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Entry Monitor System (EMS) - Proposed spacecraft operational procedures changes - Malfunction Symptoms

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SPACE DIVISION OF NORTH AMERICAN ROCKWELL CORPORATION
 To Committee 31 Jan 69
 PROPOSED SPACECRAFT OPERATIONAL PROCEDURES CHANGE

J. Swigert

EMS

CHANGE NO. = CSM 1339	REFERENCE (IF APPLICABLE)	DATE 1-21-69
INITIATED BY John L. Swigert Jr.	DEPT & GROUP NASA- CB	SC EFFECTIVITY 104 & Subs
		SUSPENSE DATE

CSM AOH VOLUME 2

SC 104	BASIC OR CHANGE DATE 20 June 1968	PAGE NO. 5-97	TIME, PARA, OR STEP NO.
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DETAIL CHANGE (Use exact handbook wording):

Replace EMS malfunction procedure with revised diagrams, copies attached

NOTE: This change has not been incorporated by NR in the 20 January 1969 issue of SM2A-03-SC104-(2).

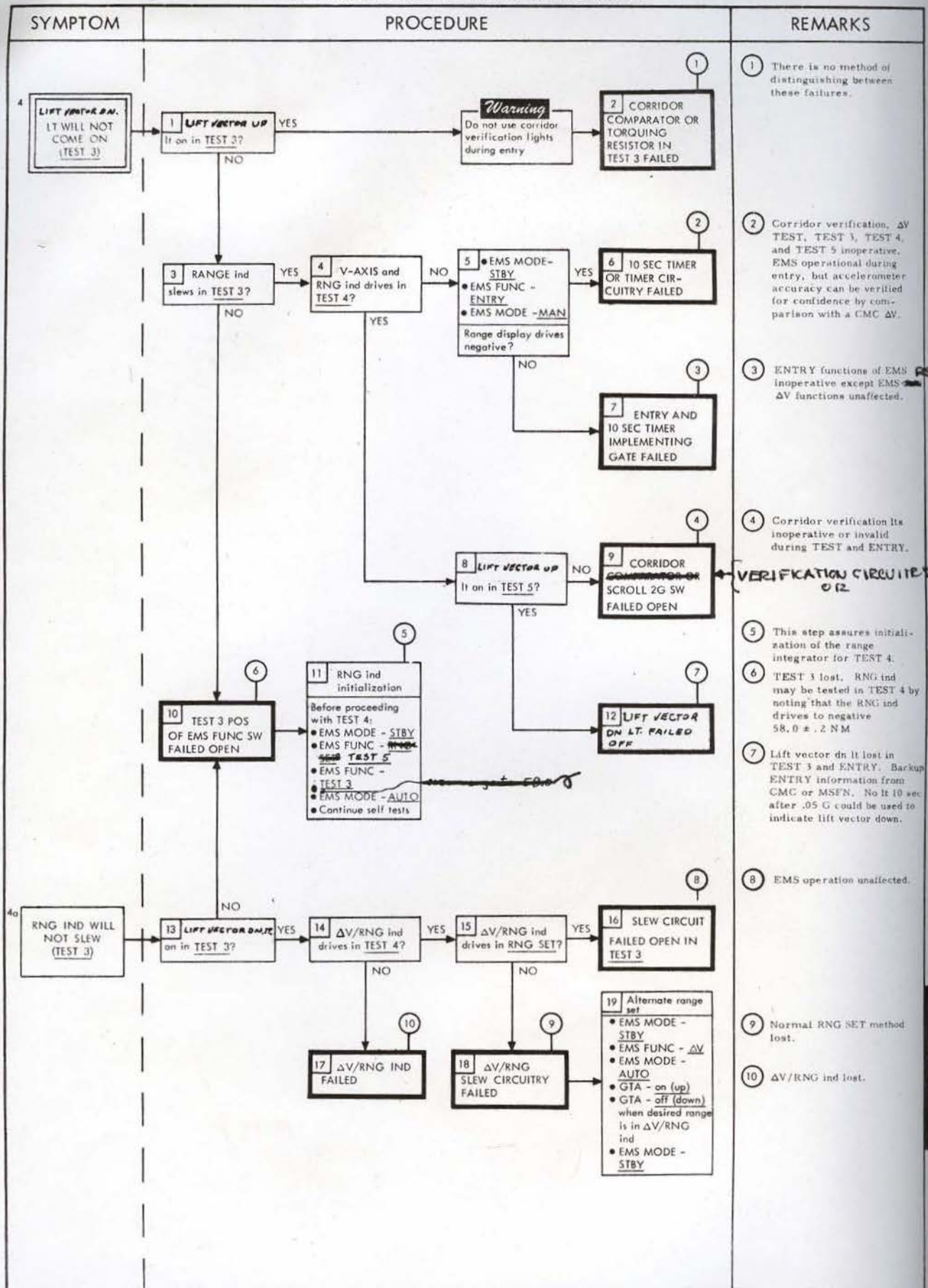
REASON:
 New diagrams incorporate changes generated during final update review for SC 104.

