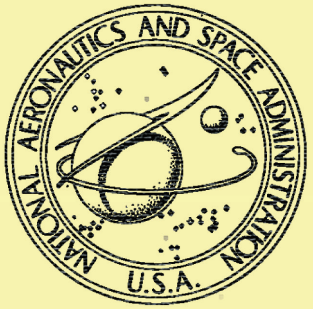
MSU 2016



APOLLO 11

SIGHTS AND SOUNDS

by Noah Hines
STA 380 - Electronic Art
Michigan State University 2016

ELECTRONIC ART AND INTERMEDIA I

MICHIGAN STATE April 2016

“We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard.”

John F. Kennedy. 12 September 1962

Introduction

This book is best accompanied with the included audio recording and a tall glass of water. The accompanying audio as well as the book can be found on my website: www.NoahHines.com/apollo. For the best experience, listen with headphones or stereo speakers in a quiet environment.

The soundscapes are designed to be a binaural representation of the sounds heard inside the Lunar Module (LM) during the Apollo 11 mission. All radio transmissions were taken from NASA's extensive online library, which offers full audio coverage of the Apollo missions. Digital synthesizers were used sparingly to preserve the authenticity of the Apollo 11 experience. The low-frequency hums during launch, for instance, were created by combining the televised launch audio with my own digital synthesizers. Without the added synthesizers, the listener would be sitting front row, rather than performing on stage.

To begin, turn the page and listen to **Track 1: Launch.**

Contents

Launch

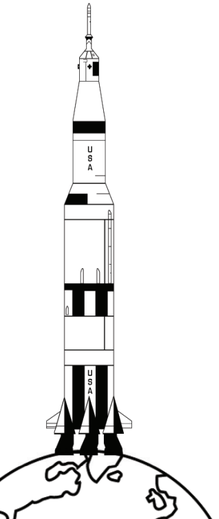
Commander Neil A. Armstrong, Command Module Pilot Michael Collins, and Lunar Module Pilot Edwin “Buzz” Aldrin enter the Command Module (CM) “Columbia” hours before the scheduled 9:32 A.M. launch time.

The Saturn V rocket launches at the Kennedy Space Center at 9:32 a.m. July 16, 1969. Within 12 minutes, the rocket reaches Earth orbit, where the Saturn V engines prepare for trans-lunar injection.

The Saturn V (pronounced “Saturn Five”) is a 6,540,000 pound, three-stage liquid-fueled launch vehicle. It has been used in 13 missions and has never resulted in loss of crew or payload. As of 2016, Saturn V is also the most powerful rocket ever launched. This extra power is necessary to carry out the extreme demands of the Apollo 11 mission, where the payload is upwards of 90,000 pounds.

An estimated 1 million observers throughout Brevard County, Florida gather to watch the sky in anticipation for the launch of the first lunar landing mission.

000:01:02 McCandless:
Apollo 11, Houston. You’re good at 1 minute.

