

**CRITICAL ITEMS LIST**

PROJECT: SRMS

ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C CONTROLS' SUBSYSTEM

ASS'Y P/N: 51155E117

SHEET: 1

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RDRR / PDRC, 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
1540	3-	CAPTURE/RELEASE SWITCH QTY-1 P/N NS 27717-27	<p>MODE: LOSS OF BOTH AUTO/MANUAL CAPT/REL FUNCTION.</p> <p>CAUSE(S): (1) SWITCH FAILS IN OFF POSITION. (2) SWITCH FAILS IN CAPTURE POSITION. (3) SWITCH FAILS IN RELEASE POSITION.</p>	<p>CAUSE (1) LOSS OF ABILITY TO CAPTURE AND RELEASE PAYLOAD.</p> <p>CAUSE (2) WHEN MAN OR AUTO SELECTED CAPTURE SEQ. WILL OCCUR. RELEASE WILL BE INOPERATIVE. WHEN IN MANUAL MOTOR WILL STALL WHEN CLOSED CONDITION IS REACHED. ARM WILL REMAIN LIMP UNTIL EE MODE SW. SET TO OFF</p> <p>CAUSE (3) WHEN MAN OR AUTO SELECTED, RELEASE SEQ. WILL PROCEED. IF PAYLOAD CAPT. THEN IT WILL BE RELEASED. IN MANUAL, MOTOR WILL STALL.</p> <p>WORST CASE UNCOMMANDED RELEASE. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>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: MFWG

SUPERCEDING DATE: 09 DEC 86

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

DATE: \_\_\_\_\_

**CRITICAL ITEMS LIST**

PROJECT: RMS  
 ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

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

SHEET: 2

FMEA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 1/1 CRITICALITY RATIONALE FOR ACCEPTANCE
1540	3	CAPTURE/RELEASE SWITCH QTY-1 P/N MS 27717-27	<p>MODE: LOSS OF BOTH AUTO/MANUAL CAPT/REL FUNCTION.</p> <p>CAUSE(S):                      (1) SWITCH FAILS IN OFF POSITION.                      (2) SWITCH FAILS IN CAPTURE POSITION.                      (3) SWITCH FAILS IN RELEASE POSITION.</p>	<p>CAUSE (1)                      LOSS OF ABILITY TO CAPTURE AND RELEASE PAYLOAD.</p> <p>CAUSE (2)                      WHEN MAN OR AUTO SELECTED CAPTURE SEQ. WILL OCCUR. RELEASE WILL BE INOPERATIVE. WHEN IN MANUAL MOTOR WILL STALL WHEN CLOSED CONDITION IS REACHED. ARM WILL REMAIN LIMP UNTIL EE MODE SW.SET TO OFF</p> <p>CAUSE (3)                      WHEN MAN OR AUTO SELECTED, RELEASE SEQ. WILL PROCEED. IF PAYLOAD CAPT THEN IT WILL BE RELEASED. IN MANUAL MOTOR WILL STALL.</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, INC AND RHC; PER TP 347.</p> <p>THE TOTAL D&amp;C SUBSYSTEM UNDERGOES RMS SYSTEM TESTING, (TP 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>

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C CONTROLS SUBSYSTEM  
 ASS'Y P/N: 51155ETT7

