Questionable Items in Luminary 185 Listing

Reference: Revision 185 of AGC Program Luminary, dated 26 October 1970, received 20 November 1970.

The following questionable items have been identified as a result of a one-pass scan of the reference. These exclude those which have been added since Luminary 178 (such as the termination of V44 entering V57), in view of MSC objections to comments on programs prior to their formal release.

Page	Comment
368 (366 in Lum 178)	If an R60 maneuver is interrupted by taking PGNCS mode out of Auto, then lines 960-1 on this page are entered (from line 8 on page 370) to cause "ZATTEROR". Efforts to find other places in the program where this routine was entered, however, such as P68, V77E, and DAP, did not reveal an instance of where the routine was entered without interrupts being inhibited. A similar deficiency in the CSM Apollo 12 program was pointed out on page ATTM-10 of the programmed equations document, and eventually was acknowledged by the MSC AAP G&N contractor to be a program deficiency (see anomaly report COM 33, dated 20 January 1970). A similar problem to that described also exists for the "STOPRATE" entrance, which seems done also without interrupts being inhibited. Lines 962-3, of course, can be entered if a 401_8 alarm is generated, although "ZATTEROR" is bypassed in this case.
560 (558 in Lum 178)	Except for FLAGWRD4 (used only by display interface routines), efforts to find places in the program where a flagword is sampled, <u>then</u> interrupts inhibited prior to storing it back (modified), were unsuccessful. Since RADMODES can be modified in the T4RUPT package, the failure to observe proper interrupt inhibit logic standards on lines 2191-4 could presumably yield undesirable behavior. What is necessary is the reversal of lines 2192 (MASK RADMODES) and 2193 (INHINT).
608 (605 in Lum 178)	The constant with notation "FT99999", scaled B19, actually corresponds to only 99997 feet. Value in meters should be 30479.7, as given correctly for the N68 R3 initialization constant "99999CON", scaled B24, on page 776 of listing.
650 (647 in Lum 178)	Although P21 stores the results of each integration for use as a "base vector" for the subsequent integration, the INTYPFLG which controls whether conic or precision integration is done is set <u>only</u> for the initial integratic after enter the program (line 91 on page 649, but not e.g. line 111 on page 650). Hence, as noted in the Apollo 14 CSM AOH, subsequent integrations could be degraded in the event that R31 (for example) was selected during one of the P21 displays. Note that the W-matrix flag DIMOFLAG, which per page 2-42 of the MSC AAP G&N contractor's Section 2 Rev. 10 GSOP is unlikely to get set <u>during</u> P21, <u>is</u> set both for the initial integration (page 649 lines 89-90) and the "recycles" (page 650 lines 103-4).
831 (826 in Lum 178)	Page 5.3-136 of Section 5 Rev. 8 GSOP specifies a ZDOTD initialization (top box) of "5509.5". The "VINJNOM" constant on this page, however, causes the initialization (and DSKY XXXX.X fps display) to be only 5509.3 fps.

Comments on LM Program Zerlina 56

Reference: Revision 56 of AGC Program Zerlina, dated 21 October 1970, received 5 November 1970.

The referenced program apparently continues the off-line Luminary "test bed" functions reflected in earlier versions of the series, which were initially concerned with evaluation of the "variable servicer" concept. In addition to retaining the items necessary for this purpose, the major additional change which seems to have been incorporated in the reference is a redesigned P66 logic, involving a fast throttle loop and a capability of indicating desired horizontal-velocity changes via the LPD (i.e. RHC) channel.

A functional summary of some of the features of the new computations which may be of interest is given on the following pages. An attempt has been made to exclude those items which are related to the variable-servicer mechanization, as well as minor program-sequence changes which would not be expected to have a strong impact on the performance of the program (the same statement also applies to different program tags for essentially equivalent computations). The program baseline employed seems to have been roughly a pre-H3 third (Luminary 178) release, as evidenced by the fact that K1VAL is 141.12 rather than 140.12, for example. Major attention seems to have been focused upon the descent area, and as a result other areas of the program have been only incompletely updated (for example, during abort/ascent burns, V06N94 is displayed as specified by PCR 334R1; after the burn, however, the V16N63 display would still be seen).