DISPOSITION

<input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED	NR (SIGNATURE AND TITLE) J. R. Potts FP & P	DATE 1-27-69
<input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED	NASA (SIGNATURE AND TITLE) Baker	DATE 2-4-69

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>OK</p> <p>1 .05G LT ON (TEST 1)</p>	<p><i>ward used to be deleted</i></p> <p>1 LIFT VECTOR UP It - on in TEST 3?</p> <p>2 Displays out of tolerance in TEST 4 and ΔV TEST?</p> <p>3 NULL BINS CHECK FAILED?</p> <p>4 EMS ACCELEROMETER FAILED</p> <p>5 ACCEL LOW RANGE OUTPUT FAILED</p> <p>6 Compare EMS during CMC ΔV EMS agrees?</p> <p>7 TORQUE PWR SUPPLY FAILED</p> <p>8 EMS MODE - STBY EMS FUNC - ENTRY EMS MODE - AUTO .05 G It on?</p> <p>9 RNG display drives in ENTRY?</p> <p>10 THRESHOLD COMPARATOR FAILED</p> <p>11 EMS MODE - MAN at .05 G indication from MSFN or G&N</p> <p>12 TORQUING RESISTOR IN TEST 1 FAILED</p> <p>13 .05 G LT FAILED ON</p>	<p>1 The EMS MODE sw assumed to be in STBY for at least 5 sec before self-test started.</p> <p>2 All self test capability lost. For entry, G-Drive, and corridor verification will be erroneous. ΔV/RNG ind, V AXIS and EMS MAN RSI unaffected.</p> <p>3 AUTO position functions of EMS MODE sw lost. <i>for entry only</i></p> <p>4 EMS lost except EMS MAN RSI</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>OK</p> <p>2 G/V SCROLL ASSY DOES NOT SLEW (TEST 1)</p>	<p>1 RNG display drives in TEST 3?</p> <p>2 V AXIS drives normally in TEST 4?</p> <p>3 TEST 1 POS OF EMS FUNC SW FAILED OPEN</p> <p>4 Slew scroll for TEST 4 Alternate method: • EMS MODE - STBY • EMS FUNC - TEST 5 • Slew scroll to start of test pattern • EMS FUNC - TEST 1 • EMS MODE - AUTO • Resume EMS self test</p> <p>5 SLEW SW FAILED</p> <p>6 V-AXIS DRIVE FAILED</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 GFA 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). Vo 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 ΔV functions unaffected. RSI</p>
<p>3 .05 G LT OUT (TEST 2)</p>	<p>1 .05 G It on in other positions?</p> <p>2 EMS MODE - STBY EMS FUNC - ENTRY EMS MODE - MAN Range display drives?</p> <p>3 MAN ENTRY IMPLEMENTING GATE FAILED</p> <p>4 TEST 2 POS OF FUNC SW FAILED OPEN</p> <p>5 .05 G LT FAILED</p>	<p>1 EMS FUNC - TEST 4 inoperative.</p> <p>2 ENTRY functions of EMS inoperative except EMS ΔV functions unaffected. RSI</p> <p>3 EMS operation unaffected. RNG ind operation is indication of .05 G.</p>



1-27-69

APOLLO OPERATIONS HANDBOOK

SYMPTOM	PROCEDURE	REMARKS
<p>8 LIFT VECTOR UP LT NOT ON (TEST 5)</p> <p>8a G-AXIS DOES NOT DRIVE (TEST 5)</p>		<p>1 Lift vector up Lt lost in TEST 5 and ENTRY. Backup entry angle information from GMC 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 GMC.</p> <p>3 EMS FUNC - TEST 5 lost only.</p> <p>4 Scroll G display inoperative.</p>
<p>9 RNG IND DOES NOT SLEW IN RNG SET</p> <p>9a G-AXIS DOES NOT ZERO 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 V-AXIS DOES NOT SLEW IN Vo SET</p>		<p>1 Range display erroneous during ENTRY. Other ENTRY functions unaffected after Vo slewed by alternate methods.</p>

