

# Apollo 10 Real Time Simulation debriefing

for a real-time run performed on the month of may 2023

Intention of this document is to do like a memory of the simulation performed by NASSP user TurryBoeing, and streamed online and publically on his YouTube channel.

This user is doing one of this simulations every six months (if real life allows it) since may 2021, when he attempted an Apollo 8 RTS (Real Time Simulation) using NASSP 7 as he considered that the current stable release of the NASSP project was the most adequate to perform this kind of simulations. However, an issue was found and the simulation had to be ended early (but successfully, at least for the simulated crew's lives). Issue found there is discussed on the following Orbiter-forum thread.

User decided to go to NASSP 8 Beta, and start again from Apollo 7, completing this mission successfully without completing a full specific training, at november 2021.

The following missions were completed succesfully in may 2022 (Apollo 8) and in january 2023 (Apollo 9).

## Training phase

### *Flat reform, life happens*

For Apollo 10, the training phase had to start late because we had a reform on the flat where I live with my parents, and a reform that I knew about since october 2022, and we HAD to perform. Reform consisted on a full change of our bathrooms (main and auxiliary one), gas system rerouting and recertification (this was the main issue, as now we own the flat and responsibility of law infringement on regular inspections is on our side now; for example, butane tank was placed on a place where it couldn't be, same for water heater as we needed to put its exhaust gases away directly outside instead of using the common funnel for all the building, and we also needed a cooking fume extractor that extracted through the building funnel), water tubing rerouting and renewal, electric circuit redistribution and renewal (we were using iron tubes that were unchanged since the flat was built around 1972 and were really obscured of water residues, and also cables were routed and installed without any logic or standard), new kitchen (complete new kitchen). Reform was scheduled to last around one month, but took around two weeks longer because of workers holidays for carnival and other logistics issues. In the end, those were not a big deal. The worst part of it was that when I was on the afternoon shift I had to wake up a little bit earlier than 9:30 AM, because they started to work at 8:00 AM (there is a law here in Spain wich is called the "noise law", wich I support; you cannot make disturbing noises (play loud music, party aloud, loud TV, noise with drills or hammers or things like that) from 8:00 PM till 8:00 AM, because there are persons who wake up early (really early) for work). Also I felt extremely bored sometimes because I could not do anything with the computer and using the laptop was uncomfortable... but I killed that by going outside for long walks, watching TV, reading, and that was enjoyable.

"But why are you 32 and don't have your own house???" That is another topic, but I said on Apollo 7 that I wanted to live alone ASAP, but now I gave that a rethought, and I think that the best option for me is to stay living with them. They helped me a lot during my life getting care of me, supporting me in everything that I did (even when I started failing at school around 2006, yeah I am a bad student), and for sure took many advantages and probably a lot of selfish ones. I have to give it back to them when they are old (wich they are starting to be, my father is 62 and retires on february 2024 (still with 62, he really deserves it!), and my mother is 61) I will help them live, and I

could keep the flat once they are gone (in 15 or 20 years, wich go by fast, and they had a hard life). Everything I have is for sure thanks to them, and also to my sister who is 38. However, I still consider getting like a small apartment or studio, for when they are really old, and we start to really collide or I for sure disturb them doing these RTS stunts, or just playing videogames. Getting a flat is really hard in Spain, I don't have a partner (or intend to have... but I guess it will come someday :-)) , so it will have to be all paid by myself, my salary is not bad but not great, and I don't expect the situation to get better anytime soon. Apollo 9 and 10 (as you will see further ahead on this debrief) were a lot easier for lunch, dinner, sleep. (More regular, longer periods) (Yes, I can't cook, but I am working on it! :P )

### Training starts

For Apollo 10 I didn't want to move the mission away from May, as I want to stick to doing them in May and in November, because those are months that I enjoy and that are easier for me to get holidays on. I want to keep holidays regular so it's easier for my companions at work, wich already know that I do these. Here in Spain we have 22 days in the year to pick for holidays, and I have the luxury to take them when I want. (With the corresponding notice of course). Taking them in these months allows me to pick some additional days corresponding to national, regional or local holidays, so I have more days available for non RTS stuff.