In addition to these "incomplete" items, however, some other questionable items were identified which may be a cause of difficulty in demonstrating the capabilities of the program on a simulation. These include:

1. The cell with tag TREDES (redesignation time left) is no longer computed; instead, a forward-velocity cell FORVDSKY is computed and displayed. Nevertheless, P64 logic checks still make use of the TREDES tag (which would, of course, base results on the numerical magnitude of the forward velocity).

2. The same cells are used in P66 for horizontal velocity control as are used in P64 for LPD processing. These count cells, however, are initialized to zero only for a PRO to the P64 N64 display. Consequently, if enter P66 automatically from P64, the initial contents of these cells could cause difficulty if no PRO had been provided. If enter via ROD clicks, however, the effect seems benign. As a perhaps less likely event, if enter P66 from P63, the program interrupt for RHC inputs seems never to be enabled, if "PITFALL" entered after "STARTSB2" but before P66.

3. The program logic for deciding whether to execute the ROD computations, among other parameters, makes use of a cell with tag "-OLDTAU". No initialization of this cell was located at the start of P66: the effect may be benign since other logic checks also are employed for initiating P66 ROD computations, however.

4. Near the start of the P66JOB computations (lines 763-4 on page 801), the IMU-offset correction factor is used to modify the sampled contents of $PIPA_X$, and the result is stored via a TS order. Since the variable-servicer concept deliberately does <u>not</u> zero accelerometers when read, it appears possible to get overflow in this computation, leading to subsequent improper cell loadings (an EXTEND is skipped, making a READ order merely a redundant INHINT, for example).

5. In the perhaps unlikely event that bit 10(FLUNDISP) of FLAGWRD8 = 1, the HZCOUNT cell used to sequence through P66 computations is incremented twice in the same computing interval, destroying the phasing relationships presumably intended. This is done on lines 1174-8 on page 810 (and could be readily fixed).

Extended Verb Changes

1. V57E has been changed per PCR 334R1 so as to delete its display, merely setting the LRINH bit to 1 (means allow updates) and then transferring to "PINBRNCH".

Noun Changes

1. N94 has been added, containing VGBODY$_x$, HDOTDISP, and HCALC (per PCR 334R1). It is displayed during the burn for abort/ascent (but, as mentioned, the post-cutoff display is still V16N63).

2. R1 of N63 has been changed to display DELTAH (per PCR 334R1). In P63, the (LRINH=0 display flashes, as also specified by PCR 334R1. All responses go to End of job.

3. R1 of N68 is now computed as merely RGU$_z$ rather than |RGU| (see page DESC-6 of 70-FS-6, the official MSC Luminary equations), again as specified by PCR 334R1. It retains the tag of RANGEDSP. R3 has ABVEL (former N63 quantity) per PCR 334R1.

4. As part of the revised evaluation capability, R1 of N60 now has a split scale, with the left two digits being forward velocity (units of fps, rounded), middle digit blank, and right 2 digits being LOOKANGL (set to 99 if outside the range of greater than 0 and less than/equal to 75°, with latter being limit on single precision arc angle routine). The DSKY noun display routine ("2INTOUT") for the split display has been modified to display the sign of forward velocity (at present, e.g. H3 program, sign always plus). R2/R3 now ALTRATE/ALTITUDE (R10/11 update rate).

5. Due to #4, R1 of N64 also has this information: no display of TREDES is provided although information to determine it could be obtained by manual initiation of N68.

No N77 change (PCR 334R1) has been made, since it is an ascent-only noun.

Descent Changes

Most of the other changes are related to descent-only, mainly an impact on computations associated with P66. These changes include:

1. The VVECT computation (top of SERV-13 of official MSC Luminary equations) is done prior to the checks for bits that enable the display. The computation, as at present, is done every $\frac{1}{4}$ second.

2. Following the VVECT computation, checks are made for P66. These are:

a) If MODREG =66, meaing P66 currently active, the job "P66JOB" is established at priority 24_8. Exit is then to "LANADISP".

b) If a new flagbit (bit 9 of FLAGWRD1, ALW66FLG) is 0, RODCOUNT is set 0 and exit is to "LANADISP". This bit is set 1 at start of P63; set 0 at start of P12, P70, and P71.

c) If cells are set indicating guidance transition to P66 (FLPASS0 = 0 and WCHPHASE = 2), exit is to "STARTP66".

d) If in attitude hold with ROD clicks, exit is to "STARTP66" (standard manual way of entering program).

e) Otherwise, RODCOUNT is set 0 and exit is to "LANADISP".

