

Fort Hays State University

FHSU Scholars Repository

Apollo One Investigation Materials

Cosmosphere Collection

1-1-1968

Entry Monitor System (EMS) - Malfunction Symptoms 1 - 15

National Aeronautics and Space Administration (NASA)

Follow this and additional works at: <https://scholars.fhsu.edu/apollo>

Recommended Citation

National Aeronautics and Space Administration (NASA), "Entry Monitor System (EMS) - Malfunction Symptoms 1 - 15" (1968). *Apollo One Investigation Materials*. 13.

<https://scholars.fhsu.edu/apollo/13>

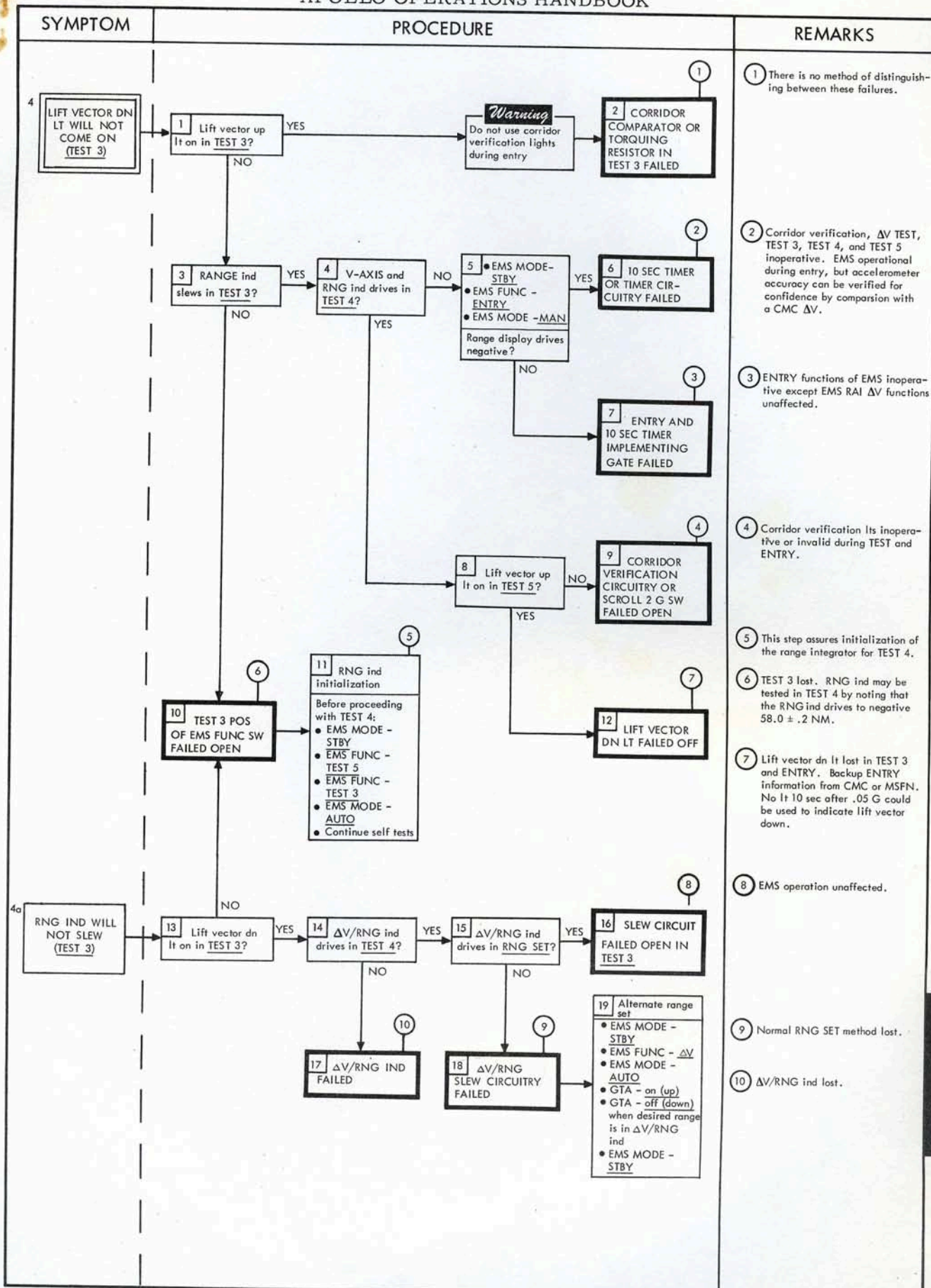
This Document is brought to you for free and open access by the Cosmosphere Collection at FHSU Scholars Repository. It has been accepted for inclusion in Apollo One Investigation Materials by an authorized administrator of FHSU Scholars Repository.