SYMPTOM	PROCEDURE	REMARKS
<p>8 LIFT VECTOR UP LT NOT ON (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 RNG IND DOES NOT SLEW 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 V-AXIS DOES NOT SLEW IN Vo SET</p>		<p>① Range display erroneous during ENTRY. Other ENTRY functions unaffected after Vo slewed by alternate methods.</p>

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SYMPTOM	PROCEDURE	REMARKS
<p>11 ΔV/RNG IND ABNORMAL IN ΔV TEST</p>	<p><i>CSM # 1356 well reviewed contents of boxes 5 and 6 and associated notes</i></p>	<p>1 ENTRY TEST patterns constrain option of ENTRY self test.</p> <p>2 ΔV/RNG ind lost for ΔV maneuver and ENTRY.</p> <p>3 ΔV TEST only lost.</p> <p>4 EMS STBY, 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 STBY unaffected. All 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 AFTER SPS FIRING DURING QV'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 LIFT VECTOR EITHER EMR RALLT ON AFTER 2G</p>		<p>1 EMS functions unaffected.</p>

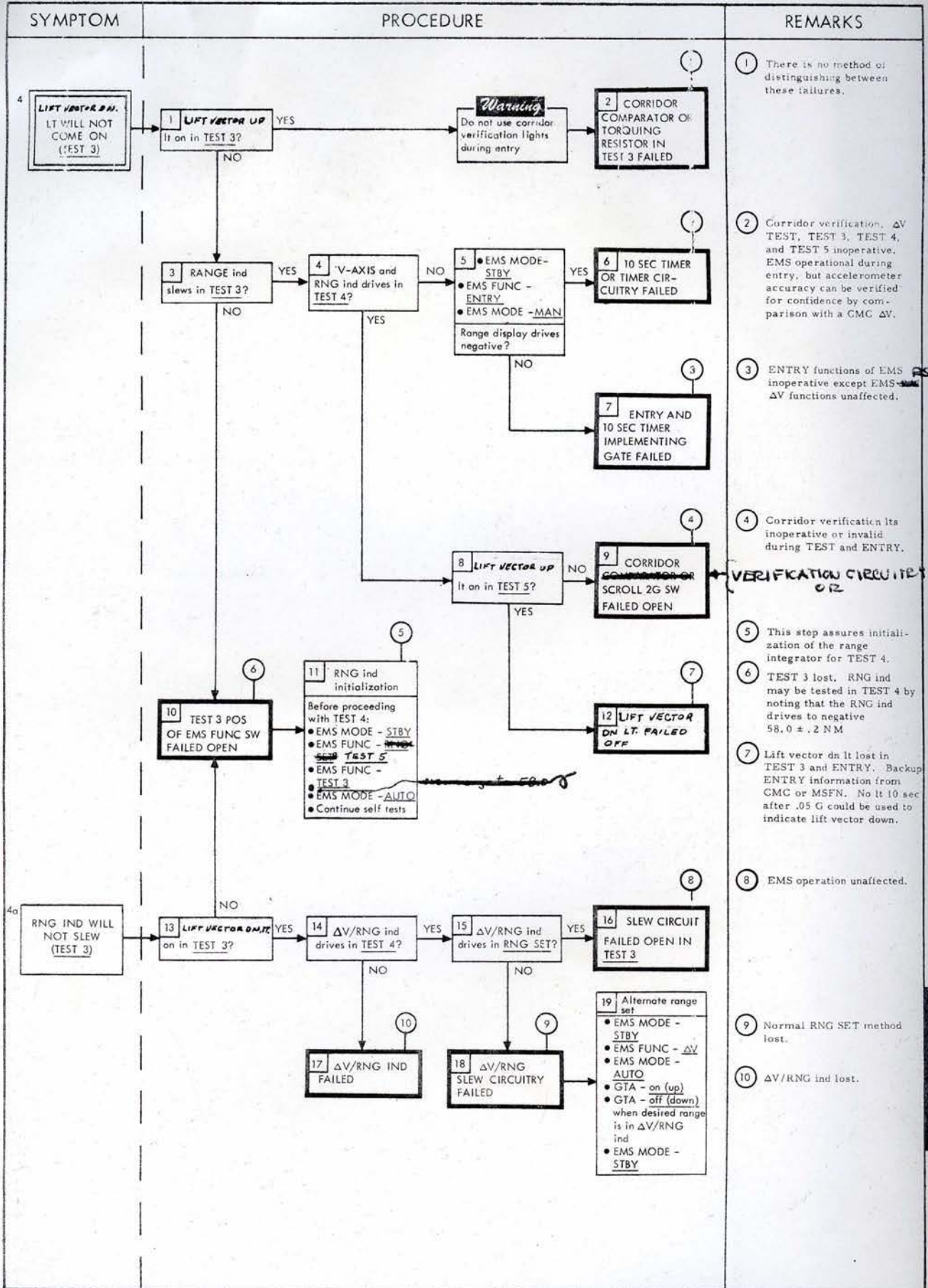
at Paris
 as submitted to NASA

SYMPTOM	PROCEDURE	REMARKS
<p>OK</p> <p>1 .05G LT ON (TEST 1)</p>	<pre> graph TD S1[1 .05G LT ON (TEST 1)] --> P1{1 LIFT VECTOR UP It - on in Test 3?} P1 -- NO --> P8[8 • EMS MODE - STBY • EMS FUNC - ENTRY • EMS MODE - AUTO .05 G It on?] P1 -- YES --> P2{2 Displays out of tolerance in TEST 4 and ΔV TEST?} P2 -- NO --> P5[5 ACCEL LOW RANGE OUTPUT FAILED] P2 -- YES --> P3{3 Accelerometer NULL BIAS CHECK FAILED?} P3 -- NO --> P6[6 Compare EMS during CMC ΔV EMS agrees?] P3 -- YES --> P4[4 EMS ACCELEROMETER FAILED] P6 -- NO --> P8 P6 -- YES --> P7[7 TORQUE PWR SUPPLY FAILED] P8 -- NO --> P12[12 TORQUING RESISTOR IN TEST 1 FAILED] P8 -- YES --> P9{9 RNG display drives in ENTRY?