

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51155E117      SIB#1: 1

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
1520	2	CAPTURE/RELEASE SWITCH QTY-1 P/N MS 27717-27	<p>MODE: LOSS OF ABILITY TO AUTOMATICALLY CAPTURE AND RELEASE.</p> <p>CAUSE(S): (1) 10V POLE FAILURE TO OFF POSITION. (2) 10V POLE FAIL IN CAPTURE POSITION. (3) 10V CAPTURE CONTACT FAILS SHORT. (4) 10V POLE FAILURE IN RELEASE POSITION. (5) 10V RELEASE CONTACT FAILS SHORT.</p>	<p>CAUSE (1) AUTO MODE LOST. IN 'MANUAL' ARM WILL NOT LIMP FOR CAPTURE. ARM WILL LIMP FOR RIGIDIZE.</p> <p>CAUSE (2 &amp; 3) PERMANENT FLAG TO GPC. WHEN EE AUTO SELECTED EE WILL PERFORM AUTO CAPTURE SEQUENCE. WHEN EE MANUAL SELECTED ARM WILL BE LIMPED. ARM MAY TAKE UNEXPECTED TRAJECTORY. UNCOMMANDED RELEASE CHECK WILL BE INOPERATIVE.</p> <p>CAUSE (4 &amp; 5) EE WILL RELEASE PAYLOAD IMMEDIATELY IF EE AUTO MODE SELECTED.</p> <p>WORST CASE ----- UNCOMMANDED RELEASE UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING ----- N/A</p>	1/1	<p>DESIGN FEATURES -----</p> <p>THE CAPTURE/RELEASE SWITCH IS A TOGGLE - ACTUATED SWITCH, TYPE MS27717-27, QUALIFIED TO MIL-C-83731.</p> <p>REPRESENTATIVE SWITCHES AND ACTUATORS WERE LIFE TESTED FOR SRMS USE.</p> <p>THIS TEST WAS CONDUCTED BY MOUNTING THE SWITCHES IN A REPRESENTATIVE HAND GRIP FRAME. TESTING INCLUDED - RANDOM VIBRATION TO QVT LEVELS AND OPERATING LIFE TESTS TO 10000 CYCLES (5000 BEFORE VIBRATION, AND 5000 POST-VIBRATION) CONTACT RESISTANCE, AND ACTUATOR OPERATING FORCES. FOR SWITCH OPERATIONAL CYCLES REFER TO TABLE 13.</p> <p>SOLDERED CONNECTIONS TO THE SWITCHES ARE POTTED TO AFFORD STRAIN RELIEF, AND PROTECTION AGAINST SHORT CIRCUIT.</p> <p>THE PROCUREMENT SPECIFICATION FOR THE SWITCH INCLUDES THE REQUIREMENT FOR DPA ON SAMPLES FROM EACH DELIVERED LOT.</p>