SM2A-03-SCI04-(2)
 APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>1 .05G LT ON (TEST 1)</p>		<p>1 The EMS MODE sw assumed to be in STBY for at least 5 sec before self-test started.</p> <p>2 EMS lost except EMS RAI.</p> <p>3 All self test capability lost. For entry, G-Drive, and corridor verification will be erroneous. ΔV/RNG ind, V AXIS and EMS RAI unaffected.</p> <p>4 AUTO position functions of EMS MODE sw lost for entry only.</p> <p>5 Corridor verification inoperative with EMS MODE sw - MAN.</p> <p>6 EMS FUNC - TEST 1 - lost only.</p> <p>7 Loss of threshold cue only (.05 G Lt). RNG ind operation is indication of .05 G.</p>
<p>2 G/V SCROLL ASSY DOES NOT SLEW (TEST 1)</p>		<p>1 EMS FUNC - TEST 1 capability lost only.</p> <p>2 RNG SET capability lost. SCS ΔV possible only if ΔV display is driven positive by placing the GTA sw - on (up), then - off (down) at the desired value. G&N or ΔV maneuver with the SPS THRUST - DIR ON can be monitored by the change in the ΔV display (down to -9999 fps). V_o can be set by using EMS FUNC - TEST 4 (repeatedly if necessary), stopping the V drive at the desired value by EMS FUNC - TEST 5. No backup capability available.</p> <p>3 EMS lost for ENTRY except THRESHOLD, CORRIDOR, and EMS RAI. ΔV functions unaffected.</p>
<p>3 .05 G LT OUT (TEST 2)</p>		<p>1 ENTRY functions of EMS inoperative except EMS RAI. ΔV functions unaffected.</p> <p>2 EMS FUNC - TEST 2 inoperative.</p> <p>3 EMS operation unaffected. RNG ind operation is indication of .05 G.</p>