} P9 -- NO --> P13[13 .05 G LT FAILED ON] P9 -- YES --> P10[10 THRESHOLD COMPARATOR FAILED] P10 --> P11[11 • EMS MODE - MAN at .05 G indication from MSFN or G&N] P11 --> P4 P11 --> P5 P11 --> P7 P11 --> P12 P11 --> P13 </pre>	<p>1 The EMS MODE sw assumed to be in STBY for at least 5 sec before self-test started.</p> <p>2 All self test capability lost. For entry, G-Drive, and corridor verification will be erroneous. ΔV/RNG ind. V AXIS and EMS MAN RST unaffected.</p> <p>3 AUTO position functions of EMS MODE sw lost. for entry only</p> <p>4 EMS lost except EMS MAN RST</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>OK</p> <p>2 G/V SCROLL ASSY DOES NOT SLEW (TEST 1)</p>	<pre> graph TD S2[2 G/V SCROLL ASSY DOES NOT SLEW (TEST 1)] --> P1{1 RNG display drives in TEST 3?} P1 -- NO --> P5[5 SLEW SW FAILED] P1 -- YES --> P2{2 V AXIS drives normally in TEST 4?} P2 -- NO --> P6[6 V-AXIS DRIVE FAILED] P2 -- YES --> P3[3 TEST 1 POS OF EMS FUNC SW FAILED OPEN] P3 --> P4[4 Slew scroll for TEST 4 Alternate method: • EMS MODE - STBY • EMS FUNC - TEST 5 • Slew scroll to start of test pattern • EMS FUNC - TEST 1 • EMS MODE - AUTO • Resume EMS self test] </pre>	<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 ipse. Vc 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 MAN ΔV functions unaffected.</p>
<p>3 .05 G LT OUT (TEST 2)</p>	<pre> graph TD S3[3 .05 G LT OUT (TEST 2)] --> P1{1 .05 G It on in other positions?} P1 -- NO --> P2[2 • EMS MODE - STBY • EMS FUNC - ENTRY • EMS MODE - MAN Range display drives?] P1 -- YES --> P4[4 TEST 2 POS OF FUNC SW FAILED OPEN] P2 -- NO --> P3[3 MAN ENTRY IMPLEMENTING GATE FAILED] P2 -- YES --> P5[5 .05 G LT FAILED] </pre>	<p>1 EMS FUNC - TEST 2 inoperative.</p> <p>2 ENTRY functions of EMS inoperative except EMS ΔV functions unaffected.</p> <p>3 EMS operation unaffected. RNG ind operation is indication of .05 G.</p>

