

Massachusetts Institute of Technology  
Instrumentation Laboratory  
Cambridge, Massachusetts

LUMINARY Memo #51

To: Distribution  
From: C. Schulenberg  
Date: 2 November 1968  
Subject: LUMINARY Revisions 51-53

Major Changes Incorporated into Revision 51

- 1) Coding was added to the P70/P71 lead-in to disable R25 (RR gimbal monitor).
- 2) Several calls to the 2PHSCHNG routine in the Servicer-Descent guidance-ascent guidance area were changed to double calls to the PHSCHNG routine in order to minimize the chance of a hardware restart causing an inflight-fresh-start (due to phase-table disagreement).
- 3) R31CALL was changed from a NOVAC to a WAITLIST. R31, as a result, ties up only a FINDVAC and a WAITLIST until the noun 54 display is put up. Formerly, a NOVAC was needed as well. In addition, the check for P11 was deleted from R31 since this was Colossus coding. For the same reason, R31FLAG and its associated checking logic was deleted. R31 was also modified to pick up a consistent set of state vectors.
- 4) V37 was shortened slightly by performing ENGINOF1 instead of ENGINOF2. V37 has always been a problem area with regard to causing downrupts to be lost.
- 5) P70 was corrected to turn the DPS engine off immediately instead of waiting 3 seconds. P71 still waits 3 seconds before turning on engine off in this early abort case (TFI < 50 secs).
- 6) The P70/P71 restart protection was improved.
- 7) The R10, R11 task was restart protected almost completely (all except the display part). Formerly, R11 could be off-the-air for as long as two seconds following a restart - thus conceivably delaying entry into P70 or P71.
- 8) An EBANK related problem was fixed in the R51-P63 interface.
- 9) An error was corrected in R59.

- 10) R13 (auto-modes monitor) was altered to sense the "presence" of the attitude-hold discrete rather than the "absence" of the auto-stabilization discrete.
- 11) A new log section called "Controlled Constants" was created in the non-subroutinized (MAIN) portion of LUMINARY. All constants in LUMINARY relating to engine characteristics were moved into this log section. Eventually, all of the LUMINARY fixed constants relating either to the LM vehicle or to extra-vehicular parameters such as lunar radius or rotation rate, etc., will be defined in this log section grouped by type.
- 12) Coding was added to the restart routine, for both hardware and software restarts, to clear the READRFLG. The result of this is that if R29 had been reading the radar at the time of the restart, it will be forced to begin designation over again.
- 13) An unneeded checking of MANUVFLG was deleted from R24.
- 14) The call to RESTORDB was moved in R23 in order to conform to the GSOP.
- 15) To achieve conformity with the GSOP, P20 was changed to call R65 with N=2 when the NOUPDATE flag is set.
- 16) Documentation was changed in LUMINARY to indicate that alarm 523 is a non-priority alarm in Verb 60, but a priority alarm in R14.
- 17) Verb 60 was changed to allow 22 seconds for the LR to reach position 2 before issuing alarm 523. Formerly it was allowing 24 seconds.
- 18) The Verb 85 computational cycle time was changed from 2 seconds to 1 second in order to obtain a better display (Noun 75).

#### Major Changes Incorporated into Revision 53

Note: Revision 53 was made to fix difficulties in Rev. 52.

- 1) The sign convention of the cross-range distance computation was corrected in P63 to conform to the GSOP (R3 of noun 61).
- 2) A program bug was fixed in P63. The desired ignition attitude as computed by the ignition algorithm for later use by P63's R60 was being destroyed by the R51 routine, which also performs R60 maneuvers.
- 3) The enabling of R25 was put back into STARTSB2 (executed by V37, software-restart, and hardware-restart) and deleted from V37, V56, P70, P71 and P12. This had to be done in order to insure R25 begins running if a restart has terminated a designation or remoding operation. R25 was modified to suppress itself if the NOR29FLG was 0, i. e. R29 or R10 might be in operation.
- 4) The restart protection of AVGENG was improved. As a result the AVGENG/V37 interface had to be changed, i. e. the group 2 phase changes required for the P20's are done in V37 after the return from AVGENG rather than in AVGENG itself.

- 5) To allow compact coding in the above change (item 4) and to gain future flexibility, a new entry was added to the PHASCHNG routine. The new entry, PHSCHNGA, allows the first octal number, that would normally follow the "TC PHASCHNG" to be in A.
- 6) The constant 57FPS used by P12 was corrected. At the scaling used previously the number was effectively 28.5 feet/sec. The result of this was that the noun 74 display of post-pitchover ball angles (computed in the P12 preburn computation) was slightly in error.
- 7) PCR 593.2 was implemented converting the 1301 alarm (ARCCOS, ARCSIN) from a POODOO to an ALARM1.
- 8) In connection with item #7 a new entry was added to the ALARM routine, namely, ALARM1. This entry performs the normal functions of ALARM, but, like BAILOUT1 and POODOO1 allows the caller to specify in A and L what he desires to appear in ALMCADR and ALMCADR +1.
- 9) A correction was made to the overflow detection logic (responsible for alarm 1600) of the IMU Performance Test Routine.
- 10) Coding was added to P76 to load noun 84 with the contents of noun 81 thus perhaps saving the astronaut the trouble.
- 11) In R12 a program error was corrected which had been preventing LR state vector updating until 30,000 feet (the time at which X-axis override is inhibited).
- 12) PCR 248 was implemented (LR Reasonability Test).
- 13) PCR 253 was implemented (Landing Radar Read Initiation).
- 14) A coding error was corrected in RADAREAD which had been preventing the LR altitude and velocity data fail DSKY lights from coming on.
- 15) RADAREAD was modified by a simple check for a spurious rupt. This was necessary since an unexpected rupt, in a peculiar way, could destroy the value of CSMMASS.
- 16) Restart protection was added to the main body of the Ascent guidance equations.
- 17) PCR 244 was implemented. This causes R12 to delay at least 4 seconds after receipt of a data-good inbit before beginning updates.
- 18) Verbs 65 and 75 were added. Verb 68 sets the SNUFFER flag and Verb 75 clears the SNUFFER flag. The corresponding DAP changes were still lacking. This is part of the implementation of PCR 539.
- 19) The display logic in R04 was corrected. In addition coding was added to blank R3 of the option code display.