

MIT/IL SOFTWARE ANOMALY REPORT

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| MIT REPORT NO. LNy 32 |
| PROGRAM Luminary |
| PROGRAM REVISION 69 |

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| 1.1 ORIGINATOR: Allan Klumpp | 1.2 ORGANIZATION: MIT/IL | 1.3 DATE: 1/23/69 | 1.4 ORIGINATOR CONTROL NO. |
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| 1.5 DESCRIPTION OF ANOMALY: <p style="text-align: center;">SEE PAGE 2</p> <p style="text-align: right;">CONTINUED ON PAGE</p> |
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| 1.6 DESCRIPTION OF RUN: <p style="text-align: center;">N/A</p> <p style="text-align: right;">CONTINUED ON PAGE</p> |
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- MIT ANALYSIS -

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| 2.1 CAUSE: <p style="text-align: center;">SEE PAGE 2</p> <p style="text-align: right;">CONTINUED ON PAGE 2</p> |
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| 2.2 RECOGNITION: <p style="text-align: center;">SEE PAGE 2</p> <p style="text-align: right;">CONTINUED ON PAGE 2</p> |
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| 2.3 MISSION EFFECT: <p style="text-align: center;">SEE PAGE 2</p> <p style="text-align: right;">CONTINUED ON PAGE 2</p> |
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| 2.4 AVOIDANCE PROCEDURE: <p style="text-align: center;">Proper Targeting</p> <p style="text-align: right;">CONTINUED ON PAGE 2</p> |
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| 2.5 RECOVERY PROCEDURE: <p style="text-align: center;">Abort</p> <p style="text-align: right;">CONTINUED ON PAGE 2</p> |
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| 2.6 PROGRAM CORRECTION: <p style="text-align: center;">SEE PAGE 2</p> <p style="text-align: right;">CONTINUED ON PAGE 2</p> |
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| 2.7 RECOMMENDED DISPOSITION (Fix, Work-around, etc) <p style="text-align: center;">Fix per PCN 688</p> <p style="text-align: right;">CONTINUED ON PAGE</p> |
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| 2.8 RECOMMENDED RE-TESTING: <p style="text-align: center;">Nominal landing</p> <p style="text-align: right;">CONTINUED ON PAGE</p> |
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| 2.9 MIT/IL SIGNATURE: <i>George W. Cherry</i> | 2.10 DATE: 1/29/69 |
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| 3.1 NASA DIRECTION: <p style="text-align: right;">CONTINUED ON PAGE</p> |
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| 4.1 CLOSING ACTION TAKEN: <p style="text-align: center; font-size: 1.2em;">Fix in LUMINARY 1A</p> <p style="text-align: right;"><i>George W. Cherry</i></p> <p style="text-align: right;">CONTINUED ON PAGE</p> |
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|-------------------------|-------------------|-----------|----------------|-------------------|-----------|
| 3.2 NASA/NSC SIGNATURE: | 3.3 ORGANIZATION: | 3.4 DATE: | 4.2 SIGNATURE: | 4.3 ORGANIZATION: | 4.4 DATE: |
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con't of 1.5

Cause, recognition, Mission effect

The landing guidance equations are solved in a floating coordinate frame which is presently erected each pass thru the guidance equations. The consequence of erecting the guidance coordinate frame (GCF) backward, (rotated 180 degrees about the vertical) is that the IM turns upside down and crashes. This phenomenon has been observed in several independent simulations. The targeting for the previous one-phase trajectories made it impossible for the GCF to be erected backward. With many of the trajectories presently being considered, the criteria precluding backward erection are no longer met. However, it can be shown that the GCF will always be erected forward provided it is only erected when time-to-go is between certain limits. These limits are a function only of the targeting. With the proposed change, trajectory restrictions are eliminated, and we can permit trajectories which are far closer to the desires of the FCSD than were previously considered possible. Without the proposed change, certain of these trajectories would be precluded.

con't of 2.4

Avoidance Procedure:

This effect is impossible if the z components of the approach phase targets alternate in sign, e.g. in GSOP notation,

| | | |
|-----|------|----------|
| r | IFEG | Negative |
| v | IFEG | Positive |
| a | IFEG | Negative |
| J | IFEG | Positive |

These criteria have been met on all previously considered landing trajectories. If a landing is done with targeting not meeting these criteria, a detailed analysis would have to be made to determine:

- 1) The limits on dispersions at the start of the approach phase, and
- 2) the limits on site redesignation during the approach phase.

con't 2.6

- A. Establish 4 erasable cells in the W matrix along with the descent targeting parameters for the storage of time-to-go limits for the braking and approach phases.
- B. Branch around erection of the GCF whenever time-to-go is outside the limits for current phase.