EMS
 MALFUNCTION

SM2A-03-SC104-(2)
 APOLLO OPERATIONS HANDBOOK



EMS MALFUNCTION

SM2A-03-SC104-(2)
 APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>5 V-AXIS ONLY OR MULTIPLE DISPLAYS ABNORMAL (TEST 4)</p>	<pre> graph TD S5[V-AXIS ONLY OR MULTIPLE DISPLAYS ABNORMAL (TEST 4)] --> Q1{1 V-AXIS fails to drive?} Q1 -- YES --> Q2{2 Other displays fail to drive also?} Q1 -- NO --> Q9{9 Other displays also out of tolerance in TEST 4?} Q2 -- ALL --> B3[3 TEST 4 POS OF EMS FUNC SW FAILED OPEN] Q2 -- V-AXIS AND RNG --> Q4{4 Perform ΔV TEST} Q4 -- ΔV TEST normal? --> Q5{5 EMS MODE - STBY, EMS FUNC - ENTRY, EMS MODE - MAN, Range ind drives?} Q4 -- NO --> B7[7 10 SEC TIMER OUTPUT (I2) FAILED] Q5 -- YES --> B6[6 TEST 4 CIRCUITRY OPEN FROM 10 SEC TIMER] Q5 -- NO --> B8[8 PULSE SCALER AND RNG DISPLAY LOGIC CKT FAILED] Q9 -- ALL --> B14[14 TORQUING RESISTOR IN TEST 4 FAILED] Q9 -- V-AXIS AND RNG ONLY --> Q10{10 Range error > 2.2 NM?} Q9 -- V-AXIS ONLY --> Q15{15 Perform ΔV TEST} Q10 -- YES --> B11[11 10 SECOND TIMER OUT-OF-TOLERANCE] Q10 -- NO --> Q12{12 Perform ΔV TEST} Q12 -- ΔV TEST normal? --> B13[13 PULSE SCALER OUT-OF-TOLERANCE] Q12 -- NO --> B17[17 ACCEL DIGITAL OUTPUT OUT-OF-TOLERANCE] Q15 -- ΔV TEST normal? --> B16[16 VELOCITY DRIVE MOTOR CONTROLLER INTERMITTENT OR PULSE SCALER OUT-OF-TOLERANCE] Q15 -- NO --> B17 </pre>	<p>① EMS FUNC - TEST 4 capability lost. EMS operational but accelerometer accuracy can be verified only by performing a ΔV TEST.</p> <p>② TEST 4 and ΔV TEST only lost.</p> <p>③ V-axis and range display lost.</p> <p>④ This failure will invalidate the ΔV TEST and TEST 4, except the G-axis display. EMS should be operational but corridor verification erroneous during entry.</p> <p>⑤ V AXIS and RNG information erroneous only.</p> <p>⑥ EMS FUNC - TEST 4 lost but EMS operation during entry should be normal.</p> <p>⑦ V AXIS, ΔV and RNG information erroneous. Other EMS information unaffected. MSFN may be able to supply a correction factor for this error.</p> <p>⑧ There is no method of distinguishing between these two failures. Scroll velocity information will be erroneous. Range readout of uncertain validity.</p>
<p>6 RNG IND ONLY ABNORMAL (TEST 4)</p>	<pre> graph TD S6[RNG IND ONLY ABNORMAL (TEST 4)] --> Q1{1 Fails to drive?} Q1 -- YES --> Q2{2 Out-of-tol ck} Q1 -- NO --> Q3{3 Perform ΔV TEST} Q2 --> B5[5 ΔV/RNG DISPLAY FAILED] Q3 -- ΔV TEST normal? --> Q4{4 EMS MODE - STBY, EMS FUNC - TEST 5, Slow V AXIS to next test pattern, EMS FUNC - TEST 3, Slow range to 58.0, EMS MODE - AUTO, EMS FUNC - TEST 4, RNG ind drives normally} Q3 -- NO --> B6[6 RANGE INTEGRATOR FAILED] Q4 -- YES --> B4[4 INTEGRATOR RESET LOGIC OPEN IN TEST 3] Q4 -- NO --> B6 </pre>	<p>① This check constrained by test pattern availability.</p> <p>② EMS ENTRY and ΔV functions unaffected.</p> <p>③ RNG and ΔV displays lost.</p> <p>④ RNG display lost.</p>
<p>7 G-AXIS ONLY ABNORMAL (TEST 4)</p>	<pre> graph TD S7[G-AXIS ONLY ABNORMAL (TEST 4)] --> Q1{1 Fails to drive?} Q1 -- YES --> Q2{2 G-AXIS drives in TEST 5?} Q1 -- NO --> B4[4 G-AXIS CIRCUITRY OUT-OF-TOLERANCE] Q2 -- YES --> B3[3 G-AXIS SELF TEST FAILED TEST 4 ONLY] Q2 -- NO --> B5[5 G-AXIS DRIVE FAILED] </pre>	<p>① Scroll G display erroneous.</p> <p>② Scroll G display lost. Backup G information from CMC or G METER.</p>