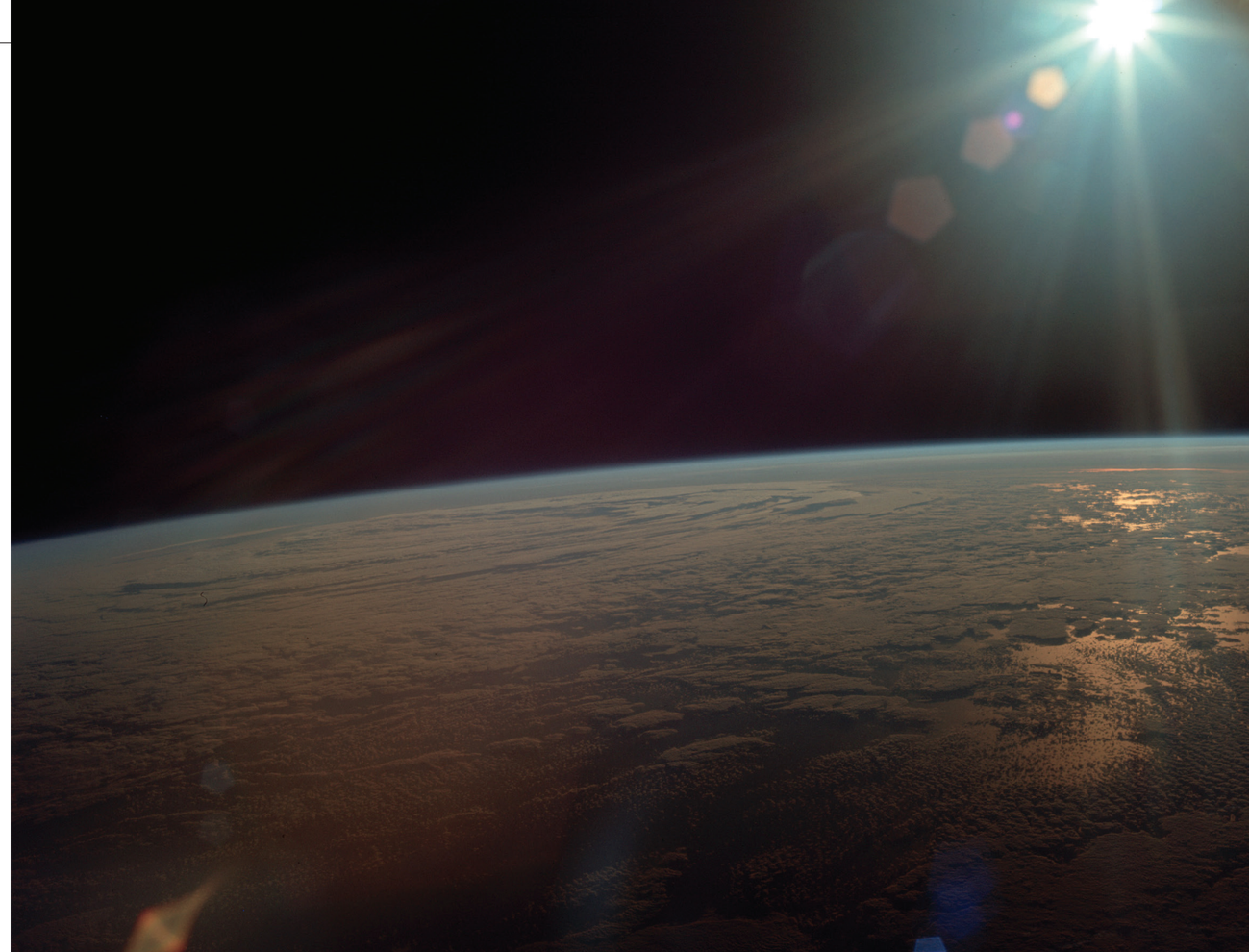


Earth Orbit

The Saturn V is an assembly of three spacecraft, each serving a special purpose in the mission. This assembly was required to achieve Lunar Orbit Rendezvous (LOR): a manned spacecraft strategy where the lunar lander independently descends to the surface of the Moon, while the main spacecraft remains in lunar orbit. Despite this being the first LOR attempt, the strategy was found to be the cheapest and most likely to succeed.

After one and a half orbits and 2 hours 44 minutes into the mission, the Saturn V re-engages its stage 3 rockets. Starting at 26,000 feet per second, the rocket quickly begins accelerating up to 35,000 feet per second towards the moon. To achieve lunar orbit, the rocket must aim for a location ahead of the moon, since the moon moves at an average speed of 2,288 miles per hour.

000:12:06 McCandless:
Apollo 11, this is Houston. You are confirmed Go for orbit.