3. "STARTP66" sets VDGVERT to $VVECT_x$, THRUST to -0 (stops any further throttle outputs), increments FLPASSO, sets "PIPCYCLE" (essentially "SERVEXIT" function) into AVEGEXIT to disconnect guidance from Servicer cycle, sets some bits (as now), establishes "P66JOB", and exits to "LANADISP".

4. "LANADISP" parallels what done now, except for the early VVECT computation already mentioned.

5. The option for entering R51 (buffer storage and checklist display) at the start of P63 has been deleted per PCR 335.

6. The "LUNLAND" (page DESC-4 of official MSC equations) checks for P66 have been deleted, since moved to the R10/R11 package as discussed in #2 above.

7. The LPD input processing is now done in units of counts, rather than in units of radians as previously. In addition, for P64 processing the scale factor is 1° in each axis, as specified by PCR 338.

8. The LOOKANGL routine computation is handled by "LPDFVSUB" now, entered with sine information in MPAC. This subroutine also computes forward velocity display information for N60/N64. It is entered in place of LOOKANGL computation on DESC-6, for example.

9. The throttle routine has been redesigned (page DESC-14/15). A special entrance has been added for P66 purposes, allowing input to be directly the throttle pulses desired (bypassing limit checks since duplicate the P66 ones). In addition, a check has been added for AGS control: if so, throttle output is run down to zero.

10. A check has been added to terminate computations if enter P66 during a P63/64 cycle (due to ROD clicks, for example).

11. LPD inputs are allowed for P66 as well as P64. If in AGS control, however, no increments to the cumulative counts are made. As mentioned in #7, values now kept in units of counts, and scaled as necessary by the user.

12. The computation of TREDES has been deleted (see Noun item #4), although program logic checks still use the cell (to decide when to stop flashing N64, for example).

13. The remainder of the changes, involving P66 almost exclusively, can most economically be presented in the programmed equations format:

P66JOB (Established every $\frac{1}{4}$ second by R10/11 package)

(Transfer pad-load cells into buffer storage for EBANK considerations)

Inhibit interrupts

$MPAC+4 = \cos_{sp} CDU_y \quad \cos_{sp} CDU_z$

$P66PIPX = PIPA_x - K_{rimuz} OMEGAQ$ (if overflow, improper results)

$P66TPIP = (channel\ 4)$ (B9 centi-seconds)

$GTCTIME = T_{now}$

If MODREG $\neq$ 66:

TS = 66 and perform "NEWMODEX" (interrupts released)

THRUST = -0

HZCOUNT = 3

$VHZC_y$ = 0

$VHZC_z$ = 0

FWEIGHT = 0

Proceed to "ENDROD"

$VVECT_x = V_x - VSURFACE_x$ (B5) (make more up to date than R10/11)

DT = GTCTIME+1 - PIPTIME+1 + 16384, modulo 16384 (same as GTCTIME - T_{pptm})

$VVECT_x = VVECT_x + K_{p66kpip}$ (P66PIPX - PIPAXOLD) (difference overflow corrected)
+ DT ($GRAVACC_x$ - $BIASACC_x$)

Set TS = RODCOUNT and RODCOUNT = 0

$VDGVERT = VDGVERT + C_{rodscale}$ TS

If bit 5(Auto throttle complement) of channel 30 = 1:

VDGVERT = $VVECT_x$

Proceed to "ENDROD"

TS =(VDGVERT - $VVECT_x$), with sign agreement forced (B5 m/cs)

MPAC+3 = P66TPIP - OP66TPIP + 512, modulo 512 (scaled B9, cs)

If MPAC+3 - $K_{p66pmin} \leq 0$:

Proceed to 3rd line of "ENDROD"

If $|TS_{sp}| > K_{dec48}$:

$TS_{sp} = K_{dec48}$ sgn TS

If $|TS| \geq C_{vercrit}$:

$TAU = C_{taurod1}$

Proceed to "P66ROD"

