Bue Stoval

OPTIONAL FORM NO. 10 MAY 1962 EDITION GSA FPMR (41 CFR) 101-11.6 UNITED STATES GOVERNMENT

## Memorandum

TO : Flight Director, Apollo 10

DATE: JUN 1 3 1969

FROM : Retrofire Officer

SUBJECT: Postflight Report

1. Prelaunch.

a. During the CDDT's, the CMC clock and the LGC clock were observed to have a drift. From KSC readouts, the drifts for the clocks were determined to be .00145 secs/hour fast for the LGC, and .00046 secs/hour fast for the CMC. On May 17, 1969, the CMC clock was initially misaligned by .007 secs at about 6:00 GMT. It was then decremented by .03 secs so that it would be correct at lift-off.

b. Due to bad weather in the Atlantic, the onboard block data for the 2 - 1 area would have been unacceptable for launch azimuths greater than  $77^{\circ}$ . After coordination with Weather and Recovery, the following decision was made: For a hold causing the launch azimuth to be greater than  $77^{\circ}$ , we would advise the crew to use the 1 - 4 area instead of the 2 - 1 area.

c. The CSM, LM, and SIVB weights and aerodynamics updates went smoothly.

d. The ACR wind data for Mode I aborts was run. The RSO determined the launch azimuth to be 96° based on this data.

e. A trajectory confidence run had to be terminated early, because of the interference problem with receiving TM during a CMD test. However, confidence in the system was achieved.

2. Launch Phase.

a. The GMT of the first motion was 16:49:00.623. The CMC lift-off time was 16:49:00.70 which was input to the RTCC.

b. The launch phase trajectory was nominal with SIVB C/O at about 11:45.

3. Earth Orbit.

a. The "carry-on" earth orbit block data was checked using the insertion vector and determined to be satisfactory, thus, no update was required.



Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

b. The SIVB weight and propellant quantity predictions were input to the RTCC at 19:00.

c. The Network was sent a GMTLO update, however, the command computer at CRO was inoperative at the time of the transmission (25:00) and was manually updated when the problem was corrected.

d. The TLI + 10-min abort pitch gimbal angle was computed by the ACR to be 267 and was listed on the TLI pad.

e. The TLI + 90-min abort pad with the TLI + 4-hr data in the comments was passed to the CAPCOM at 1:25:00 and verified onboard at 1:35:00.

4. TLI - The TLI trajectory appeared to be nominal, however, the crew reported high frequency vibrations about 1 min before C/0.

5. TLC.

a. The TLI + 90 min and the TLI + 4-hr abort data was checked and determined to be satisfactory, thus, no update was required.

b. After the SPS evasive maneuver, it was decided to postpone MCC<sub>1</sub> until the time of MCC<sub>2</sub>. The TLI + 25 and TLI + 35 abort data is nominally passed (after MCC<sub>1</sub> is confirmed) at a GET of 12:00:00. Since MCC<sub>1</sub> was to be delayed, we decided to pass the above abort data at 5:30:00 GET along with the TLI + 11 abort data. This decision allowed the crew to be undisturbed at 12:00:00 GET.

c. The P37 data for TLI + 11, TLI + 25, and TLI + 35 (assuming no MCC, or MCC<sub>2</sub>) was verified onboard at 5:59:00.

d. MCC<sub>2</sub> was executed nominally.

e. The TLI + 35 hr and the TLI + 53 hr block data was computed on the confirmed MCC<sub>2</sub> maneuver, verified by the ACR, and then passed to the crew. The flyby and PC + 2 pads were passed up such that there was a gap between them. That is, the flyby  $T_{TG}$  was at GET = 70:44:21 and the PC + 2 data was passed to the crew at 71:12.

(1) Passing the PC + 2 late allowed the crew to sleep late. The Retro position was that the PC + 2 data should have been passed to the crew prior to the flyby  $T_{TC}$  time, because the crew could not compute any maneuvers in the moon's sphere. However, they were on a near free-return trajectory to 85°E that only required a 13 fps correction at MCC<sub>5</sub>. The crew could have computed and performed this since it was in the earth's sphere.

(2) Original TLC block data was good without any updates because subsequent trajectory updates were very small after MCC<sub>2</sub>.

f. During the TLC phase, the prelaunch CMC clock drift was confirmed as predicted. The CMC clock was updated at about GET = 67:00 hrs with a

-.04 sec load. This update caused the CMC clock to be correct at GET = 100:00 for the DOI/Rendezvous day.

g. Prior to LOI, the onboard chart for the LOI + 15-min abort was updated with the correct data from the Abort Specialist in the ACR. The update was necessary because the onboard charts were based on a trajectory that did not reflect the G-mission ground track. This should have been updated prior to lift-off. If this was not possible, the operational people should have had prior knowledge of the situation.