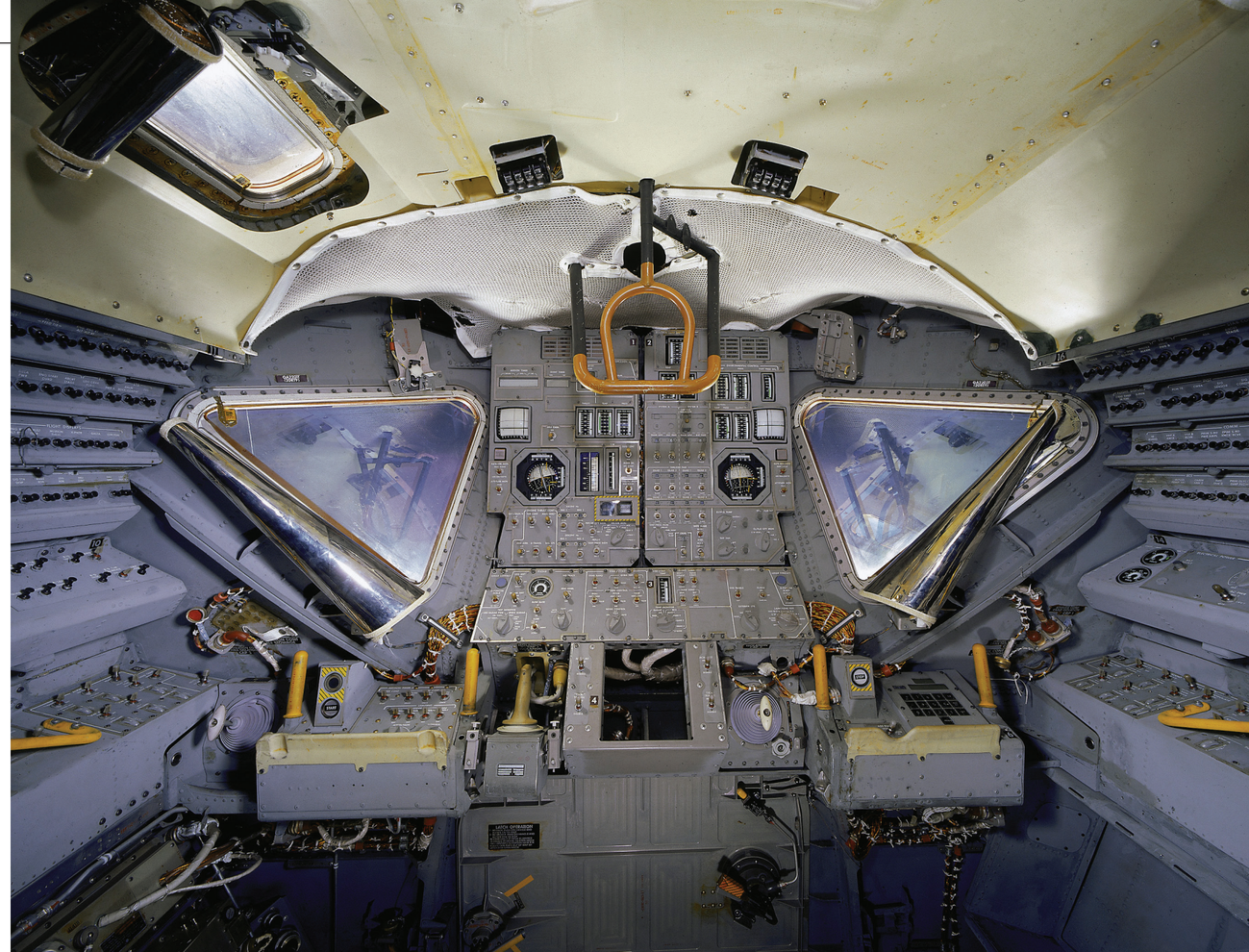
The Eagle

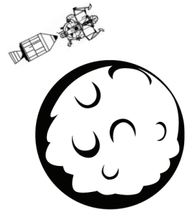
While Apollo 11 drifts towards lunar orbit, Armstrong and Aldrin move into the Apollo 11 Lunar Module: the Eagle. Armstrong and Aldrin are prepping supplies for the landing when they notice a communication loss. Communication is quickly reestablished by adjusting the onboard antennas and Apollo Control can begin preparations for crossing the Moon's sphere of influence.

The sphere of influence marks the point where the Moon's gravitational force overpowers the Earth's. Instead of Apollo 11 fighting the gravitational force pulling it towards Earth, the ship is now being helped by the Moon, which is pulling it towards the lunar surface.

The ship's velocity is currently 1,990 feet per second with respect to the Earth. But from now on, Apollo Control will be doing calculations with respect to the Moon, which finds the CM's velocity to be 3,272 feet per second.

060:11:51 Aldrin:
Roger. We read you loud and clear.





Lunar Orbit

Emerging from the far side of the Moon, Apollo 11 successfully enters lunar orbit. Armstrong and Aldrin quickly prepare to separate from the CM, where Michael Collins will be left behind to manage communications and help with the lunar ascent rendezvous.

To reach the lunar surface, the LM must undergo a Descent Orbit Insertion (DOI) burn. This maneuver allows the LM to avoid lunar mountains that reach as tall as 20,000 feet on its journey to the Moon's surface.