Practise run for the Real Time Simulation started on march 4th, and was done in somehow long sessions, to be able to end quickly and get into the specific training soon.

Picture represents my plan of GET's to get to each day for the month of march. It was a bit challenging also because one of my companions was still on absence from work because he had a baby on october (and that is why Apollo 9 was performed on january instead of november, I knew that since july 2022). "T" and "M" on that calendar represents my scheduled work shift ("Tarde" = "Afternoon, 12-20", "Mañana" = "Morning, 08-16")

## Marzo 2023

Calendarpedia  
Your source for calendars

Sem.	Lunes	Martes	Miércoles	Jueves	Viernes	Sábado	Domingo
9	27	28	1	2	3	4 0 ✓	5 10 ✓
10 T	6 16 ✓	7 20 ✓	8 24 ✓	9 30 ✓	10 38 ✓	11 50 ✓	12 62 ✓
11 M	13 68 ✓	14 74 ✓	15 80 ✓	16 86 ✓	17 90 ✓	18 96 ✓	19 106 ✓
12 T	20 110 ✓	21 114 ✓	22 121	23 126	24 132	25 144	26 156
13 M	27 164	28 176	29 180	30 184	31 188	1 196	2

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You might see that there are no ticks from hour 121, because I found ways to hack the flightplan and hours per day, during Trans Earth Coast, to finish even sooner.

Specific training started on April 7th 2023, as I took the chance to disconnect a bit after the initial practise run was complete. For the specific training I focused on activities on the moon, specifically the FD5 10 hours run, from 96h to 106h. I performed two additional full flight day 5 simulations on April 29th and May 13th.

I struggled a lot with the rendezvous part of the mission and failed almost all of the attempts to perform it:

- April 15th: Possible side lobe after CSI, which I couldn't get around; failed rendezvous
- April 22nd: Success 96h to 106h.
- May 7th: Rendezvous failed (crew called the failure and sim interruption) after CSI. Pilot induced procedural error, lack of P20 knowledge (unable to understand and react to P20 program alarms, also lack of knowledge on how to react to 06 49's).
- May 13th: (Training added because of the previous fail) Not completed to 100% because of pilot procedural mistake (human factor, stress related, as pilot blocked himself and didn't see at all a clearly highlighted item on electronic checklist that was waiting for around 20 minutes to be performed to allow the RR to move; checklist was not scrolled causing it to not be seen, it was there all the time) in preparation for Insertion burn. Recovered later on another run the same day, after explanations by MCC. Learned about VHF Markings for the first time.
- Unknown dates, but around end of April and first days of May: Theoretical training, reading about P20, Rendezvous software routines, recovery procedures... asked and got answers for many questions.
- May 17th: Additional unscheduled practise to attempt a recovery of the situation at the moment of interruption of the May 7th run. Not completed, but learned much. Launch was next day, crew was unable to complete rendezvous consistently, but decided to not scrub the launch taking advantage of the "time to think" that a RTS run provides. I might be worse if I kept on overtraining as I might fall on a "damn I can't do this!" negative thoughts spirale. Tried to sleep well that night.

### Streaming goals, mission objectives

#### *Apollo 10 mission*

Apollo 10 is the second crewed flight to the moon, carrying Lunar Module 4 (LM-4) nicknamed "Snoopy" and Crew and Service Module 106 (CSM-106) nicknamed "Charlie Brown". The main goal of the mission was a rehearsal and validation test for the Apollo mission, but without the actual landing: to test the LM in lunar orbit environment, perform a DOI burn and perform a rendezvous with the CSM.

