

Massachusetts Institute of Technology
Instrumentation Laboratory
Cambridge, Massachusetts

LUMINARY Memo #73

To: Distribution
From: C. W. Schulenberg
Date: 26 March 1969
Subject: LUMINARY Revisions 80-92

Major Changes Incorporated into Revision 80

- 1) PCR 722 was partially implemented. (Improve performance of RR designate procedure on Lunar Surface) This resulted in the creation of a new flagword bit (FSPASFLG; bit 10 of flagword 0), and a new alarm code (503: LOS not in mode 2 coverage on Lunar Surface after 600 seconds).
- 2) The following constants were changed: GUIDDURN, HIGHESTF, DPSVEX, FMAXODD, FMAXPOS, SCALEFAC, and TRIMACCL. These are the same variables mentioned in PCR 649 which was disapproved because the values quoted in the PCR did not agree with LM data-book values. The values used in this revision, however, do correspond to the data-book.
- 3) Coding was added to the restart logic to reset P21FLAG (part of PCR 719).
- 4) P66 was modified to allow for the total lag in its control loop. The compensation accounts for both computation lag and engine response lag. This required the addition of a new pad-loaded parameter, LAG/TAU, which is the ratio of the total lag to the time constant specified by the already existent padload TAUROD. (PCR 700)

Major Changes Incorporated into Revision 81

- 1) PCR 737 was implemented. (Permit Attitude-Hold in P63, P64, and P65).
- 2) PCR 646 was implemented. (Give astronaut the option to confirm Main-lobe lock-on after R21 acquisition).
- 3) Anomaly LNY 37 was corrected in R24.
- 4) Anomaly LNY 39 was corrected in R21.
- 5) PCR 642 was partially implemented. (Provide "Wings-Level", Heads Up, Fine Z-Axis Tracking).
- 6) The implementation of PCR 722 was completed.
- 7) Assembly Control Board Request #2 was implemented. (Reduce DAP time in interrupt).
- 8) The following subroutines were deleted: SMCDURES, READPIPS, TRANSP1, TRANSP2, and INCRCDUS.
- 9) Two unused flagbits were deleted: Computer flag and CPHIFLAG.
- 10) PCR 716 was implemented. (Ascent Powered Flight RCS Control).
- 11) PCR 718 was implemented. (Light Ascent Control with Jet Failure).

Major Changes Incorporated into Revision 82

- 1) PCR 715 was implemented. (Docked DAP Bending Stability).
- 2) PCR 268.2 was implemented. (Reduction of P34/P35 run time).
- 3) PCR 710 was implemented. (Provide a larger RCS pulse width during minimum impulse control mode when CSM attached).
- 4) The implementation of PCR 642 was completed.

Major Changes Incorporated into Revision 83

- 1) P66 was modified to limit its maximum acceleration command to a pad-loaded value and also to limit its minimum acceleration command to a pad-loaded value. This required the addition of two new pad-loads to the W-matrix: MAXFORCE and MINFORCE.

Major Changes Incorporated into Revision 84

- 1) PCR 723 was implemented. (Two-Segment LR altitude and velocity weighting functions). This PCR required the addition of 5 new pad-loads to the W-matrix: LRVF, LRWVFZ, LRWVFY, LRWVFX, and LRWVFF.
- 2) PCR 267 was implemented. (Time homogenous RR downlink data from P20 and P22).
- 3) PCR 736 was partially implemented. (Add source code to noun 49 in P20/P22).
- 4) PCR 647 was implemented. (Replace Lambert with "A" steer in P40, P41, and P42).
- 5) Assembly Control Board Request #1 was implemented. (Replace CALCSMSC routine with a basic language equivalent).
- 6) As a result of PCR 647 the following two flagbits were deleted: CYCLESW and FIRSTFLG.

Major Changes Incorporated into Revision 87

Note: Revision 87 was made to correct bank overflow problems in Revisions 85 and 86.

- 1) PCR 707.2 was implemented. (Change from 1968/1969 Ephemeris Data to 1969/1970 Ephemeris Data).

- 2) PCR 271 was implemented. (Add RLS to Coast/Align downlist in place of VGTIG).
- 3) Assembly Control Board Request #3 was implemented. (Eliminate ARC-cosine from R61/R65 coding to prevent alarms in R65 at short ranges).

Major Changes Incorporated into Revision 88

- 1) PCR 751 was implemented. (Make 1406 alarm non-abortive).
- 2) Anomaly LNY-41 was repaired.
- 3) Assembly Control Board Request #4 was implemented. (Make the CONIC Routines clear the overflow indicator at the conics entries).
- 4) As part of PCR 647 a new pad-load was created for ASTEER: TNEWA.
- 5) PCR 738 was implemented. (H, V, gamma display with P21). This entailed the addition of a new noun: noun 91.
- 6) Anomaly LNY-42 was repaired.
- 7) Anomaly LNY-43 was repaired.
- 8) The implementation of PCR 736 was completed.
- 9) PCR 732 was implemented. (Permit the crew to modify W-matrix bias error in V67 routine).
- 10) PCR 744 was implemented. (Change epsilon to 1.5 seconds in R24).

Major Changes Incorporated into Revision 89

- 1) Assembly Control Board Request #6 was implemented. (Force restart routine to check for astronauts simultaneous depression of mark reject and error reset buttons before verifying sanctity of erasable memory).
- 2) An anomaly was corrected in the Verb 97 and Verb 99 logic.

- 3) Anomaly LNY-46 was repaired.
- 4) PCR 740 was implemented. (Display TLAND in P52, option 4).
- 5) The implementation of PCR 731 in the Landing Guidance equations was completed by altering the code so that redesignations would be disallowed in P64 4 seconds before TTF becomes less than the pad-load TCGFAPPR.
- 6) Assembly Control Board Request #5 was implemented. (Use erasables other than DSPTEMs for noun 79: CURSOR, SPIRAL, and POSCODE).

Major Changes Incorporated into Revision 90

- 1) Anomaly LNY-50 was repaired.
- 2) Anomaly LNY-49 was repaired.
- 3) Anomaly LNY-47 was repaired.
- 4) PCR 754 was implemented. (Provide IMU Orientation Selection Option Code in P57).
- 5) Anomaly LNY-48 was repaired.
- 6) The angle criterion in R65 was changed from 10 degrees to 15 degrees as a consequence of PCR 716.

Major Changes Incorporated into Revision 91

Note: This assembly was made to fix several program errors, particularly in R65 and R59.

Major Changes Incorporated into Revision 92

- 1) A scaling problem was corrected in verb 67.

- 2) The time-step value in MIDTOAVE was changed from 10 seconds to 15 seconds in order to lessen the chance of a 1204 POODOO (waitlist routine called with negative delta-time). A PCN number was not available at the time of writing.
- 3) PCR 757 was implemented. (Initialize RADMODES at entry to P20/P22, P70/P71), and P12.
- 4) The implementation of PCR 751 was reworked so that 1406 is a POODOO during the ignition algorithm of P63 and an alarm during guidance.
- 5) PCR 756 was implemented. (Guidance frame erection gains). This PCR requires two new pad-loads in the W-matrix for the landing: GAINBRAK and GAINAPPR.
- 6) Anomaly LNY-51 was repaired.