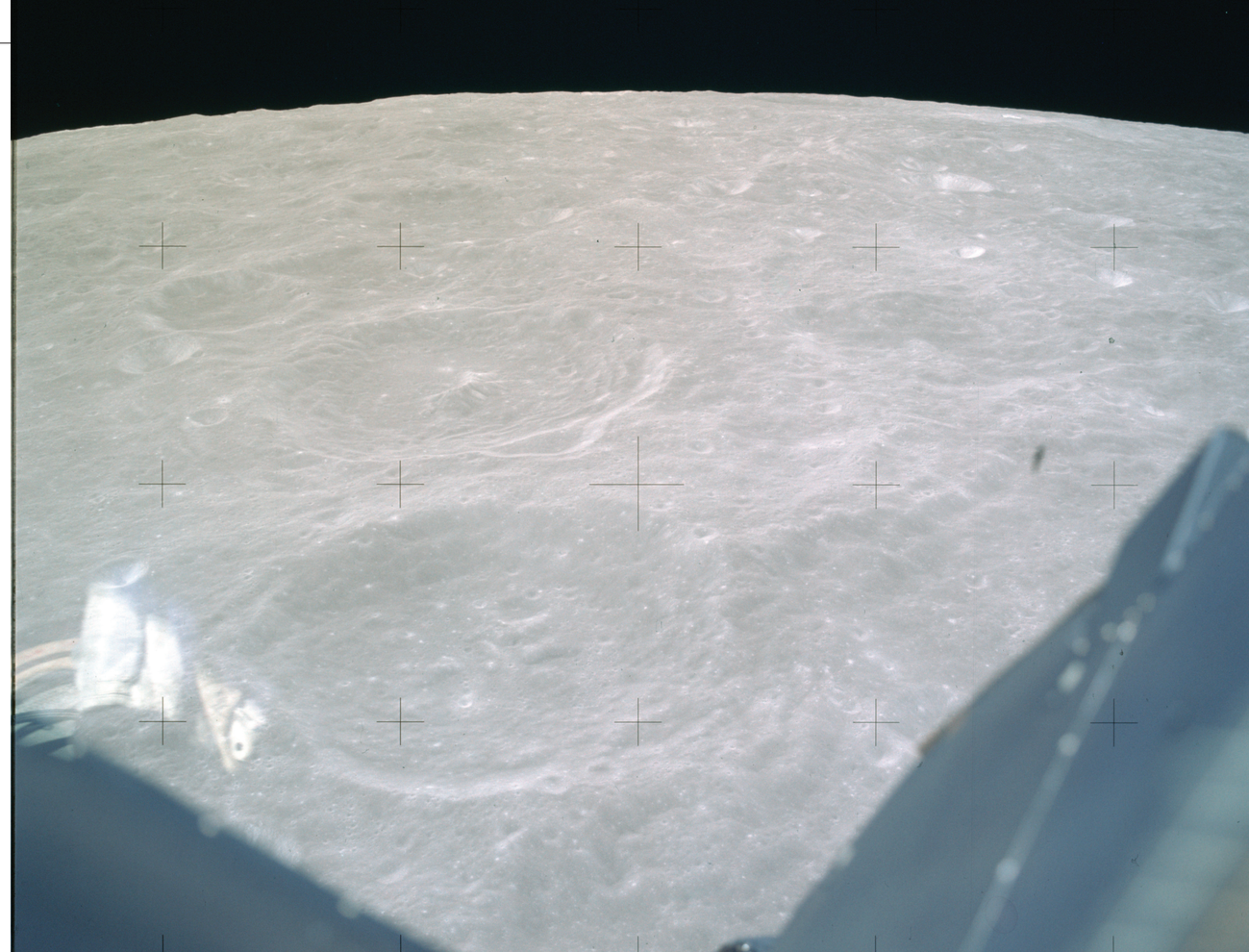
076:34:34 Armstrong:
It looks very much like the pictures, but like the difference between watching a real football game and one on TV.

Lunar Descent

Five minutes into lunar descent, an error appears on the LM navigation and guidance computer: 1202 Alarm.

The tone of communications immediately shifts to swift urgency. Armstrong can be heard requesting the lookup on the alarm. Apollo Control quickly diagnoses the problem as an executive overflow error, and gives Armstrong and Aldrin the Go for landing.

102:38:53 Duke:
We got you... We're Go on that alarm.



Lunar Contact

Landing on the Moon marks the ending of the most difficult part of the mission. During descent, the Eagle used nearly all of its fuel. This close call, and the fact that this was the first attempt at an LOR, is certainly a call for celebration. The nervous excitement that aroused Apollo Control is best summed up by CAPCOM Charles Duke's response:

"Roger, Twank... Tranquility, we copy you on the ground. You got a bunch of guys about to turn blue. We're breathing again. Thanks a lot!"

102:45:58 Armstrong:
Houston, Tranquility Base here.
The Eagle has landed.

A Small Step

600 million people around the world watch Neil Armstrong take the first step on the Moon. Due to static on the transmission, Armstrong's famous quote is misheard. It sounds like he says "small step for man", but Armstrong actually says "small step for a man".

Walking along the surface, Armstrong describes the qualities of the dust and rock that are displaced by his boots. Following behind, Aldrin exits the Eagle and the two astronauts begin taking pictures of the first footprints on the Moon.