#### *"Another" Real Time Simulation stream*

Didn't want to do anything different than the Apollo 9 or 8 livestreams for the RTS, but wanted to see if it was possible for Apollo 10 to be the first one to complete without simulation reloads because of stutter. Almost got it, as another obscure bug was found on Flight Day 5 and caused a crash to desktop. Another challenge for the livestream was to perform the black and white TV camera transmission after TEI. Couldn't complete it very well as I messed the camera settings when trying to change it to black and white.

## Flight Day 1 (may 18th, 08:04 AM to may 19th, 01:49 AM)

First day of the mission started at 08:04 AM, when I woke up for the mission. I wake up a bit earlier than T-4 hours, to prepare the PC, make sure that it's OK, prepare OBS, start the stream, confirm connection to YouTube's stream server, start Orbiter, launch the Apollo 10 launch scenario and leave paused at T-4 hours, go have breakfast. This time it was easier than on the first lunar mission, as was already a bit of natural light at the time of wake up.

After a quick but good breakfast I started the stream at the scheduled time.

For this mission I was using the high resolution VC branch from @jordan64, wich was aligned with "master" at the date of liftoff for this RTS. On previous tests I already observed that performance was better.

Activities for this first flight day would be as follows:

- Startup checklist and backup crew prelaunch procedure

Startup checklist was started at T-3:59:29 and completed at T- 03:55:59, and then the backup crew prelaunch procedure was started.

Backup crew prelaunch procedure was complete at T- 03:23:47. Prime crew pre ingress procedure was performed between T -02:59:20 and T -02:56:00.

- Prime crew prelaunch procedure

After some refreshment and saluting a beagle who looked like he could snoop around the lunar surface to find a proper landing site, pre launch procedure itself started at T-02:37:40 and concluded nominally without major things to point out. Because of the event occured during boost of Apollo 9 RTS where suit temperature reached high values, more care was applied on the following step of the backup crew prelaunch procedure, and monitoring of that temperature was done during prelaunch and boost of this Apollo 10 RTS.

615	SUIT H2O ACCUM AUTO - ctr			
616	SUIT H2O ACCUM ON - ctr			
617	SUIT HT EXCH - ON for 20 sec			
618	SUIT HT EXCH - off (ctr)	20	HIDDEN DELAY	
619	SEC COOL EVAP - RSET for 58 sec			
620	co2 PP ind - 0.0 mmHg	58	HIDDEN DELAY	
621	SEC COOL PUMP - off (ctr)			
622	GLY EVAP IN TEMP - MAN			
623	GLY EVAP STM AUTO - MAN			
624	GLY EVAP STM INCR - INCR for 58 sec			
625	GLY EVAP STM INCR - DECR for 8-9 sec	58	HIDDEN DELAY	
626	GLY EVAP STM INCR - ctr	8	HIDDEN DELAY	
627	GLY EVAP H2O FLOW - off (ctr)			
628	CAB TEMP - MAN			
629	CAB TEMP tw - max decr			
630				
631	HI GAIN ANT PWR - OFF			
632	HI GAIN ANT TRACK - AUTO			
633	HI GAIN ANT BEAM - WIDE			
634	HI GAIN ANT SERVO - PRIM			
635				
636	S BD XPNDR - PRIM			3
637	S BD PWR AMPL HI - HI			
638	PWR AMPL tb - gray (after 90 sec)	92	HIDDEN DELAY	
639	VHF AM B - DUPLEX			
640				
641	MODE - INTERCOM/PTT			9
642	PAD COM - T/R			
643	PAD COM VOL tw - 5			

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Startup Checklist
Backup Crew Prelaunch Checklist
Prime Crew Prelaunch Checklist

