# IIT/IL PROGRAM CHANGE ROUTING SLIP

PCR/PCN # _____

ANOMALY # L-1B-09

☐ COLOSSUS 2C
☐ COLOSSUS 2D
☐ COLOSSUS 2E
☐ COLOSSUS 2F

☐ LUMINARY 1B
☑ LUMINARY 1C
☐ LUMINARY 1D
☐ LUMINARY 1E

☐ MIT Approved PCN

☐ NASA Approved PCR
☐ NASA Approved PCN

☐ NASA Approved Software Anomaly
☑ MIT Approved Software Anomaly

Bruce McCoy

A. Coding

✓ Begin coding immediately

ACTION: _____

Program Supervisor's Approval: Margaret Hamilton

○ Do not code until new GSOP material has been approved by the MIT Mission Design Review Board (MDRB) and distributed.

B. GSOP Preparation

○ Prepare GSOP revisions for MDRB consideration _____

ACTION: _____

☐ Technical Committee Meeting not required.

☐ Technical Committee Meeting(s) held on _____
Attendees:

C. KSC Testing and Checkout

○ Review for possible impact on KSC testing and checkout

ACTION: _____

D. Other Programs Affected

○ Review for corresponding changes in _____

ACTION: _____

Special Instructions

Project Manager Russell H. Larson

Date 10-31-69

(Rev 10/69)

# MIT/IL SOFTWARE ANOMALY REPORT

| 1.1 ORIGINATOR: | 1.2 ORGANIZATION: | 1.3 DATE: | 1.4 ORIGINATOR CONTROL NO. | MIT REPORT NO. |
|---|---|---|---|---|
| R. COVELLI | MIT/IL | 10/28/69 | | L-1B-09 |
| | | | | PROGRAM: LUMINARY |
| | | | | PROGRAM REVISION: 99, 116 |

1.5 DESCRIPTION OF ANOMALY:

If a restart occurs during a radar read, the following radar read may be incorrect. If this happens in R12, the state vector may be incorrectly updated.

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1.6 DESCRIPTION OF RUN:

Apollo 11 flight. There were two incorrect altitude readings in powered descent after software restarts.

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## -MIT ANALYSIS-

2.1 CAUSE:

See Digital Development Memo #483, "LGC Radar Timing," by Allen Harano, 26 August 1969.

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2.2 RECOGNITION:

Monitor radar data on downlink.

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2.3 MISSION EFFECT:

With the current landing radar weighting functions, an altitude error of up to 4400 ft. could be introduced into the state vector. In the worst possible case,

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2.4 AVOIDANCE PROCEDURE:

None

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2.5 RECOVERY PROCEDURE:

Subsequent radar updates will correct the state vector.

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2.6 PROGRAM CORRECTION:

Inhibit incorporation of landing radar data on the first radar read after a restart.

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2.7 RECOMMENDED DISPOSITION (Fix, Work-around, etc):

Fix in LUMINARY 1C.

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2.8 RECOMMENDED RE-TESTING:

Digital simulation with restarts to verify that the radar data is not incorporated after a restart.

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| 2.9 MIT/IL SIGNATURE: | 2.10 DATE: |
|---|---|
| Ronald H. Larson | 11-3-69 |

| 3.1 NASA DIRECTION: | 4.1 CLOSING ACTION TAKEN: |
|---|---|
| CONTINUED ON PAGE | CONTINUED ON PAGE |

| 3.2 NASA/MSC SIGNATURE: | 3.3 ORGANIZATION | 3.4 DATE: | 4.2 SIGNATURE: | 4.3 ORGANIZATION: | 4.4 DATE: |
|---|---|---|---|---|---|
| | | | | | |

MSC Form 1409 (Rev May 68)

2.3 Mission Effect, cont'd.

the radar might indicate zero altitude. The altitude update, $\Delta R$, is then given by:

$$\Delta R_{max} = W_h \Delta H = W_h (O - H) = -W_h H$$

The present weighting function is

$$W_h = .35 (1 - H/50000)$$

so that

$$\Delta R_{max} = -.35 H (1 - H/50000)$$

The following table gives the value of the update as a function of altitude in the case where the radar gives a zero reading:

| H | $\Delta R_{max}$ |
|---|---|
| 50000 ft. | 0 ft. |
| 40000 | -2800 |
| 30000 | -4200 |
| 25000 | -4375 |
| 15000 | -3675 |
| 10000 | -2800 |
| 5000 | -1675 (would fail reab. test) |
| 1000 | - 333 |

In Apollo 11, the two bad readings gave altitude errors of -1000 ft. and -272 ft., which was much less than the maximum possible error.