109:24:23 Armstrong:
That's one small step for (a) man; one giant leap for mankind.

The Flag

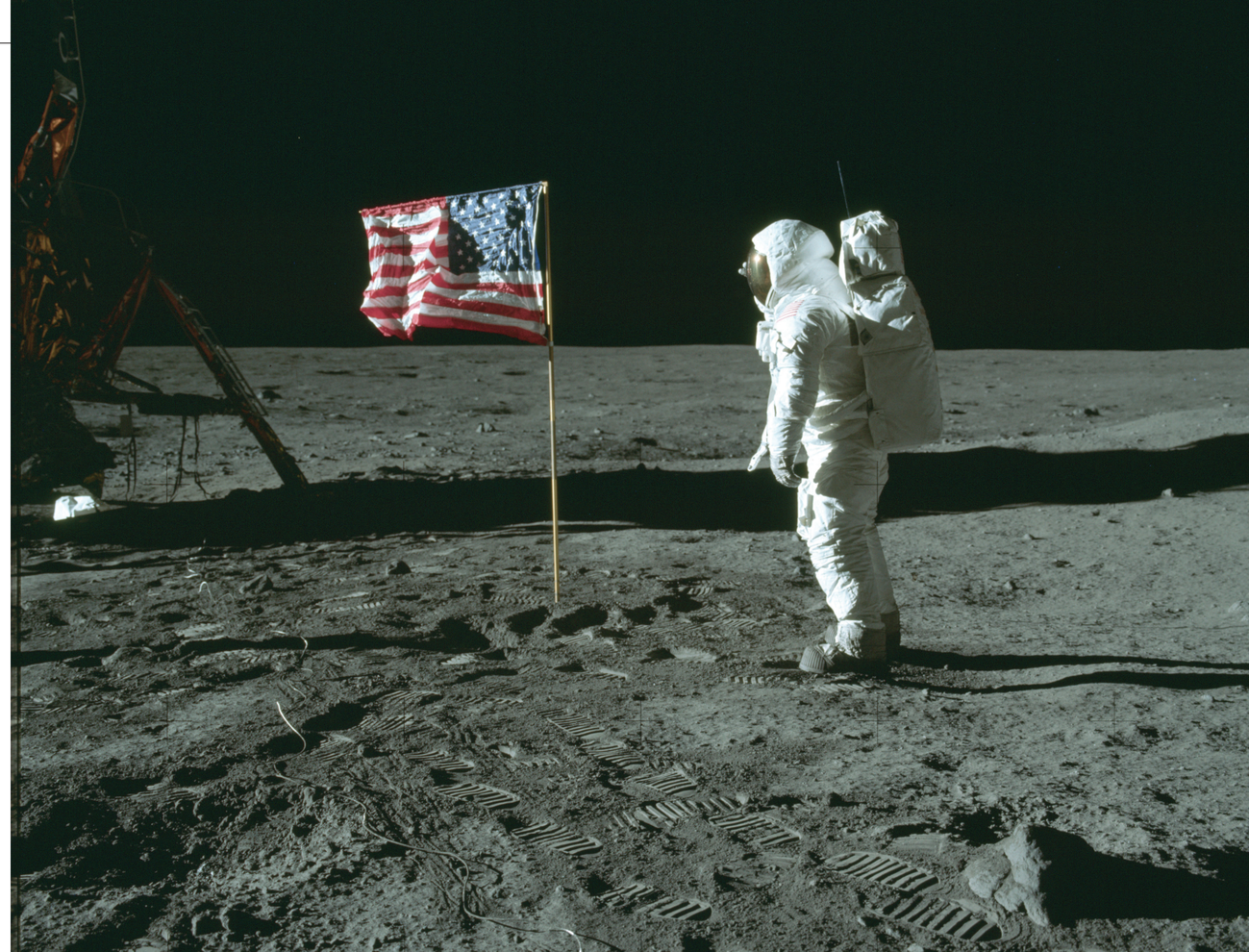
It was Richard Nixon's 1969 inaugural address that inspired NASA to plant a flag on the Moon.

"As we explore the reaches of space, let us go to the new worlds together -- not as new worlds to be conquered, but as a new adventure to be shared."
-Richard Nixon 1969

Since there is no wind or atmosphere on the Moon, a horizontal bar is used to support the flag. After the flag is erected, the nylon material slowly vibrates, which will inspire conspiracy theorists for years to come.

Many Americans expected controversy over the flag, but, the act was well-received around the world.