- Saturn V Boost procedure
  - AS-505 lifted off at 12:49
    - Roll program was called at 12 seconds
    - Pitch program was called at 30 seconds
    - Mode I-B was called at 42 seconds
    - Cabin pressure relief was observed starting at 54 seconds
    - Mode I-C was called at 2 minutes
    - SIC Inboard engine out occurred at 2 minutes 15 seconds
    - SIC-SII staging occurred at 2 minutes 45 seconds
    - Skirt sep occurred at 3 minutes 15 seconds
    - Tower jett occurred at 3 minutes 22 seconds
    - SII Inboard engine out occurred at 7 minutes 44 seconds
    - SII-SIVB staging occurred at 9 minutes 15 seconds
    - SECO occurred at 11:42
  - Data from DSKY was:
    - 06 62: +25565;+00004;+01029
    - 16 44: +01036;+01019;-59 59

- Post insertion checks and config

Insertion checklist was started at 0:14:32 GET, and the following data was recorded at 28 minutes, 45 seconds into the flight:

- O2, H2 quantity: 99 percent.
- Fuel Cell 1 amps: 20A; Fuel Cell 2 amps: 24A; Fuel Cell 3 amps: 16A
- Main A Volts: 28V
- Main B Volts: 29V
- SPS Fuel, SPS Oxid: 99%, recorded at 35 minutes into the flight.

An SCS Attitude reference comparison check was performed at 01:33:30, and data is as follows:

DSKY (IMU)	ASCP (IMU)
+17937	179,5
+00466	4,8
+00099	0,9
DSKY (GDC)	ASCP (GDC)
+17913	179,1
+35403	354,5
+00091	000,7

Docking probe was extended successfully at 01:37:05 GET.

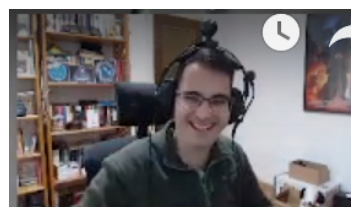
TLI +90 minutes PAD was received at 01:40:00 GET and can be viewed [here](#). CSM State vector update and a V66 was uplinked to the CSM at 01:40:50 GET, concluding the post insertion checklist.

TLI +4 hours PAD was received at 01:44:20 GET and can be viewed [here](#).

TLI PAD was received at 01:47:20 GET and can be viewed [here](#).

- TLI

For the first TV transmission of the mission, wich would feature the crew performing the transposition and docking maneuver, a test was performed to attach the TV camera to the head of the CDR starting at 01:48:15 GET.



TLI preparation checklist was started at 01:55:25 GET, and S-IVB TIG -9 minutes was reached at 02:24:17 GET, and a nominal S-IVB reignition occurred at 02:33:17 GET. Burn duration was 5 minutes and 43 seconds. Noun 62 showed the following after TLI:

- +35615; 04459; 01716

Noun 83 showed the following:

- +95747; 10854; 40159

EMS Counter was -18,2

- Transposition, Docking, LM Extraction – First TV transmission

Preparations for turning around and docking with LM-4 were started soon after TLI. Cabin pressure was configured for being at 5,7 PSI starting at 02:45:40 GET, by opening the Direct O2 valve.

S-IVB started maneuver to separation attitude at 02:54:00 GET. Maneuver was complete by 02:57:08 GET.

SM RCS Hot fire was performed at 02:58:30 GET, test passed.

Direct O2 valve was closed at 03:00:00 GET.

TV came up and was received at 03:00:35 GET.

Separation from S-IVB occurred late, but at 03:03:04 GET and crew lost the time reference. What happened was that the doorbell sounded 10 seconds before expected sep. Pitcharound started at slow rate but was corrected later to 2 degrees per second, because FDAI scale was set incorrectly.

Visual inspection, docking target was clear, S-IVB was clear and SLA panels were clear.

Soft dock occurred at 03:11:53 GET. Hard dock at 03:12:17 GET.