PREPARED BY: MFVG      SUPERCEDING DATE: 06 OCT 87      APPROVED BY: \_\_\_\_\_      DATE: 24 JUL 91      CIL REV: 3

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51155E117

SHEET: 2

FMEA REF.	FMEA REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
1520	2	CAPTURE/RELEASE SWITCH QTY-1 P/N MS 27717-27	<p>MODE: LOSS OF ABILITY TO AUTOMATICALLY CAPTURE AND RELEASE.</p> <p>CAUSE(S):                      (1) 10V POLE FAILURE TO OFF POSITION.                      (2) 10V POLE FAIL IN CAPTURE POSITION.                      (3) 10V CAPTURE CONTACT FAILS SHORT.                      (4) 10V POLE FAILURE IN RELEASE POSITION.                      (5) 10V RELEASE CONTACT FAILS SHORT.</p>	<p>CAUSE (1)                      AUTO MODE LOST. IN 'MANUAL' ARM WILL NOT LIMP FOR CAPTURE. ARM WILL LIMP FOR RIGIDIZE.</p> <p>CAUSE (2 &amp; 3)                      PERMANENT FLAG TO GPC. WHEN EE AUTO SELECTED EE WILL PERFORM AUTO CAPTURE SEQUENCE. WHEN EE MANUAL SELECTED ARM WILL BE LIMPED. ARM MAY TAKE UNEXPECTED TRAJECTORY. UNCOMMANDED RELEASE CHECK WILL BE INOPERATIVE.</p> <p>CAUSE (4 &amp; 5)                      EE WILL RELEASE PAYLOAD IMMEDIATELY IF EE AUTO MODE SELECTED.</p> <p>WORST CASE                      -----                      UNCOMMANDED RELEASE UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING                      -----                      N/A</p>	<p>ACCEPTANCE TESTS                      -----                      THE RHC IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTING AS AN SRU.</p> <p>O VIBRATION: LEVEL AND DURATION REFERENCE TABLE 1</p> <p>O THERMAL: +120 DEGREES F TO 20 DEGREES F (12 HRS PER CYCLE) 2 CYCLES TOTAL.</p> <p>THE RHC IS TESTED AS PART OF THE D&amp;C SUBSYSTEM; WHICH CONSIST OF D&amp;C PANEL, THC AND RHC; PER TP 347.</p> <p>THE TOTAL D&amp;C SUBSYSTEM UNDERGOES RMS SYSTEM TESTING, (1P 518 RMS STRONGBACK, AND TP552 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p>QUALIFICATIONS TESTS                      -----                      THE RHC IS CERTIFIED BY SIMILARITY TO THE ORBITER USED RHC EXCEPT FOR FINGER OPERATED SWITCHES. THE BASIC DIFFERENCES IS THAT THE ORBITER RHC IS TRIPLE REDUNDANT AND THE RMS RHC IS SINGLE STRING.</p> <p>FLIGHT CHECKOUT                      -----                      PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>	

PREPARED BY: MFNG

SUPERCEDING DATE: 06 OCT 87

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**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51155E117

SHEET: 3

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	W / FUNC. I / CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
1520	2	CAPTURE/RELEASE SWITCH QTY-1 P/N MS 27717-27	<p>MODE: LOSS OF ABILITY TO AUTOMATICALLY CAPTURE AND RELEASE.</p> <p>CAUSE(S):                      (1) 10V POLE FAILURE TO OFF POSITION.                      (2) 10V POLE FAIL IN CAPTURE POSITION.                      (3) 10V CAPTURE CONTACT FAILS SHORT.                      (4) 10V POLE FAILURE IN RELEASE POSITION.                      (5) 10V RELEASE CONTACT FAILS SHORT.</p>	<p>CAUSE (1) AUTO MODE LOST. IN 'MANUAL' ARM WILL NOT LIMP FOR CAPTURE. ARM WILL LIMP FOR RIGIDIZE.</p> <p>CAUSE (2 &amp; 3) PERMANENT FLAG TO GPC. WHEN EE SELECTED EE WILL PERFORM AUTO CAPTURE SEQUENCE. WHEN EE MANUAL SELECTED ARM WILL BE LIMPED. ARM MAY TAKE UNEXPECTED TRAJECTORY. UNCOMMANDED RELEASE CHECK WILL BE INOPERATIVE.</p> <p>CAUSE (4 &amp; 5) EE WILL RELEASE PAYLOAD IMMEDIATELY IF EE AUTO MODE SELECTED.</p> <p>WORST CASE                      -----                      UNCOMMANDED RELEASE UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING                      -----                      N/A</p>	QA/INSPECTIONS	<p>TOGGLE SWITCHES ARE PROCURED TO MS27717 AS REQUIRED BY HONEYWELL DRAWING NO. 10067199. SWITCHES ARE QUALIFIED AND SCREENED TO THE REQUIREMENTS OF MIL-S-83731 AND DRAWING NO. 10067199. QUALIFICATION TESTING OF SWITCHES WAS PERFORMED TO THE REQUIREMENTS OF HONEYWELL TEST PROCEDURE NO. SW-QTP-01. THE SWITCH MECHANISMS AND SWITCHES SUCCESSFULLY COMPLETED 10,000 CYCLES OF LIFE CYCLING. IN ADDITION TO THE 10,000 LIFE CYCLES, THE SWITCH MECHANISMS AND SWITCHES WERE SUBJECTED TO THE QAVT AND FLIGHT VIBRATION REQUIREMENTS OF CAE SPECIFICATION PS 87827.51. PRIOR TO ANY SWITCH CYCLING OR VIBRATION, SWITCH MECHANISM SUB ASSEMBLIES WERE GIVEN A FUNCTIONAL PERFORMANCE TEST ON THE SSHC TEST CONSOLE. DETAILED TEST RESULTS ARE COVERED IN HONEYWELL TEST REPORT NO. AEX-77-059. NASA APPROVAL OF SWITCHES IS UNDER NSPAR 4092 AND NSPAR 4093.</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 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 INSPECTION FOR CORRECT SOLDERING, WIRE LOOPING, STRAPPING, ETC. OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA MHB 5300.4(3A) STANDARD, AS MODIFIED BY JSC 08800A.</p> <p>PRE-CLOSURE INSPECTION, WORKMANSHIP AND CLEANLINESS (CAE/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, VIBRATION AND THERMAL TESTING (CAE/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p> <p>INTEGRATION OF D&amp;C PANEL, RHC, THC 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>