SHEET: 3

FMEA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWR / FUNC. 1/1	CRITICALITY RATIONALE FOR ACCEPTANCE
1540	3-	CAPTURE/RELEASE SWITCH QTY-1 P/N MS 27717-27	<p>MODE: LOSS OF BOTH AUTO/MANUAL CAPT/REL FUNCTION.</p> <p>CAUSE(S):                      (1) SWITCH FAILS IN OFF POSITION.                      (2) SWITCH FAILS IN CAPTURE POSITION.                      (3) SWITCH FAILS IN RELEASE POSITION.</p>	<p>CAUSE (1) LOSS OF ABILITY TO CAPTURE AND RELEASE PAYLOAD.</p> <p>CAUSE (2) WHEN MAN OR AUTO SELECTED CAPTURE SEQ. WILL OCCUR. RELEASE WILL BE INOPERATIVE. WHEN IN MANUAL MOTOR WILL STALL WHEN CLOSED CONDITION IS REACHED. ARM WILL REMAIN LIMP UNTIL EE MODE SW SET TO OFF</p> <p>CAUSE (3) WHEN MAN OR AUTO SELECTED, RELEASE SEQ. WILL PROCEED. IF PAYLOAD CAPT. THEN IT WILL BE RELEASED. IN MANUAL MOTOR WILL STALL.</p> <p>WORST CASE                      UNCOMMANDED RELEASE. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>N/A</p>		<p>QA/INSPECTIONS</p> <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-OTP-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 87027.51. PRIOR TO ANY SWITCH CYCLING OR VIBRATION, SWITCH MECHANISM SUB ASSEMBLIES WERE GIVEN A FUNCTIONAL PERFORMANCE TEST ON THE SSMC 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 NHB 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: HFMG

SUPERSEDING DATE: 09 DEC 86

APPROVED BY:

DATE:

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C CONTROLS SUBSYSTEM  
 ASS'Y P/N: 51155E117 SHEET: \_\_\_\_\_

P/N REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOW / FORC. 1/1 CRITICALITY RATIONALE FOR ACCEPTANCE
1540	3	CAPTURE/RELEASE SWITCH QTY-1 P/N MS 27717-27	MODE: LOSS OF BOTH AUTO/MANUAL CAPT/REL FUNCTION.  CAUSE(S): (1) SWITCH FAILS IN OFF POSITION.  (2) SWITCH FAILS IN CAPTURE POSITION.  (3) SWITCH FAILS IN RELEASE POSITION.	CAUSE (1) LOSS OF ABILITY TO CAPTURE AND RELEASE PAYLOAD.  CAUSE (2) WHEN MAN OR AUTO SELECTED CAPTURE SEQ. WILL OCCUR. RELEASE WILL BE INOPERATIVE. WHEN IN MANUAL MOTOR WILL STALL WHEN CLOSED CONDITION IS REACHED. ARM WILL REMAIN LIMP UNTIL EE EE MODE SW. SET TO OFF  CAUSE (3) WHEN MAN OR AUTO SELECTED, RELEASE SEQ. WILL PROCEED. IF PAYLOAD CAPT. THEN IT WILL BE RELEASED. IN MANUAL, MOTOR WILL STALL.  WORST CASE UNCOMMANDED RELEASE. UNANNUNCIATED. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING ----- N/A	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)

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C CONTROLS SUBSYSTEM  
 ASS'Y P/N: 5135E117

SHEET: 5

FMEA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
1540	3-	CAPTURE/RELEASE SWITCH QTY-1 P/N MS 27717-27	<p>MODE: LOSS OF BOTH AUTO/MANUAL; CAPT/REL FUNCTION.</p> <p>CAUSE(S):                      (1) SWITCH FAILS IN OFF POSITION.                      (2) SWITCH FAILS IN CAPTURE POSITION.                      (3) SWITCH FAILS IN RELEASE POSITION.</p>	<p>CAUSE (1)                      LOSS OF ABILITY TO CAPTURE AND RELEASE PAYLOAD.</p> <p>CAUSE (2)                      WHEN MAN OR AUTO SELECTED CAPTURE SEQ. WILL OCCUR. RELEASE WILL BE INOPERATIVE. WHEN IN MANUAL MOTOR WILL STALL WHEN CLOSED CONDITION IS REACHED. ARM WILL REMAIN LIMP UNTIL EE EE-NODE SU.SET TO OFF</p> <p>CAUSE (3)                      WHEN MAN OR AUTO SELECTED, RELEASE SEQ. WILL PROCEED. IF PAYLOAD CAPT. THEN IT WILL BE RELEASED. IN MANUAL, MOTOR WILL STALL.</p> <p>WORST CASE                      UNCOMMANDED RELEASE. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING                      N/A</p>	<p>FAILURE HISTORY</p>	<p>THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.</p>