1-27-69

Coordinated with J. Swigert & H. Markarian

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



FORM 2997-E New 11-67

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EMS MALFUNCTION

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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 -- NO --> Q2{2 Other displays fail to drive also?} Q1 -- YES --> Q2 Q2 -- ALL --> B3[3 TEST 4 POS OF EMS FUNC SW FAILED OPEN] Q2 -- V-AXIS AND RNG --> Q4{4 Perform ΔV TEST ΔV TEST normal?} Q4 -- YES --> B5[5 EMS MODE - STBY EMS FUNC - ENTRY EMS MODE - MAN Range ind drives?] Q4 -- NO --> B7[7 10 SEC TIMER OUTPUT (T2) FAILED] B5 -- YES --> B6[6 TEST 4 CIRCUITRY OPEN FROM 10 SEC TIMER] B5 -- NO --> B8[8 PULSE SCALER AND RNG DISPLAY LOGIC CKT FAILED] Q2 -- V-AXIS ONLY --> Q9{9 Other displays also out of tolerance in TEST 4?} 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 ΔV TEST normal?} Q10 -- YES --> B11[11 10 SECOND TIMER OUT-OF-TOLERANCE] Q10 -- NO --> Q12{12 Perform ΔV TEST ΔV TEST normal?} Q12 -- YES --> B13[13 PULSE SCALER OUT-OF-TOLERANCE] Q12 -- NO --> B17[17 ACCEL DIGITAL OUTPUT OUT-OF-TOLERANCE] Q15 -- YES --> 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>1ST SENTENCE OF 4 THIS FAILURE WILL INVALIDATE THE ΔV TEST, AND TEST 4 EXCEPT THE G-AXIS DISPLAY.</p> <p>2 TEST 4 and V TEST only lost.</p> <p>3 V-axis and range display lost.</p> <p>4 Range error > 2.2 NM? 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 -- NO --> Q2{2 Out-of-tol ck Perform ΔV TEST ΔV TEST normal?} Q1 -- YES --> B5[5 ΔV/RNG DISPLAY FAILED] Q2 -- YES --> B3[3 RANGE INTEGRATOR INIT CHECK EMS MODE - STBY EMS FUNC - TEST 5 Slow V AXIS in next test pattern RANGE IND - TEST 3 EMS FUNC - TEST 2 Slow range to SR, 0 EMS MODE - AUTO EMS FUNC - TEST 4 RNG ind drives normally] Q2 -- NO --> B5 B3 -- YES --> B4[4 INTEGRATOR TEST LOGIC OPEN IN TEST 3] B3 -- NO --> B6[6 RANGE INTEGRATOR FAILED] </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 -- NO --> B4[4 G-AXIS CIRCUITRY OUT-OF-TOLERANCE] Q1 -- YES --> Q2{2 G-AXIS drives in TEST 5?} 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 GMC or G METER.</p>

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SM-2A-15576

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SYMPTOM	PROCEDURE	REMARKS
<p>8 LIFT VECTOR UP LT NOT ON (TEST 5)</p>	<p>1 Lift vector dn Lt on in TEST 5? NO → 2 G-AXIS drive normal in TEST 5? YES → 3 LIFT VECTOR UP LT FAILED OFF (1) YES → 4 CORRIDOR COMPARATOR CIRCUIT FAILED (2)</p> <p>8a G-AXIS DOES NOT DRIVE (TEST 5)</p> <p>5 Lift vector up Lt on in TEST 5? NO → 6 EMS MODE - STBY, EMS FUNC - RNG SET, Slew display off zero, EMS FUNC - TEST 5, RNG ind resets to zero? NO → 7 TEST 5 POS OF FUNC SW FAILED OPEN (3) YES → 8 G-AXIS drives to zero in RNG SET? NO → 9 SCROLL G-AXIS FAILED (MECHANICAL) (4) YES → 10 SCROLL G-AXIS CIRCUITRY OPEN TEST 5 (3)</p>	<p>(1) Lift vector up Lt lost in TEST 5 and ENTRY. Backup entry angle information from CMG 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 RNG IND DOES NOT SLEW IN RNG SET</p>	<p>1 G-AXIS zero's in RNG SET? YES → 2 SLEW LOGIC IN RNG SET FAILED OPEN (1) NO → 3 RNG SET POS OF FUNC SW FAILED OPEN (2)</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>9a G-AXIS DOES NOT ZERO IN RNG SET</p> <p>5 RNG ind slews in RNG SET? YES → 6 G-AXIS zero's in ENTRY? YES → 8 G-AXIS CIRCUITRY OPEN IN RNG SET (2) NO → 7 MECHANICAL G-AXIS OFF-SET ERROR (3)</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 V-AXIS DOES NOT SLEW IN Vo SET</p>	<p>1 Vo SET POS OF FUNC SW FAILED OPEN (1) → 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>