6. Lunar Orbit.

a. LOI, and LOI, were executed nominally.

b. All lunar orbit block data solutions were GO without any updates, because the differences resulting from subsequent trajectory updates were very small.

c. The CMC clock was updated at about GET = 119:00 with a -.01 sec load. This update corrected the CMC clock for the landmark tracking at about 125:00 GET.

d. The LGC was initialized at about 95:00 GET. Then the LGC clock was updated with a -.62 sec load in order for it to be synced with GET.

e. The AGS was initialized at about 97:00 GET. The AGS clock was initialized 3 secs late, therefore, the KF was changed from 90:00:00.00 to 90:00:03.00 in the LGC and RTCC. The first time the crew updated the KF they input 90:00:30.00, but this was quickly noticed and soon corrected.

f. The VHF range and the RR range and range rate were continuously monitored throughout the rendezvous. The ranges agreed within 1 n.m. throughout the rendezvous.

At the start of the rendezvous they agreed very well with the relative motion on the ground, but began to differ some toward the end of the rendezvous. This difference was expected due to the way the vectors were handled on the ground. This subject will be discussed in greater detail in other reports.

g. TEI was nominal. The residuals were nulled to X = +.2 fps, Y = +1.6 fps, and Z = -.2 fps. As a result of this maneuver, the TE trajectory was well within the entry corridor. Below is a summary of the entry conditions:

CONDITION	V <sub>400 K</sub>	8	Ч <sub>400 К</sub>
Pre-TEI 31 and post-rev 31 trajec-	36314.36		-6.80
tory update Confirmed maneuver 40-min vector 8-hr vector	36314.38 36314.98 36314.67		-7.22 -8.09 -6.93

7. TEC.

a. The CMC clock was again updated with a -.03 sec load. This update corrected the CMC clock for entry.

4

b. The MCC solutions (P-37) which were run by the crew compared very well with the ground solution when the current CMC TM vector was used.

c. MCC<sub>6</sub> was computed and passed to the crew based on our best knowledge of the trajectory. It was then scrubbed based on the recommendations from the Data Selects. Due to about 3 hrs of H<sub>2</sub> venting, for a few hours prior to MCC<sub>6</sub>, the orbit determination processor had much difficulty and had not converged. The Data Selects said their confidence in their knowledge of the best trajectory was very low and that if MCC<sub>6</sub> was executed on this trajectory an MCC<sub>7</sub> would be required. They further felt that if the MCC<sub>6</sub> was performed they would not have enough data to determine the trajectory for a good MCC<sub>7</sub> solution. This is what convinced the Flight Dynamics team that we would wait and do MCC<sub>7</sub>. This was different from what we had been led to believe premission when the MCC's were scheduled. There is a lot that could be discussed on this subject and it will be in a postflight get-together.

d. The weight and aerodynamics for entry were computed based on the crew's storage status report, and G and C and EECOM's predictions of the consumables. This task was done very well with good cooperation from G and C, EECOM, and MPAD personnel.

e. MCC, was computed, passed to the crew, and executed nominally for the center of the entry corridor.

8. Entry.

a. When the EMS was initialized, it failed to scribe. It was then slewed back and forth until it started scribing. Later, at SEP, it started decrementing the range and had to be reinitialized to the next non-exit scroll. It is our opinion, at this time, that the problem at SEP was that the EMS was in AUTO instead of STANDBY and that it sensed the SEP  $\Delta V$  as .05g and started running. We immediately recommended to reinitialize to the next non-exit pattern. This was finally accomplished.

b. All other entry sequences were nominal. A summary of the entry and landing is listed below:

	- 1. 1. <sup>3</sup> - 1.	HAW 908 (EI-6:30:00)	NEB 932 (EI-1:00:00)	CMC (EI+0:06:20)	Recovery
GET 400K V400K V400K Entry Range EMS Range Ø IP XIP MAX G		191:48:54 363315 fps -6.52 1288 n.m. 1204.1 n.m. 15.07S 164.67W 6.8 G's	191:48:54 36315 fps -6.54 1290 n.m. 1206.1 n.m. 15.07S 164.67W 6.8 G's	  15.07S 164.60W	  15.03S 164.65W

9. General.

a. The ACR pitch and yaw trim values were used for the evasive and TEI maneuvers. The CMC pitch and yaw trim values were used for the MCC<sub>2</sub>, LOI<sub>1</sub>, and LOI<sub>2</sub> maneuvers. All burns showed very small transients which indicates that we had good knowledge of the C.G.

b. The RTCC and the RTACF areas gave excellent support. All problems encountered were overcome and should be fixed for subsequent missions.

c. The cooperation from all support areas was excellent and appreciated.

Tom Weekel

Thomas E. Weichel RFO, Black Team

A Receipt John S. Llewellyn

RFO, Orange Team

and to. VUSI

James E. I'Anson RFO, Maroon Team

Charles A. Deiterich

Charles F. Deiterich RFO, Launch and TLI