PREPARED BY: MEMG

SUPERSEDING DATE: 09 DEC 81

APPROVED BY:

DATE:

**CRITICAL ITEMS LIST**

PROJECT: SMS  
 ASS'Y NOMENCLATURE: ROTATIONAL HAND CONTROLLER

SYSTEM: D&C CONTROLS SUBSYSTEM  
 ASS'Y P/N: STISSETT

SHEET: 6

AREA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
1540	4	CAPTURE/RELEASE SWITCH QTY-1 P/N MS 27717-27	<p>MODE: LOSS OF BOTH AUTO/MANUAL CAPT/REL FUNCTION.</p> <p>CAUSE(S):                      (1) SWITCH FAILS IN OFF POSITION.                      (2) SWITCH FAILS IN CAPTURE POSITION.                      (3) SWITCH FAILS IN RELEASE POSITION.</p>	<p>CAUSE (1)                      LOSS OF ABILITY TO CAPTURE AND RELEASE PAYLOAD.</p> <p>CAUSE (2)                      WHEN MAN ON AUTO SELECTED CAPTURE SEQ. WILL OCCUR. RELEASE WILL BE INOPERATIVE. WHEN IN MANUAL MOTOR WILL STALL WHEN CLOSED CONDITION IS REACHED. ARM WILL REMAIN LIMP UNTIL EE MODE SW SET TO OFF</p> <p>CAUSE (3)                      WHEN MAN ON AUTO SELECTED, RELEASE SEQ. WILL PROCEED. IF PAYLOAD CAPT. THEN IT WILL BE RELEASED. IN MANUAL MOTOR WILL STALL.</p> <p>WORST CASE                      UNCOMMANDED RELEASE. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING                      N/A</p>		<p>OPERATIONAL EFFECTS                      -----                      LOSS OF PRIMARY CAPTURE/RELEASE CAPABILITY. WITH MANUAL OR AUTO SELECTED AND PAYLOAD CAPTURED, PAYLOAD WILL BE RELEASED, UNANNUNCIATED.                      OR                      WHEN MANUAL SELECTED ARM WILL LIMP UNEXPECTEDLY AND WILL REMAIN LIMP UNTIL EE MODE SW. SET TO OFF. OPERATOR WILL DETECT OFF NOMINAL EE OPERATIONS.</p> <p>CREW ACTION                      -----                      EE MODE SW TO OFF. IF PAYLOAD CAPTURED SELECT BACKUP TO RELEASE PAYLOAD. RMS D&amp;C IFN KIT AVAILABLE.</p> <p>CREW TRAINING                      -----                      CREW WILL BE TRAINED TO DETECT OFF NOMINAL EE OPERATIONS. IF PAYLOAD CAPTURED CREW WILL BE TRAINED TO SELECT EE MODE AFTER PAYLOAD IS STABILIZED AND AT ITS RELEASE POSITION.</p> <p>MISSION CONSTRAINTS                      -----                      NONE.</p> <p>SCREEN FAILURES                      -----                      N/A</p> <p>OMRSD OFFLINE                      -----                      EXERCISE CAPTURE / RELEASE SWITCH                      VERIFY CONTINUITY OF MANUAL CONTACTS.</p> <p>OMRSD ONLINE INSTALLATION                      -----                      WITH EE SWITCH IN MANUAL MODE SELECT CAPTURE / RELEASE                      VERIFY CORRECT VOLTAGES AT LONGERON INTERFACE</p> <p>OMRSD ONLINE TURNAROUND                      -----                      WITH EE SWITCH IN MANUAL MODE                      VERIFY CAPTURE/RELEASE FUNCTION</p>

PREPARED BY: RFMG

SUPERSEDING DATE: 06 OCT 87

APPROVED

RMS/D&C - 400

DATE: \_\_\_\_\_