PREPARED BY: MFWG

SUPERSEDING DATE: 06 OCT 87

APPROVED BY: \_\_\_\_\_

DATE: 26 JUL 91

CIL REV: 3

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51155ET7 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
1520	2	CAPTURE/RELEASE SWITCH QTY-1 P/N MS 27717-27	<p>MODE: LOSS OF ABILITY TO AUTOMATICALLY CAPTURE AND RELEASE.</p> <p>CAUSE(S): (1) 10V POLE FAILURE TO OFF POSITION. (2) 10V POLE FAIL IN CAPTURE POSITION. (3) 10V CAPTURE CONTACT FAILS SHORT. (4) 10V POLE FAILURE IN RELEASE POSITION. (5) 10V RELEASE CONTACT FAILS SHORT.</p>	<p>CAUSE (1) AUTO MODE LOST. IN 'MANUAL' ARM WILL NOT LIMP FOR CAPTURE. ARM WILL LIMP FOR RIGIDIZE.</p> <p>CAUSE (2 &amp; 3) PERMANENT FLAG TO GPC. WHEN EE AUTO SELECTED EE WILL PERFORM AUTO CAPTURE SEQUENCE. WHEN EE MANUAL SELECTED ARM WILL BE LIMPED. ARM MAY TAKE UNEXPECTED TRAJECTORY. UNCOMMANDED RELEASE CHECK WILL BE INOPERATIVE.</p> <p>CAUSE (4 &amp; 5) EE WILL RELEASE PAYLOAD IMMEDIATELY IF EE AUTO MODE SELECTED.</p> <p>WORST CASE ----- UNCOMMANDED RELEASE UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING ----- N/A</p>	1/1	<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: MFWG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY: \_\_\_\_\_

DATE: 24 JUL 91

CIL REV: 3

**CRITICAL ITEMS LIST**

ASSY Nomenclature: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C SUBSYSTEM  
ASSY P/N: 51155E11

SHEET: 5

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
1520	2	CAPTURE/RELEASE SWITCH QTY-1 P/N MS 27717-27	<p>MODE: LOSS OF ABILITY TO AUTOMATICALLY CAPTURE AND RELEASE.</p> <p>CAUSE(S): (1) 10V POLE FAILURE TO OFF POSITION. (2) 10V POLE FAIL IN CAPTURE POSITION. (3) 10V CAPTURE CONTACT FAILS SHORT. (4) 10V POLE FAILURE IN RELEASE POSITION. (5) 10V RELEASE CONTACT FAILS SHORT.</p>	<p>CAUSE (1) AUTO MODE LOST. IN 'MANUAL' ARM WILL NOT LIMP FOR CAPTURE. ARM WILL LIMP FOR RIGIDIZE.</p> <p>CAUSE (2 &amp; 3) PERMANENT FLAG TO GPC. WHEN EE AUTO SELECTED EE WILL PERFORM AUTO CAPTURE SEQUENCE. WHEN EE MANUAL SELECTED ARM WILL BE LIMPED. ARM MAY TAKE UNEXPECTED TRAJECTORY. UNCOMMANDED RELEASE CHECK WILL BE INOPERATIVE.</p> <p>CAUSE (4 &amp; 5) EE WILL RELEASE PAYLOAD IMMEDIATELY IF EE AUTO MODE SELECTED.</p> <p>WORST CASE ----- UNCOMMANDED RELEASE UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING ----- N/A</p>	1/1	<p>FAILURE HISTORY ----- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.</p>