110:09:43 McCandless:
They've got the flag up now and you can see the stars and stripes on the lunar surface.



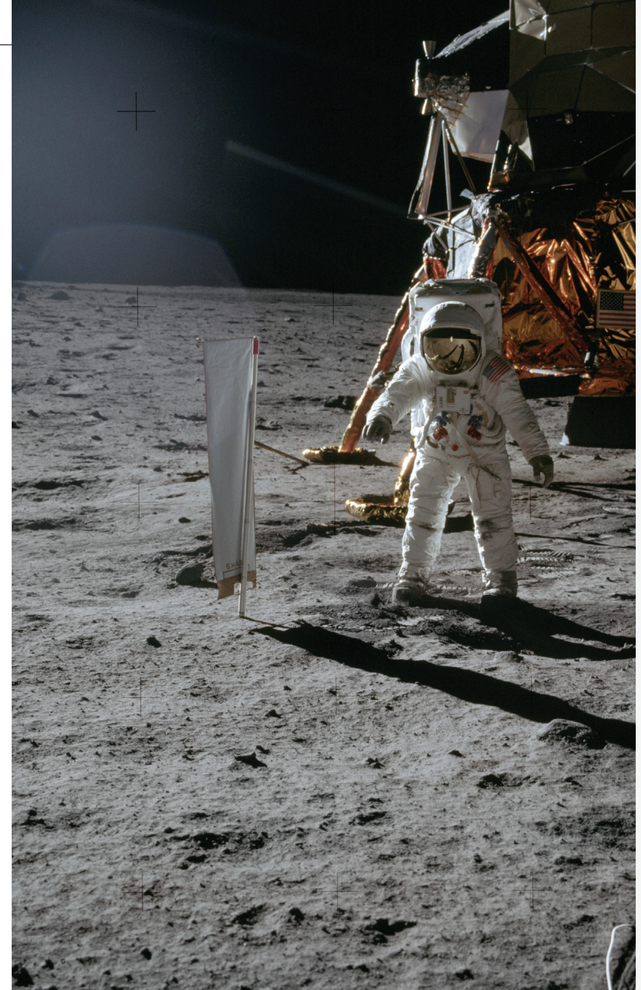
Experiments

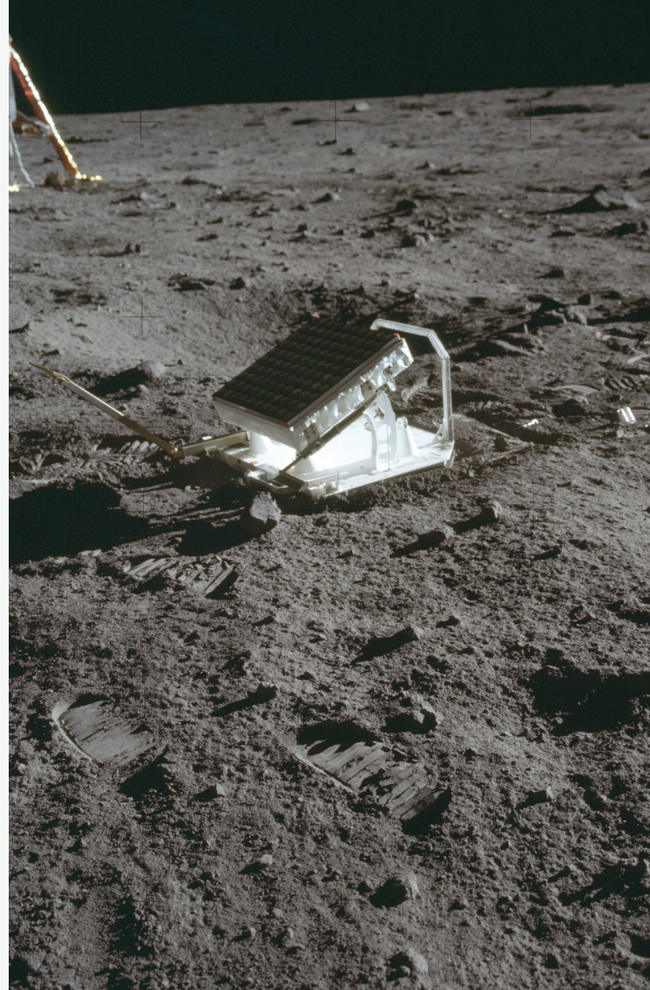
The Apollo 11 mission includes three important scientific experiments. The **Lunar Laser Ranging Experiment** is the most significant and is carried out by planting and aligning a laser reflector to the lunar surface. With this instrument planted, observers on Earth can emit lasers, which will be reflected back to Earth. By dividing the return time in half, one can calculate the distance to the Moon, since the speed of light is constant.