After docking, an CSM/LM pressure equalization was performed. Crew transmitted a launch debriefing at 03:28:05 GET, and it was as follows:

“I think that launch was pretty good, nothing special to comment there, the suit temperature was high again, but not as high as on Apollo 9 because we figured out what happened there, it was a mistake on the checklist I did on Apollo 9 so I avoided it today, knowing what happened there, and yeah, launch was pretty smooth, we used the cue cards for that, hard to read the cue cards during all the shaking of launch, I think that is realistic and normal, no problem there. Then, nothing special to comment there. We had TLI on time, perfect, spot on. For T&D we had to delay the separation for 1 minute because life happened and I think the docking was good, we went a little bit far from the S-IVB because of losing the time reference but we were able to align properly, we were a bit off of the target at the beginning, but we were able to maneuver properly in place, docking speed I think was good, and it was easier than all the previous missions, Apollo 7 and Apollo 9 because there was no aero stuff messing around our trajectory. So yeah, I think it was pretty good”

PAD for SPS evasive maneuver was received at 03:34:04 and it can be viewed [here](#).

CSM/LM pressure equalization and tunnel verification was complete at approximately 03:50:00 GET.

LM started receiving power from CM at 03:47:26 GET.

By using the S-IVB/LM separation switch at 04:09:05 GET, the Apollo spacecraft separated from the S-IVB booster. A 3 seconds -X RCS translation burn was executed at 04:09:10 GET, and the following data was shown on DSKY and on EMS counter:

DSKY R1	-00004
DSKY R2	-00002
DSKY R3	+00000
EMS Counter	100,6

- SPS Evasive maneuver

Maneuver to SPS evasive maneuver was started at 04:11:08 GET, and attitude for this burn was achieved at 04:15:07 GET.

P30 for SPS evasive maneuver was executed at 04:15:37 GET and obtained the following orbit prediction, and DVR: +99999;+01222;+00197.

Burn was performed with SPS at 04:39:04 GET, with bank A. Burn duration was 4 seconds. No ullage was performed. Post burn data is as follows:

DSKY 16 85 R1	+00007
DSKY 16 85 R2	-00001
DSKY 16 85 R3	-00002
EMS Counter	-3,6
Fuel, Oxid, Unballance (post-burn)	99,6%, 99,6%, 0

- P23 runs

Starting at 05:32:10 GET, the following P23 runs were made: 2 sets of Star 40, Earth Near Horizon. 2 sets of Star 33, Earth Far Horizon. 1 set of star 42, Earth Near Horizon. Results were as follows:

Set 1: Star 40, Earth Near Horizon

DSKY 06 49 R1	+00087
DSKY 06 49 R2	+00207
06 49 accepted?	No
DSKY 06 49 R1	+00035
DSKY 06 49 R2	+00102
06 49 accepted?	Yes

Set 2: Star 40, Earth Near Horizon

DSKY 06 49 R1	+00048
DSKY 06 49 R2	+00342
06 49 accepted?	Yes ("let's see what happens")

Set 3: Star 33, Earth Far Horizon

Star was changed to Star 34 because LM was on the way

DSKY 06 49 R1	+00083
DSKY 06 49 R2	+00251
06 49 accepted?	Yes

Set 4: Star 34, Earth Far Horizon

DSKY 06 49 R1	+00015
DSKY 06 49 R2	+00068
06 49 accepted?	Yes

Set 5: Star 42, Earth Near Horizon

DSKY 06 49 R1	+00328
DSKY 06 49 R2	+00708
06 49 accepted?	No
DSKY 06 49 R1	+00402
DSKY 06 49 R2	+00811
06 49 accepted?	No
DSKY 06 49 R1	+00440
DSKY 06 49 R2	+00801
06 49 accepted?	No

P23 runs were finished at 06:30:00 GET

- MCC-1

Decision to scrub MCC-1 was received at 05:59:20 GET, and was expected by crew.

Maneuver to PTC attitude was started at 11:51:48 GET. PTC right roll rate of 0,3 degrees per second was started at 12:19:43 GET.

Crew started an sleep cycle from 13:00:00 GET to 21:25:00 GET.