TS_2 = MPAC+3, rescaled to scale factor B14 (truncated shift)

If TS_2 + 12 + mOLDTAU ≤ 0: (units centi-seconds)

Proceed to 3rd line of "ENDROD"

$TAU = C_{taurodb}$

Proceed to "P66ROD"

P66ROD

TS = (TS/TAU - $GRAVACC_x$), rescaled to B-4 m/cs^2

$TS_1 = K_{scalefac}$ MASS TS/MPAC+4 (MPAC+4 loaded at start of "P66JOB")

Limit $TS_1 \geq$ MINFORCE

If $|TS_1| >$ MAXFORCE:

TS_1 = MAXFORCE sgn TS_1 (positive, of course)

FC = TS_1

TS = OP66PIPX - P66PIPX, corrected for overflow

FP = $K_{scalefac}$ MASS (BIASACC$_x$ + $K_{p66kpipb}$ TS/MPAC+3) - FWEIGHT/MPAC+3

FP = FP/MPAC+4 (now complement of present thrust)

TS = FC + FP

If $|TS| \geq K_{p66pmin}$:

TS = $K_{p66pmin}$ sgn TS

Perform "P66THROT" (loads TS into THRUST cell if not in AGS control)

Release interrupts (tag here "P66REL")

FWEIGHT1 = K_{2sec9} MPAC+4 FWEIGHT1 (now rescaled for use in 2nd equtn above)

Set TS_1 = $C_{rohzscal}$ AZCOUNT1 and AZCOUNT1 = 0 (TS_i units B-3 m/cs)

Set TS_2 = $C_{rohzscal}$ ELCOUNT1 and ELCOUNT1 = 0

$VHZC_y$ = $VHZC_y$ + M32 TS_1 - M22 TS_2

$VHZC_z$ = $VHZC_z$ + M22 TS_1 + M32 TS_2

FWEIGHT = FWEIGHT1

mOLDTAU = - TAU

Proceed to "ENDROD"

ENDROD

OP66TPIP = P66TPIP

OP66PIPX = P66PIPX

Change priority to 22_8

Change priority to 23_8

If bit 14 (Auto mode) of channel 31 = 1: (means not Auto)

FLPAUTNO = 8192

$VHZC_y$ = 0

$VHZC_z$ = 0

Proceed to "HZTIME"

If FLPAUTNO $\neq$ 0:

$VHZC_y$ = 0

$VHZC_z$ = 0

HZCOUNT = 0

Proceed to "HZTIME"

HZTIME

TS = bits 3-1 of HZCOUNT

If TS = 0:

Proceed to "P66HZ" (i.e. every 8th time or once every 2 seconds)

TS = bits 2-1 of TS

If TS = 2:

Proceed to "P66DISPS" (every second, $\frac{1}{2}$ second out of phase with "P66HZ")

HZCOUNT = HZCOUNT + 1

End of job

P66HZ (Entered every 2 seconds)

$\underline{TS} = (\underline{VHZC} - \underline{VVECT})/C_{tauhz} - C_{qhz}\ \underline{UNFC}$ (B-5)

$TS_x = 0$

$TS_1 = |\underline{TS}|$, limited $\leq C_{ahzlim}$ (note net angle limited, rather than each component as in H3 program)

$\underline{TS} = TS_1\ unit\underline{TS}$ (unit vector overflow-minimized) (B-4)

$TS_x = K_{ghz}$

If overflow has occurred in interpretive language:

Perform "ALARM" (pattern 1410_8)

Perform "STOPRATE"

HZCOUNT = HZCOUNT + 1

End of job

If bit 3 (Engine armed complement) of channel 30 = 1:

If bit 1(P66PROFL) of FLAGWRDO = 0:

T5ADR = "DAPIDLER"

HZCOUNT = HZCOUNT + 1

End of job

$\underline{UNFC} = \underline{TS}$

Perform "FINDCDUW"

HZCOUNT = HZCOUNT + 1

End of job

P66DISPS (Entered every second)

$\underline{TS} = \underline{VVECT}$

$TS_x = 0$

$TS_1 = |\underline{TS}|$, limited $\leq (C_{ahzlim}\ C_{tauhz})$ (B5)