The aim with the **Solar Wind Composition** Experiment is to measure and sample the solar wind outside the Earth's magnetosphere. It is the first definitive isotopic measurement of solar material.

The **Passive Seismic Experiment** measures important data of the Moon's interior structure and will verify that the Moon, like the Earth, has a crust, mantle, and core.

111:03:57 Armstrong:
The laser reflector is (pause) installed and the bubble is level and the alignment appears to be good.





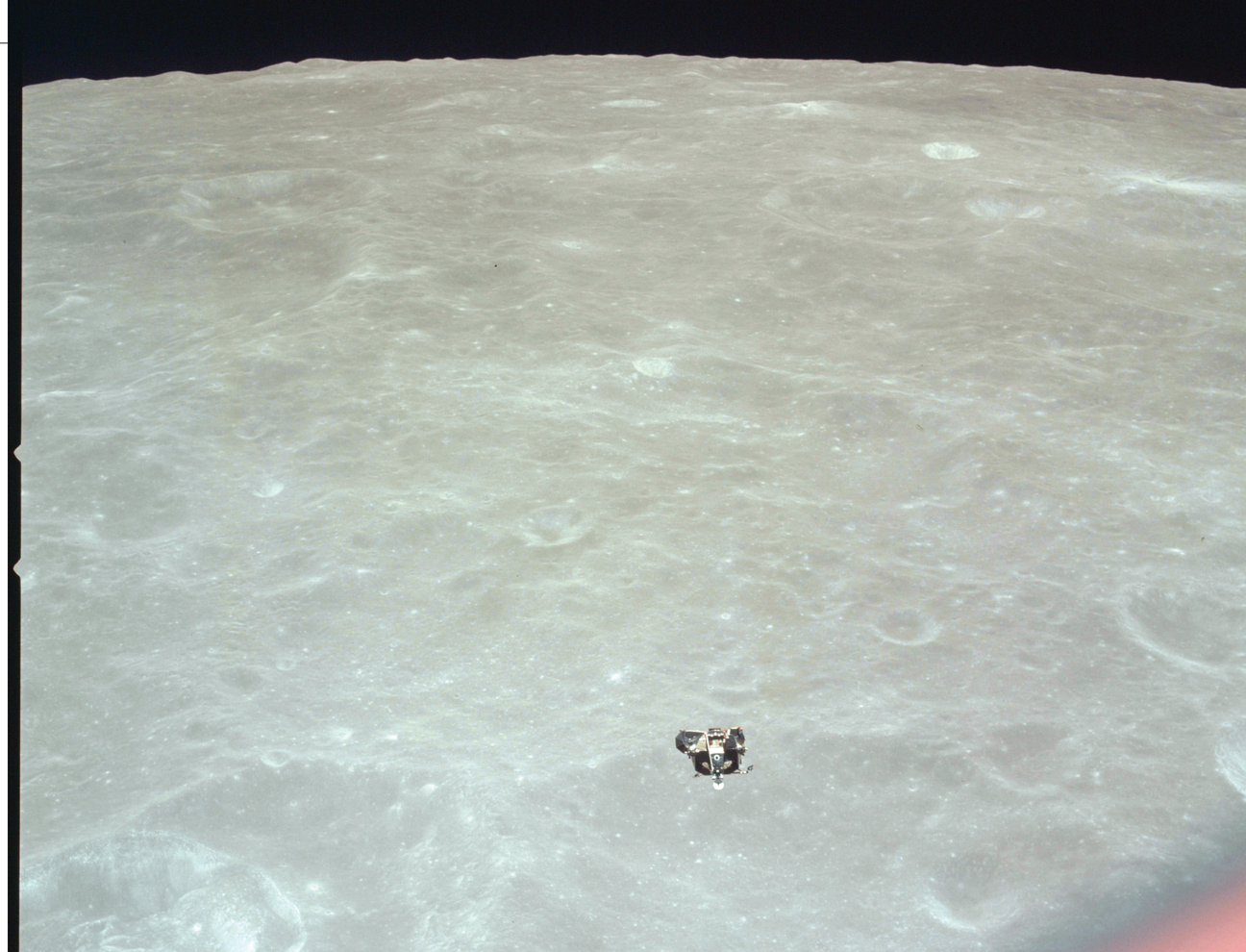
(hhh:mm:ss)
124:22:00

Lift Off

The ascent from the Moon is swift and quiet. Aldrin remarks:
"A very quiet ride, just a little bit of slow wallowing back and forth. Not very much thruster activity."

