

J. DUNBAR

MITIL SOFTWARE ANOMALY REPORT

MSC CONTROL NO. L-1B-03
PROGRAM LUMINARY 1B
PROGRAM REVISION Rev 116

1.1 ORIGINATOR: R. GOSS
1.2 ORGANIZATION: MIT/IL
1.3 DATE: 8/27/69
1.4 ORIGINATOR CONTROL NO.

1.5 DESCRIPTION OF ANOMALY:
The quantity COEFFR, computed in the 1/ACCS Program, will be incorrectly determined to be an extremely small (essentially zero) value whenever the quantities 1JACCQ and 1JACCR are equal. In the present program (and previous programs), 1JACCQ and 1JACCR must differ by at least one bit and the anomaly is not observed. Modifications in future programs, however, might result in the occurrence of the anomaly. In particular, if values of LM descent mass...
CONTINUED ON PAGE 2

1.6 DESCRIPTION OF FIX:
The hybrid simulator was used with Luminary 116. The fixed constant HDESCNT was changed to allow higher values of LM descent mass to be used in the computations of 1JACCQ and 1JACCR. A mass was loaded in such that 1JACCQ and 1JACCR were computed to be exactly equal. Under these conditions the anomaly...
CONTINUED ON PAGE 2

-MIT ANALYSIS-

2.1 CAUSE:
In the "COMMEQS" section of 1/ACCS, the expression (1JACCQ-1JACCR)/1JACCR is computed whenever 1JACCR is greater or equal to 1JACCQ.
CONTINUED ON PAGE 2

2.2 RECOGNITION:
The occurrence of the anomaly would result in a buildup of attitude errors and error rates about the Z-axis during each two-second interval in which the...
CONTINUED ON PAGE 2

2.3 EFFECTS:
The anomaly cannot occur for the present program. If it were to occur in a future program, control would be lost about the vehicle Z-axis for every two-second period in which the quantities 1JACCQ and...
CONTINUED ON PAGE 2

2.4 PREVENTION:
For powered descent, the value of initial LM descent mass loaded into the computer should be selected to lie below the regions in which the anomaly can occur.
CONTINUED ON PAGE 2

2.5 RECOVERY PROCEDURES:
If anomaly were to occur in powered ascent, the DAP would automatically begin correcting errors at the end of the two-second interval. In powered...
CONTINUED ON PAGE 2

2.6 RECOMMENDATIONS:
To correct anomaly, a ZL instruction should be added at "COMMEQS" in the 1/ACCS section.
CONTINUED ON PAGE 2

2.7 RECOMMENDED DISPOSITION (Fix, Work-around, etc):
For missions after Apollo 12, fix should be made.
CONTINUED ON PAGE 2

2.8 RECOMMENDED RE-TESTING:
When fix is made, above testing should be repeated.
CONTINUED ON PAGE 2

2.9 MITIL SIGNATURE: [Signature]
2.10 DATE: 9/16/69

3.1 NASA DIRECTOR:
Fix in LUMINARY 1B
CONTINUED ON PAGE 2

4.1 CLOSING ACTION TAKEN:
[Signature]
CONTINUED ON PAGE 2

3.2 APPROVED SIGNATURE: [Signature] 3.3 ORGANIZATION: MIT/IL 3.4 DATE: 9/16/69

MIT/IL SOFTWARE ANOMALY REPORT

| |
|-------------|
| J-113-03 |
| LUMINARY 1B |
| Rev 116 |

| | | | |
|-------------------------|--------------------------|---------------------|----------------------|
| 1.1 COMPUTER R. COSS | 1.2 COST VALUE MIT/IL | 1.3 DATE 8/27/69 | 1.4 CENTER CSC/IL |
|-------------------------|--------------------------|---------------------|----------------------|

1.5 Description of Anomaly, cont'd.

...exceeding 10120 kg were to be allowed in computing 1JACCO and 1JACC, then for various initial values of mass, 1JACCO and 1JACC could be equal. (The fixed constant 10120 kg would have to be increased for this situation to occur.) Also, if the coefficients used to compute 1JACCO and 1JACC as a function of mass were to be modified, the anomaly might occur in either descent or ascent.

1.6 Description of Log, cont'd.

...was observed. Examination of individual computations provided an explanation for the anomaly.

2.1 Cause, cont'd.

The result of this computation should be either a negative number or zero. However, when 1JACCO = 1JACC, a non-zero positive number may result from the division. This results from the fact that 1JACCO and 1JACC are single precision numbers, and the division computation uses both the upper and lower second bytes for the numerator. Since 1 was not zeroed before the computation, a positive number rather than zero can result from the division. This quotient is 1-ix subtracted from NEGMAX leading to an overflow and the subsequent incorrect value for COEFFIL.

2.3 Mission Effect, cont'd.

...1JACC were computed to be equal. If the anomaly were to occur during powered ascent, it would not be expected to exist in more than one two-second period. In descent, however, it could conceivably occur for several two-second periods. Appropriate action could prevent necessity for mission abort.

2.5 Recovery Procedure, cont'd.

...descent, it would be necessary for the astronaut to decrease the value of mass (through R03) to a value which lies below the regions in which the anomaly can occur.