$TS_2 = (TS_1^2 + \frac{1}{2}|\underline{TS}|^2)/C_{ahzlim}$ (B14)

$TS_3 = C_{textra}\ |\underline{TS}| + TS_2$

$\underline{TS} = -\ TS_3\ unit\underline{TS}$ (B15) (unit vector overflow-minimized)

$\underline{TS} = unit\left((ALTITUDE + K_{dalteye}), TS_y, TS_z\right)$

Perform "QUICTRIG" with $\underline{ANG} = \underline{CDU}$

Perform "SMTONB"

$\underline{TS} = [SMNBMAT]\ \underline{TS}$

$TS = TS_x$ (B2)

Perform "LPDFVSUB"

HZCOUNT = HZCOUNT + 1

If bit 10(FLUNDISP) of FLAGWRD8 = 1:

HZCOUNT = HZCOUNT + 1 (perhaps not desired)

End of job

TS = 0660_{vn}

Proceed to "REFLASH": if terminate, End of job
if proceed, proceed
otherwise, proceed

Set bit 1(P66PROFL) of FLAGWRD0 = 0

End of job

LPDFVSUB (from "RGVGCALC" and "P66DISPS")

LOOKANGL = K:180DEGS$\left(\sin^{-1}_{sp}(TS) + K:1d2DEG + ELBIAS\right)$

If $0 < LOOKANGL \leq 75$:

Skip next line

LOOKANGL = 99

TS = $K_{fvscale}$ FORVEL, rounded to nearest integer (fps)

If $|TS| > 99$:

TS = 99 sgn TS

FORVDSKY = TS

Return

Quantities in Computations

NOTE: List excludes those readily available in DESC/SERV areas of Official MSC Luminary equations.

AZCOUNT1: Single precision count of number of "azimuth" LPD inputs, B14.

$BIASACC_x$: X component of PIPA bias, B-9 m/cs^2 (rescaled pad-load cell).

C_{ahzlim}: Single precision pad-load limit on P66 steering, B-5 m/cs^2.

C_{qhz}: Single precision gain on UNFC, B-1, unitless, pad-load (as are all C_{xxx}).

$C_{rodscale}$: Single precision scale factor for ROD clicks, B-3 m/cs per click.

$C_{rohzscal}$: Single precision scale factor for RHC deflections in P66, B-3 m/cs per deflection.

C_{tauhz}: Time constant for horizontal nulling in P66, B10 centi-seconds, single precision

$C_{taurodb}$: Single precision time constant for vertical P66 "inside deadband", B14 centi-seconds.

$C_{taurod1}$: Single precision time constant for P66 vertical "outside deadband", B14 centi-seconds.

C_{textra}: Single precision "time to achieve P66HZ command", B9 centi-seconds.

$C_{vercrit}$: Single precision constant used as criterion for required P66 vertical TAU, scale factor B5, units m/cs.

ELCOUNT1: Single precision count of number of "elevation" LPD inputs, B14.

FORVDSKY: Single precision cell displayed in D1 and D2 of DSKY for N60 and N64, program notation also "FUNNYDSP". Loaded with scaled and limited FORVEL, B14 in units of fps (sign is displayed in the register too).

FWEIGHT1: Cell used in conjunction with restart protection of FWEIGHT.

$GRAVACC_x$: X component of gravity during current cycle, B-9 m/cs^2.

HZCOUNT: Single precision counter, B14 counts, used to cause "P66HZ" every 8 passes (i.e. every 2 seconds), and, $\frac{1}{2}$ second out of phase, "P66DISPS" every second.

K_{2sec9}: Constant, value 200 x 2^{-9}, used in rescaling of FWEIGHT1.

$K_{dalteye}$: Constant, scale factor B15, units meters, intended to give distance from LR antenna to crew "eye". Value corresponds to 5 meters.

K_{dec48}: Single precision constant, value 48 x 2^{-14}, scale factor B5, units meters/centi-second. Value corresponds to about 9.38 m/sec.

$K_{fvscale}$: Constant, scale factor B9, value 328.084 x 2^{-9}, used to convert FORVEL to units of fps. Is single precision.

$K_{p66kpip}$: Constant, scale factor B-9, value 0.0512 (corresponds to 0.01 x 0.01 x 2^9), single precision, used to scale PIPA outputs to B5 m/cs.

