

UNITED STATES GOVERNMENT

# Memorandum

TO : F. W. Haise

DATE: June 25, 1970

FROM : D. R. Scott

SUBJECT: Luminary Improvements

The operational capability of Luminary 173 can be enhanced significantly by incorporating the following improvements:

A. The V76/V77 logic should be incorporated into the MODE CONTROL PGNS switch and internal program switching. In all non-thrusting programs MODE CONT PGNS to AUTO should function as rate command attitude hold unless an auto maneuver is enabled with a PRO on 50 18. The ATT HOLD position should function as a pulse mode with DIRECT available by switching the appropriate ATT CONT switch to DIR (currently the V76 logic).

*O.K. change would be major, though*

In all thrusting programs the AUTO position should retain its current implementation including the X-axis override capability. The ATT HOLD position should provide rate command attitude hold at the time the program is entered and revert to pulse when the program is exited.

B. The noun displayed during P63 descent should be optimized for monitoring purposes. VI in N63 is not necessary as long as H and H are available.  $\Delta H$  would be a more meaningful parameter for display since it is necessary to determine landing radar acceptance and convergence. Other parameters used which should be on call include TGO and Throttle command (i.e. a noun with TGO, Throttle command and VI).

*N63  
ΔH  
H  
H*

*N63 VI  
TGO  
THRT.*

C. V47 should perform automatic V40N20 in all programs (e.g. P63).

*AVG Test*

D. The V50N25 R1 14 display in P63 should be eliminated as it is in all other thrusting programs. An alignment 10 minutes prior to PDI is highly unlikely.

*Yes*

E. Remove PGNS auto throttle when Guidance Control is in AGS, i.e. the PGNS should run the auto throttle down to zero if AGS control is sensed. If the LM is placed under AGS control then PGNS auto throttle is undesirable since the PGNS will attempt to reach the landing site with power alone regardless of spacecraft attitude.

*Interface Problem if switch back to manual H. Making what be difficult.*

*why not go to H?*

The safest procedure if a switch to AGS control is necessary during landing is to also switch to manual throttle. This puts the pilot in the nominal LLTV configuration (i.e. rate command, attitude hold, manual throttle) in which he is best trained to perform a manual landing (admittantly ROD is much easier). The internal switching in the PGNS



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would eliminate the need to move another lever lock switch during a very time critical period (as the right hand switches to AGS, the left hand rapidly manipulates the throttle to maintain a desired rate of descent).

DONE

Done

F. Lateral velocity ( $\dot{Y}$ ) should be displayed on the cross-pointers during ascent (P12). This would alleviate the need for calling N77 during ascent to monitor out of plane velocity.

N94  
TGO  
H  
H

G. The noun displayed during ascent (P12, P70, P71) should contain only the displays necessary for monitoring the trajectory. Redundant displays should be available on callable nouns. The H and H of N63 are necessary, however VI is redundant to H having the same general characteristics relative to time and H. Hence VI should be replaced by  $\Delta V_X$  (used for pre-shutdown activities) or TGO (used to determine time of shutdown).

L. Bern...

H. Extended verbs during P20 maneuvers (V06N18) should be available as they are during P40 maneuvers. As an example, several minutes can be saved during the initial phase of the M=1 rendezvous by allowing V83 (to initialize ordeal) and V82 (to determine orbital parameters) during the P20 maneuver from LM insertion attitude to the rendezvous tracking attitude.

Major redesign of display interface

I. During rendezvous updating, a N49 display should also turn on the VEL light (or some other DSKY light). This would call the crews attention to the excessive update if another noun, e.g., N78, is being monitored over N45. Currently if any noun other than 45 is on display, the termination of updating due to the excessive update is masked.

Yes, also perhaps have some priority display light.

J. A program or routine which would permit manual updating of the LGC with range (Tapemeter R/R, CSM VHF) and/or angle (FDAI, DEDA) data. A program comparable to the P25 tracking program or a routine in P00 such as V63 which takes advantage of the existing modular design of the current program has been suggested. Data would be entered through the DSKY in standard units with the time tag based on the final ENTER. This would retain an active PGNS navigational capability in the LM in case of radar and/or IMU failure.

Extended verb routines to incorporate mark data.

K. The normal velocity display during a P34 recycle should be N81 vice N59 since the local vertical components are used for comparison with the CSM and MSFN solutions. N59 should remain available on call.

P. UCLAN  
P. WHIT  
E. MUEL

OK

L. The Ascent Propulsion System ullage time should be in erasable memory. The 4 sec now in fixed memory is inadequate for an APS TPI with either 2 or 4 jet ullage.

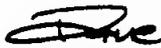
fixed

SYSTEM

P 34

M. Insure nouns loaded in P76 are not destroyed by the succeeding P20 or (P3X) programs. If auto tracking after a P76 does not appear to be accurate or if excessive updates occur, it is necessary to reverify the values of time and  $\Delta V$  loaded in P76 to insure incorrect data was not incorporated.

*OK.  
Markham to use  
different nouns*



D. R. Scott

*1  
reference  
until next P40 N84*

CB:DRSCOTT:jlf 6-25-70