R. Parson

MIT Instrumentation Laboratory

DG Memo No. 1383

TO: N. Sears

FROM: I. Johnson

DATE: 2 July 1969

SUBJECT: Ascent/Descent Monitoring

I. Descent

1. AGS and Lear Reinitialization during PDI

Exact criteria for AGS Altitude updates (besides nominal one at PGNCS 2000 ft) are not yet established, but look about like this:

a) Update AGS alt (with PGNCS) if:

1) LR/PGNCS converge

2) Δh (AGS - PGNCS) > 4K' - 5K'

b) Update (reinitialize) Lear (to PGNCS state) if:

1) LR/PGNCS converge

2) Δh (Lear - PGNCS) $>\sim$4K' - 5K' and raw doppler does not confirm Lear.

2. Fuel Depletion Detection

- DPS Low Level Light (onboard) on at 5.6% fuel remaining
- Crew has 60 sec after low level light on to decide to commit to landing or abort
- Ground is monitoring all four onboard fuel tanks and instructs crew to monitor the one least full

- Ground and onboard fuel gauges expected to agree to 3/4% (full scale)
- According to Bob Carlton (Flight Controller - LM Systems), if Low Level Light on and fuel gauge reads:
  (1) > 3.6%, believe low level light
  (2) < 3.6%, believe fuel gauge

  Almost everyone else I've talked to says believe the Low Level light all the time, unless of course it doesn't come on at all, which means abort (crew discretion) at 2% on gauge.
- There is a mission rule which says abort at 2% if altitude > 800', but almost no one seems to be aware of it and the 800' seems to have significance only in that it will enable a 10 fps vertical approach.

II. Ascent

1) AGS altitude updates similar to descent, if necessary

2) The so-called "tweak" burn after a descent abort is used to adjust the LM or CSM orbit to optimize the rendezvous sequence.

LM burns 2 min post insertion at 0/270/0 on inertial FDAI; P47; -X is retrograde

CSM burns 12 min post insertion

LM retrograde maneuver is generally given to the CSM, for which it is posigrade.

3) Ascent vector on which the tweak burn is based normally comes from active LM guidance system (normally PGNCS); Fido may

select either PGNCS, Lear, or AGS as systems comparisons indicate.

4) CMC LM State Vectors:

pre-insertion: ground's best est (time tagged at INS +18 min)

post-insertion: ground's best est (usually that of active system guiding ascent)

III. PDI 1 Rev Slips

- Retargeting consists of updating (via P27) TLAND, TIG, and abort ascent polynomials
- New abort polynomials depends on 2-pass pre-DOI tracking
- If ullage, don't remove it; TLAND and TIG changed accordingly, but not the abort polynomials
- LM state pre PDI_2 will most likely have the benefit of ground tracking during the nominal PDI pass.
- Plans for simulating this condition are very uncertain; a sim net sim appears to be out of the question

Distribution

N. Sears
P. Felleman
R. Larson
M. Johnston
E. Olsson
J. Nevins (8)