$K_{p66kpipb}$: Single precision constant, value 0.8192, scale factor B-13 (corresponds to 0.01 x 0.01 x 2^{13}), used to scale PIPA outputs to B1 m/cs.

$K_{p66pmin}$: Single precision constant, scale factor B9, units centi-seconds, value 37.5 x 2^{-9} (since THRUST output at 3200 pps, serves a time-equivalent for loading that cell too).

mOLDTAU: Complement of TAU saved for checks on period of P66 vertical, B14 cs, sp.

MPAC+3: Single precision time since last P66 computation, B9 cs.

MPAC+4: Single precision product of cosines of CDU_y and CDU_z (loaded at start of "P66JOB"), B0.

OP66PIPX: Previous value of P66PIPX.

OP66TPIP: Previous value of P66TPIP.

P66PIPX: P66 X-accelerometer output, B14 counts, corrected for OMEGAQ.

P66TPIP: Time tag (based on channel 4 readout) for P66PIPX, B9 centi-seconds.

PIPAXOLD: X PIPA sampled for Average-G, B14 counts.

TAU: Selected time constant for vertical (one of 2 padloads), B14 centi-seconds.

VDGVERT: Desired vertical velocity, B5 m/cs.

VHZC: "Desired" horizontal velocity, B5 m/cs (x component not used), updated by LPD.

Comments on Rev. 10 of Luminary Section 2 GSOP

Reference: R-567, "Guidance System Operations Plan for Manned LM Earth Orbital and Lunar Missions Using Program Luminary 1D (Rev. 178), Section 2 Data Links (Rev. 10)," dated September 1970, signed 22 October 1970, received 13 November 1970.

The following comments are provided on the reference.

Page	Comment
xii	PCR 1013, although effective in 1C program, was not reflected in Rev. 8 of the GSOP. Instead, it is reflected in the Rev. 10 configuration (and hence should not be listed under the "March 1970" Rev. 8 "Revision index cover sheet"). It gives another cause for reset of bit 12 of FLAGWRD1.
xiii	The title of PCN 1007 did not contain parentheses as distributed by NASA.
xv	Title of PCR 287 is incomplete (as distributed by NASA, also mentioned "and P20").
	The impact of PCR 1038 is also reflected in the document on pg.2-32, and hence it should be listed here (deleted "P20" from the effectivity of PCR 287).
	The citation of page xv with PCR 1069.2 violates the convention which seems employed for other changes of not listing as an "affected" page the Revision index cover sheet itself. Presumably intended reference was to page xvii anyhow.
	According to the footnote, change 1087 was a PCN, not PCR, and hence should have an asterisk in the listing of the upper part of the page.
xvii	For consistency with the footnote on page xv, the change specified by PCR 1069.2 should have been flagged as such (new third paragraph) and cited appropriately at the bottom of the page.
xix	The material on page 2-123 involves "flag bits" in the title (also continuation on page 2-124), not "flagwords".
2-7	In first line of 2.1.1.2.2, "registers are found", not "registers,are found" as seems to be printed.
2-21	For consistency with CSM Section 2 Rev. 12 GSOP, and particularly in view of the submission of (disapproved) PCR 1092, P07 should also be listed.
2-32	In 3rd from last line on page, the P22 criterion associated with display initiation and range rate check for setting the bit 0 should be mentioned.
	This page reflects the impact of PCR 1038 also, which should have been cited.