PREPARED BY: MFWG

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**CRITICAL ITEMS LIST**

PROJECT: SAMS  
 ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51155E117

SHEET: 6

FMEA REF.	FMEA REV.	NAME, QTY. & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
1520	2	CAPTURE/RELEASE SWITCH QTY-1 P/N HS 27717-27	<p>MODE: LOSS OF ABILITY TO AUTOMATICALLY CAPTURE AND RELEASE.</p> <p>CAUSE(S):                      (1) 10V POLE FAILURE TO OFF POSITION.                      (2) 10V POLE FAIL IN CAPTURE POSITION.                      (3) 10V CAPTURE CONTACT FAILS SHORT.                      (4) 10V POLE FAILURE IN RELEASE POSITION.                      (5) 10V RELEASE CONTACT FAILS SHORT.</p>	<p>CAUSE (1) AUTO MODE LOST. IN 'MANUAL' ARM WILL NOT LIMP FOR CAPTURE. ARM WILL LIMP FOR RIGIDIZE.</p> <p>CAUSE (2 &amp; 3) PERMANENT FLAG TO GPC. WHEN EE AUTO SELECTED EE WILL PERFORM AUTO CAPTURE SEQUENCE. WHEN EE MANUAL SELECTED ARM WILL BE LIMPED. ARM MAY TAKE UNEXPECTED TRAJECTORY. UNCOMMANDED RELEASE CHECK WILL BE INOPERATIVE.</p> <p>CAUSE (4 &amp; 5) EE WILL RELEASE PAYLOAD IMMEDIATELY IF EE AUTO MODE SELECTED.</p> <p>WORST CASE                      -----                      UNCOMMANDED RELEASE UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING                      -----                      N/A</p>	<p>OPERATIONAL EFFECTS                      -----                      LOSS OF EE AUTO MODE. ARM WILL NOT LIMP IN EE MANUAL MODE ARM JOINTS WILL NOT CONFORM TO PAYLOAD DURING A CAPTURE SEQUENCE. IF THERE IS ANY MISALIGNMENT WITH THE GRAPPLE FIXTURE, THE PAYLOAD WILL CHANGE ITS ATTITUDE DURING A FREE FLYING CAPTURE, OR THE ARM WILL BE PRELOADED IF THE PAYLOAD IS BERTHED. IT MAY TAKE LONGER TO COMPLETE A CAPTURE SEQUENCE.                      OR                      WITH MANUAL MODE SELECTED ARM GOES LIMP UNEXPECTEDLY AND REMAINS LIMP UNTIL EE MODE SW. IS SET TO THE OFF POSITION                      OR                      WITH AUTO SELECTED AND PAYLOAD CAPTURED, PAYLOAD WILL BE RELEASED UNANNUNCIATED. MANUAL MODE STILL OPERATIVE. OPERATOR WILL DETECT OFF NOMINAL EE OPERATIONS.</p> <p>CREW ACTION                      -----                      USE MANUAL MODE.</p> <p>CREW TRAINING                      -----                      CREW WILL BE TRAINED TO DETECT OFF NOMINAL OPERATION OF THE EE, AND TO OBTAIN MINIMUM ALIGNMENT ERRORS PRIOR TO CAPTURE OF A PAYLOAD. CREW WILL BE TRAINED TO SELECT EE MANUAL OR AUTO WHEN ARM IS STOPPED PRIOR TO MANEUVERING TO CAPTURE POSITION. IF PAYLOAD CAPTURED, SELECT EE MANUAL OR AUTO MODE AFTER PAYLOAD IS STABILIZED AND AT ITS RELEASE POSITION.</p> <p>MISSION CONSTRAINT                      -----                      WHEN CAPTURING A FREE FLYER, THE EE MUST BE FAR ENOUGH AWAY FROM STRUCTURE TO PROHIBIT CONTACT REGARDLESS OF PAYLOAD ROTATIONS.</p> <p>OMRSD OFFLINE                      -----                      EXERCISE CAPTURE/RELEASE SWITCH                      VERIFY CONTINUITY OF AUTO CONTACTS</p> <p>OMRSD ONLINE INSTALLATION                      -----                      NONE</p> <p>OMRSD ONLINE TURNAROUND                      -----                      EXERCISE CAPTURE/RELEASE SWITCH                      VERIFY CAPTURE RELEASE BITS ON DATA BUS</p>	

PREPARED BY: MFVG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY: \_\_\_\_\_

DATE: 24 JUL 91

CIL REV: 3