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SYMPTOM	PROCEDURE	REMARKS
<p>11</p> <p>ΔV/RNG IND ABNORMAL IN ΔV TEST</p>	<p>1 Problem? <i>FAILS TO DRIVE OUT OF TOLERANCE</i></p> <p>2 ENTRY self test • EMS MODE - STBY • EMS FUNC - TEST 1 • EMS MODE - AUTO • Perform ENTRY self test <i>ΔV/RNG ind drives drives negative in TEST 4?</i></p> <p>3 ΔV TEST POSITION OF FUNC SW FAILED OPEN</p> <p>4 ENTRY self test • EMS MODE - STBY • EMS FUNC - TEST 1 • EMS MODE - AUTO • Perform ENTRY self test V-AXIS and RNG within tolerance in TEST 4?</p> <p>5 ΔV/RNG DISPLAY FAILED</p> <p>6 TORQUING RESISTOR FAILED IN ΔV TEST</p> <p>7 RANGE error > 2.2 NM? YES: 10 10 SEC TIMER OUT OF TOLERANCE NO: 8 Monitor CMC ΔV EMS agrees? YES: 9 ACCELEROMETER TORQUER PWR SUPPLY FAILED NO: 11 ACCELEROMETER FAILED</p>	<p>1 ENTRY TEST patterns constrain option of ENTRY self test.</p> <p>2 ΔV/RNG ind lost for ΔV maneuver and ENTRY.</p> <p>3 ΔV TEST only lost.</p> <p>4 EMS un 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 un unaffected. All other EMS functions lost.</p>
<p>12</p> <p>SPS THRUST LT NOT ON IN ΔV TEST</p>	<p>1 SPS THRUST Lt on during SPS firing? YES: 3 SPS THRUST ON CIRCUITRY FAILED IN ΔV TEST NO: 2 SPS THRUST LT FAILED OFF</p>	<p>1 THRUST ON signal lost in ΔV TEST only.</p>
<p>13</p> <p>ΔV IND DOES NOT SLEW IN ΔV SET</p>	<p>1 • EMS FUNC - ΔV TEST • EMS MODE - AUTO ΔV ind drives negative? YES: 2 • EMS MODE - STBY • EMS FUNC - TEST 5 • Attempt scroll slew V-AXIS slews? YES: 5 • EMS FUNC - RNG SET • Attempt range slew RNG ind slews? YES: 8 ΔV POSITION OF FUNC SW FAILED OPEN NO: 6 ΔV/RNG SLEW CIRCUITRY FAILED OPEN NO: 3 SLEW SW FAILED</p> <p>7 Alternate ΔV SET • EMS MODE - STBY • EMS FUNC - ΔV • EMS MODE - AUTO • GTA - on (up) • EMS MODE - STBY When desired ΔV SET in display • GTA - off (down)</p> <p>9 Alternate ΔV SET • EMS MODE - STBY • EMS FUNC - RNG SET • Slew desired ΔV • EMS FUNC (CCW) - ΔV • EMS MODE - AUTO</p> <p>4 ΔV/RNG IND FAILED</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</p> <p>ΔV/RNG IND FAILS TO COUNT AFTER SPS FIRING DURING ΔV's</p>	<p>1 ΔV POS OF FUNC SW FAILED OPEN (MOST PROBABLE FAILURE)</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</p> <p>WIFT VECTOR EITHER EMS HALLT ON AFTER 2G</p>	<p>1 2G SW FAILED</p>	<p>1 EMS functions unaffected.</p>

reverse contents of boxes [3] & [5] on associated notes

EMS MALFUNCTION

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