Page	Comment
2-33	Bit 8 is also set 1 by P57 (which, in common with P51, does not use R02). See line 32 of P57 in Section 4 Rev. 7 Luminary GSOP.
	Since bit 9 of IMODES30 left alone for a restart, the reference to "after a restart" at end of bit 8 material is no longer meaningful (not done after a restart if IMUSE = 0, either). See bit 9 of IMODES30 on page 2-73 for suitable material (or CSM GSOP definition of IMUSE bit).
2-34	In definition of bit 1, the 0 specifies "a stop to P66 horizontal nulling" only if engine not armed.
2-35	In 4th line of bit 14 definition, the "=" in left margin should be deleted.
	In bit 14 definition, the bit is set 0 "in R10", not "on entrance to R10" (which Section 4 presumably will indicate occurs every $\frac{1}{4}$ second).
	Bit 11 is set 0 unconditionally in P63 and by V36, not merely "if terrain model computations are to be performed". Perhaps "meaning that" could be substituted for "if".
2-42	For consistency with page 2-123, last line of bit 8 definition should involve "FLAGWRD3", not "FLAGWORD3" (or, alternatively, "flagword 3").
	Mnemonic for bit 15 of FLAGWRD3 is POOHFLAG, not POOFLAG, at end of bit 8 definition.
	As shown on page 2-123, the 3rd character for bit 2 is an "oh", not a "zero", in the tag ("Dimension 6 or 9", not "Dimension 60 R9").
2-48	Reference to tag in middle of 5th line of bit 8 should be consistent with references elsewhere (such as bit 5 of FLAGWRD3 or bit 7 of FLAGWRD7), namely involve "oh", not "zero".
2-60	Definition of bit 9 should distinguish between the logic function of keeping R12 from performing additional checks and actions for 30K' and the logic function of inhibiting X-axis override. Given more satisfactorily in previous issue as, for 2nd sentence, "At this point,...". See last page ("Table 2") of Luminary memo #146 dated 1 June 1970.
2-67	For consistency with degree of detail for bit 15, bit 10 should also list "Verb 37 selection of P00" as a reset cause.
2-68	Heading-print material missing for right column ("Contents" and "Meaning", see previous page or previous issue).
2-74	End of bit 3 definition should also mention R47 as a source of such a command.
2-75	The bit 8 description (what it "causes") should be modified to reflect the actual program logic. According to the Official MSC Luminary equations, it is "tested" in "DISPRSET", and if 1 causes bit 2 of channel 12 to be reset in that routine. The bit is believed to be a holdover from an earlier mechanization in which error counter disabling in the routine not desired.

Page	Comment
2-76	Second line of bit 5 should also mention R47.
2-79	Bit 8 definition should be updated to reflect impact of PCR 1058 (see page 2-34): output of DACs restriction no longer just "during landing".
2-86	The 4th sentence of channel 33 discussion ("They are also reset by a restart") seems to conflict with last sentence, which indicates that bit 13 alone is reset by such a restart (as also indicated on page 2-125). Note that no Write command is used in LM to read the channel to check for a restart loop (contrary to CSM).
	Last two sentences of channel 33 discussion (before bit definitions) seem to have words (or something) missing: punctuation before "Bit" seems to be a comma, for example.
2-101	Change to word 12 should have been flagged by a bar, not by dots, for consistency with PCR citation at bottom of page and notation standards on page xv.
2-104	Word 12 remains static, rather than being computed and displayed, if bit 6 of channel 30 indicates that no such display is desired. This is particularly significant in view of the fact that the noun display <u>is</u> updated (as presumably "authorized" originally by ACB L-11).
2-110a	Word 99 should mention the "TSIGHT" tag in first line, since the definition subsequently makes use of it.
2-114	For consistency with deletion of information on "Garbage" cells (even channel 76, page 2-65a), presumably the material concerning them in words 9b and 17b should also be deleted.
2-123/4	The RADMODES (FLGWRD12) mnemonics do not appear in the document except on this page. Either they should be deleted from this list or added to the list on pages 2-66 to 2-68. The DAPBOOLS mnemonics used disagree with those on page 2-69. Since those on 2-69 also appear on page 3.6-23 of Section 3 Rev. 5 Luminary GSOP, presumably they are the "official" ones, a conclusion also supported by Section 4 GSOP terminology.
2-125	FLAGWRD4 is set 0, not left alone, by hardware restart (line 0516 on page 226 of Luminary 178 program). Instead of setting all bits of DAPBOOLS to zero except bit 3 for a restart (which could cause some drastic behavior!), <u>only</u> bit 3 is reset zero, with others left alone. See 2nd footnote on page 3.6-2 of Section 3 Rev. 5 GSOP. For restart, channel 11 bits 14 or 13 are set 1. See page 2-77. The indication that channel 77 unchanged by hardware restart is in direct conflict with page 2-65a ("unchanged" if same as previous restart, of course). PCR 331.2 specified that this list be added "to the document on the page before the flagbit descriptions start." Instead, it appears just before the distribution list.