>	<p>HERMETICALLY SEALED TOGGLE SWITCHES ARE PROCURED TO ROCKWELL SPECIFICATION MC452-0102, AS REQUIRED BY CAE SPEC. PS-87836. CAE PART NO. PS87836: QUALIFICATION AND ACCEPTANCE TESTING OF SWITCHES IS PERFORMED TO R.I. SPEC. MC 452-0102.</p> <p>RECEIVING INSPECTION VERIFIES THAT SWITCHES RECEIVED ARE AS IDENTIFIED IN THE PROCUREMENT DOCUMENTS, THAT NO PHYSICAL DAMAGE HAS OCCURRED TO SWITCHES DURING SHIPMENT, THAT THE RECEIVING DOCUMENTS PROVIDE ADEQUATE TRACEABILITY INFORMATION AND ACCEPTANCE TEST DATA IDENTIFIES ACCEPTABLE PARTS.</p> <p>PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE,</p> <p>COMPONENT MOUNTING TO FRONT PANEL INSPECTION, SOLDERING OF WIRES TO SWITCH CONTACTS, WIRE ROUTING, STRESS RELIEF OF WIRES ETC., OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA HND 5300.4(3A) STANDARD, AS MODIFIED BY JSC08800A.</p> <p>PRE-TEST INSPECTION OF D&amp;C PANEL ASSY INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILD CONFIGURATION VERIFICATION TO AS DESIGN ETC. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p> <p>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).</p> <p>ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT PERFORMANCE, THERMAL AND VIBRATION TESTING, (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).</p> <p>INTEGRATION OF D&amp;C PANEL, RNC, IHC AND MCIU, INSPECTIONS ARE PERFORMED AT EACH STAGE OF INTEGRATION, WHICH INCLUDES GROUNDING CHECKS, INTER CONNECT CABLE VERIFICATION, CONNECTOR INSPECTION FOR BENT OR PUSHBACK CONTACTS ETC.</p> <p>SUB-SYSTEM PERFORMANCE TESTING (ATP) INCLUDES AN AMBIENT PERFORMANCE TEST. (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 SUPERSEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

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PROJECT: SRMS (-5 MCIU INSTALLED)  
 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51T40E391

SHEET: 4

FMEA REF.	FMEA REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
105	0	BRAKE ON/OFF SWITCH QTY-1. P/N CAE 87836 ME452-0102 TYPE VII ED 92020 SHEET 1	MODE: INABILITY TO PUT BRAKES ON.  CAUSE(S): (1) SWITCH FAILS TO OFF POSITION.  (2) 28V POLE FAILS TO OFF POSITION (GND TO MCIU).	REDUNDANT PATHS REMAINING ----- FAILED FREE JOINT	FAILURE HISTORY -----  THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.	

PREPARED BY: MFVG SUPERSEDING DATE: NONE

DATE: 11 JUL 91 REV: 0

RMS/D&C - 20

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**CRITICAL ITEMS LIST**

PROJECT: SRMS (-5 MCIU INSTALLED)  
 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51T&DE391

SHEET: 5

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
105	0	BRAKE ON/OFF SWITCH QTY-1. P/N CAE 07836 ME452-0102 TYPE VII ED 92020 SHEET 1	<p>MODE: INABILITY TO PUT BRAKES ON.</p> <p>CAUSE(S):                      (1) SWITCH FAILS TO OFF POSITION.                      (2) 28V POLE FAILS TO OFF POSITION (GND TO MCIU).</p>	<p>FOR ALL CAUSES: BRAKES CANNOT BE PUT ON USING BRAKES SWITCH. AUTOBRAKES ARE OPERATIVE. DIRECT DRIVE LOST. LOSS OF MCIU HARDWARE WATCHDOG TIMER/MICROPROCESSOR FAIL BITE VERIFICATION. IF AUTO-BRAKES AND/OR MCIU FAILURE WARNING SET BY MCIU DUE TO A FAILURE THEY CANNOT BE CLEARED BY THE BRAKE SWITCH. IF "MCIU" FAILURE WARNING ANNUNCIATED DUE TO MCIU HARDWARE WATCHDOG TIMER/MICROPROCESSOR FAILURE, CANNOT RESET EE AUTO MODE COMMAND CLEARING WITH BRAKE SWITCH.</p> <p>FOR CAUSE 1): IF CONSISTENCY CHECK AND/OR GPC APPLIED AUTOBRAKES ANNUNCIATED, CANNOT BE RESET WITH BRAKE SWITCH.</p> <p>FOR CAUSE 2): BRAKE SWITCH WILL RESET CONSISTENCY CHECK AND/OR GPC APPLIED AUTOBRAKES.</p> <p>WORST CASE                      UNEXPECTED MOTION. LOSS OF MANUAL BRAKES.</p>	<p>OPERATIONAL EFFECTS                      -----</p> <p>SUBSEQUENT FAILURE, I.E., FREE JOINT, CANNOT STOP THE ARM WITH THE BRAKE SWITCH. AUTO BRAKES STILL OPERATIVE. BRAKES CAN BE APPLIED BY DESELECTING ARM OR REMOVING ARM POWER.</p> <p>CREW ACTION                      -----</p> <p>NONE</p> <p>CREW TRAINING                      -----</p> <p>THE CREW SHOULD BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, THE COMMAND SHOULD BE REMOVED. IF REMOVAL OF THE COMMAND DOES NOT STOP THE ARM, THE BRAKES SHOULD BE APPLIED. IF THE BRAKES DON'T STOP THE ARM, THEN THE RMS POWER SWITCH SHOULD BE TURNED OFF.</p> <p>MISSION CONSTRAINT                      -----</p> <p>OPERATE UNDER VERNIER RATES WITHIN 10 FT OF 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.</p> <p>OMRSD OFFLINE                      -----</p> <p>EXERCISE BRAKE SWITCH ON/OFF. VERIFY BRAKE VOLTAGE AT D&amp;C PANEL OUTPUT.</p> <p>OMRSD ONLINE INSTALLATION                      -----</p> <p>EXERCISE BRAKE SWITCH ON/OFF VERIFY BRAKE VOLTAGE AT LONGERON INTERFACE</p> <p>OMRSD ONLINE TURNAROUND                      -----</p> <p>EXERCISE BRAKE SWITCH ON/OFF VERIFY ABILITY TO APPLY AND RELEASE BRAKES</p>	

PREPARED BY: MFWG

SUPERSEDING DATE: NONE

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PROJECT: SRMS (-5 MCIU INSTALLED)  
 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51140E391

SHEET: 6

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	DOWN / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
105	0	BRAKE ON/OFF SWITCH QTY-1. P/N CAE 87836 ME452-0102 TYPE VII ED 92020 SHEET 1	MODE: INABILITY TO PUT BRAKES ON.  CAUSE(S): (1) SWITCH FAILS TO OFF POSITION.  (2) 28V POLE FAILS TO OFF POSITION (GND TO MCIU).	REDUNDANT PATHS REMAINING ----- FAILED FREE JOINT		

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