## Flight Day 2 (may 19th, 10:15 AM to may 19th, 22:50 PM)

Flight Day two activities would be as follows:

- P23 runs

Starting at 25:00:10 GET, the following P23 runs were made: 1 set of Star 44, Earth Near Horizon. 1 set of Star 37, Earth Far Horizon. 2 sets of star 33, Earth Far Horizon. 1 set of Star 45, Earth Near Horizon. Results were as follows:

### Set 1: Star 44, Earth Near Horizon

Star was changed to Star 41 because LM was on the way

DSKY 06 49 R1	+00162
DSKY 06 49 R2	+00434
06 49 accepted?	No
DSKY 06 49 R1	+00069
DSKY 06 49 R2	+00205
06 49 accepted?	Yes

### Set 2: Star 37, Earth Far Horizon

DSKY 06 49 R1	+00098
DSKY 06 49 R2	+00299
06 49 accepted?	Yes

### Set 3: Star 33, Earth Far Horizon

DSKY 06 49 R1	+00014
DSKY 06 49 R2	+00047
06 49 accepted?	Yes

### Set 4: Star 33, Earth Far Horizon

DSKY 06 49 R1	+00088
DSKY 06 49 R2	+00310
06 49 accepted?	Yes

### Set 5: Star 45, Earth Near Horizon

DSKY 06 49 R1	+00013
DSKY 06 49 R2	+00034
06 49 accepted?	Yes

P23 runs were finished at 25:36:40 GET.

- MCC-2

PAD for MCC-2 was received at 25:39:00 GET and can be viewed [here](#). P30 for Mid Course Correction 2 was executed at 26:00:32 GET and obtained the following orbit prediction, and DVR: +99999;-01663;+00524. Maneuver to burn attitude was started at 26:07:23 GET. Star attitude check was performed and passed at 26:19:01 GET.

Burn was performed with SPS at 26:32:56 GET, starting with bank B but both banks were used, A was added at T +5 seconds. Burn duration was 7 seconds. No ullage was performed. Post burn data is as follows:

DSKY 16 85 R1	-00002
DSKY 16 85 R2	+00004
DSKY 16 85 R3	+00002
DSKY 16 44 R1	+99999
DSKY 16 44 R2	-01657
DSKY 16 44 R3	-59 59
EMS Counter	-4,5
Fuel, Oxid, Unballance (post-burn)	98,3%, 98,3%, 0

- Second TV transmission

Starting at 27:15:21, crew initiated the second TV transmission (color), until 27:31:59 GET. Crew showed some PTC preparation procedures, and cockpit tour.

After enjoying 6 and a half hours of “do nothing”, crew started an sleep cycle from 34:13:30 to 43:00:00 GET.

### Flight Day 3 (may 20th, 07:50 AM to may 20th, 22:50 PM)

Flight Day three activities would be as follows:

- MCC-3 decision

Flight day three could really be summarized as low workload hours, trans lunar coast enjoyment. The low workload hours during Apollo 9's FD6 to 10 really helped me cope with these situations of "boredom". Before the MCC-3 scrub decision which came at 52:27:13 GET, PTC was interrupted and restarted between 44:51:14 GET and 45:28:25 GET, for a P52 IMU realign.

- Third TV transmission

Crew started the third TV transmission of the mission at 54:05:02 GET. Crew showed another PTC reestablishment, because some moments earlier PTC was interrupted for a P52 IMU realign. TV finished at 54:15:49 GET.

Crew started an sleep cycle from 58:27:30 to 68:00:00 GET.

## Flight Day 4 (may 21th, 08:50 AM to may 22nd, 01:50 AM)

Flight Day four would be the first day on lunar orbit, and activities would be as follows:

- MCC-4 decision

MCC-4 scrub decision came at 69:27:13 GET, and at 69:34:33 GET, this PC+2 PAD was received. PTC for the Trans Lunar Coast was finished at 69:38:02 GET. Spacecraft was maneuvered to the following "TV attitude": R +330, P +30, Y +0.