EMS MALFUNCTION

SM2A-03-SC104-(2)
 APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>8</p> <p>LIFT VECTOR UP LT NOT ON (TEST 5)</p>	<p>1 Lift vector dn Lt on in TEST 5?</p> <p>2 G-AXIS drive normal in TEST 5?</p> <p>3 LIFT VECTOR UP LT FAILED OFF</p> <p>4 CORRIDOR COMPARATOR CIRCUIT FAILED</p> <p>5 Lift vector up Lt on in TEST 5?</p> <p>6 EMS MODE - STBY EMS FUNC - RNG SET Slew display off zero EMS FUNC - TEST 5 RNG ind resets to zero?</p> <p>7 TEST 5 POS OF FUNC SW FAILED OPEN</p> <p>8 G-AXIS drives to zero in RNG SET?</p> <p>9 SCROLL G-AXIS FAILED (MECHANICAL)</p> <p>10 SCROLL G-AXIS CIRCUITRY OPEN TEST 5</p>	<p>1 Lift vector up Lt lost in TEST 5 and ENTRY. Backup entry angle information from CMC or MSFN. No Lt 10 sec after .05 G could be used to indicate lift vector up.</p> <p>2 Corridor verification lost during TEST 5 and ENTRY. Backup entry angle information from MSFN or CMC.</p> <p>3 EMS FUNC - TEST 5 lost only.</p> <p>4 Scroll G display inoperative.</p>
<p>9</p> <p>RNG IND DOES NOT SLEW IN RNG SET</p>	<p>1 G-AXIS zero's in RNG SET?</p> <p>2 SLEW LOGIC IN RNG SET FAILED OPEN</p> <p>3 RNG SET POS OF FUNC SW FAILED OPEN</p> <p>4 Alternate RNG SET EMS MODE - STBY EMS FUNC - ΔV SET Slew desired range EMS FUNC (CW) - Vo SET EMS MODE - AUTO Continue EMS checkout</p> <p>5 RNG ind slews in RNG SET?</p> <p>6 G-AXIS zero's in ENTRY?</p> <p>7 MECHANICAL G-AXIS OFF-SET ERROR</p> <p>8 G-AXIS CIRCUITRY OPEN IN RNG SET</p>	<p>1 EMS operation unaffected. Use alternate RNG SET method.</p> <p>2 ENTRY operation unaffected.</p> <p>3 This failure produces an error only in the initial phase of the G trace.</p>
<p>10</p> <p>V-AXIS DOES NOT SLEW IN Vo SET</p>	<p>1 Vo SET POS OF FUNC SW FAILED OPEN</p> <p>2 Alternate slew - V-AXIS EMS FUNC (CW) - TEST 5 Slew desired Vo EMS FUNC (CCW) - ENTRY</p>	<p>1 Range display erroneous during ENTRY. Other ENTRY functions unaffected after Vo slewed by alternate methods.</p>

EMS
 MALFUNCTION

NR has
two boards
with same #

SM2A-03-SC104-(2)
APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>11 ΔV/RNG IND ABNORMAL IN ΔV TEST</p>		<p>1 ENTRY TEST patterns constrain option of ENTRY self test.</p> <p>2 ΔV TEST only lost.</p> <p>3 ΔV/RNG ind lost for ΔV maneuver and ENTRY.</p> <p>4 EMS RAI, V-AXIS and RNG displays unaffected during ENTRY, ΔV, G-AXIS and corridor verification lost.</p> <p>5 All ΔV, EMS velocity and RNG information erroneous. EMS should be operational, but corridor verification erroneous during ENTRY.</p> <p>6 EMS RAI unaffected. All other EMS functions lost.</p>
<p>12 SPS THRUST LT NOT ON IN ΔV TEST</p>		<p>1 THRUST ON signal lost in ΔV TEST only.</p>
<p>13 ΔV IND DOES NOT SLEW IN ΔV SET</p>		<p>1 Alternate ΔV SET necessary for SCS ΔV's. For CMC or MANUAL ΔV's (DIRECT THRUST sw), monitor the negatively driven ΔV ind for velocity change information.</p> <p>2 ΔV/RNG ind lost.</p> <p>3 Slew lost for ΔV SET only.</p>
<p>14 ΔV/RNG IND FAILS TO COUNT DURING ΔV'S</p>		<p>1 Thrust cutoff discrete and ΔV functions of ΔV/RNG ind lost. Performing a post-burn ΔV TEST and/or ENTRY test will aid in failure identification.</p>
<p>15 EITHER LIFT VECTOR LT ON AFTER 2 G</p>		<p>1 EMS functions unaffected.</p>

EMS
MALFUNCTION

FORM 2997-E New 11-67