Preliminary LOI-1 PAD was received at 71:27:13 GET, and can be viewed [here](#).

TEI-1 and 4 PAD's were received at 71:32:15 GET, and both can be viewed [here](#).

- Fourth TV transmission

Crew started the fourth TV transmission at 72:21:37. Crew showed pictures of planet Earth, that was visible on Window 1 because of the TV attitude established before. Could see Atlantic Ocean, Africa and cloud coverage over the north atlantic. North polar cap and south Pacific Ocean were visible. The Earth axial tilt was also noticeable. After showing Earth, crew gave a brief tour around the cockpit. TV finished at 72:36:00.

- LOI-1

While waiting for lunar orbit insertion preparations, Map Update for Revolution 1 was received at 73:42:12 GET. It can be viewed [here](#). Final LOI-1 PAD was obtained at 74:27:13 GET, and it can be viewed [here](#). P30 for Lunar Orbit Insertion 1 was executed at 74:30:00 GET and obtained the following orbit prediction, and DVR: +03973;-01005;+29985. Maneuver to burn attitude was started at 73:37:36 GET. Star attitude check was performed and passed at 73:40:40 GET.

Burn was performed with SPS at 75:58:20 GET, starting with bank A but both banks were used, B was added at T +3 seconds. Burn duration was 6 minutes and 12 seconds. No ullage was performed. Post burn data is as follows:

DSKY 16 85 R1	+00004
DSKY 16 85 R2	+00001
DSKY 16 85 R3	+00001
DSKY 16 44 R1	+01703
DSKY 16 44 R2	+00600
DSKY 16 44 R3	-59 59
EMS Counter	-5,3
Fuel, Oxid, Unballance (post-burn)	38,8%, 38,8%, 0

A 315° pitch orbital rate, heads up, was started at 76:32:15 GET. Map update for revolution 2 was received at 76:31:00 GET, and can be seen [here](#).

- LOI-2

While waiting for lunar orbit insertion 2, spacecraft was oriented to the "sleep attitude" of P 208, R 135, Y 0. LOI-2 PAD was received at 78:38:23 GET and can be viewed [here](#). Maneuver to burn attitude was started at 78:50:00 GET and accomplished at 78:53:11 GET. Attitude was not held until later. TEI-5 PAD was received at 78:53:40 GET, and Map update for revolution 3 was received at 78:58:45 GET. Both PAD's can be viewed [here](#). P30 for LOI-2 was executed at 78:59:50 GET and obtained the following orbit prediction, and DVR: +00603;+00603;+01391. LOI-2 burn attitude was reestablished at 79:29:03 Star attitude check was performed and passed at 79:31:54 GET. Burn was performed with SPS at 80:09:34 GET, starting with bank A but both banks were used, B was added at T +3 seconds. Burn duration was 15 seconds. 17 seconds 2 jets ullage was used. Post burn data is as follows:

DSKY 16 85 R1	-00004
DSKY 16 85 R2	-00002
DSKY 16 85 R3	+00000
DSKY 16 44 R1	+00604
DSKY 16 44 R2	+00599
DSKY 16 44 R3	-59 59
EMS Counter	-6,0
Fuel, Oxid, Unballance (post-burn)	36,5%, 36,5%, 0

- Fifth TV transmission

After LOI-2 burn, a 315° ordeal pitch heads down attitude was established at 80:49:20 GET, for lunar surface observation. The fifth TV transmission was started at 80:55:32 GET, featuring the lunar surface in color. Crew explained the activities that will be performed on LM “Snoopy” on Flight Day 5. TV ended at 81:04:44 GET. PAD for P22 auto optics was received during this TV transmission and can be viewed [here](#). Spacecraft attitude was changed to R 180, P 205, Y 358.