The Eagle accelerates towards lunar trajectory where it will reunite with the CM.

124:21:54 Aldrin:
9, 8, 7, 6, 5, Abort Stage, Engine Arm, Ascent, Proceed.

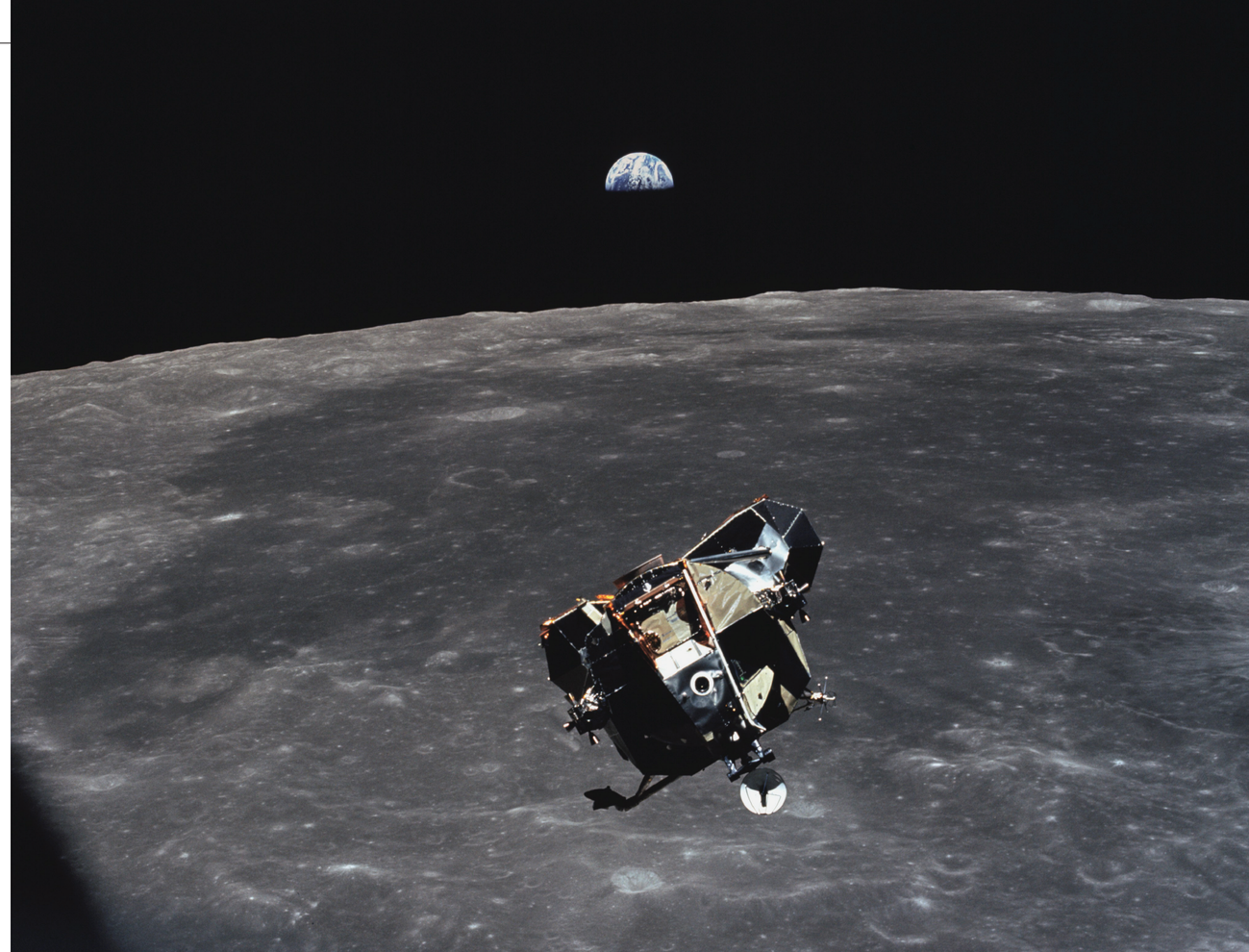


Approaching CM

Within 4 hours of lunar ascent, Astronauts Armstrong, Collins, and Aldrin are reunited in Command Module Columbia.

In preparations for Earth orbit trajectory, Columbia detaches from the LM, leaving the Eagle in lunar orbit where it is destined to crash down on the Moon's surface.

128:03:12 Armstrong:
We're all yours, Columbia.

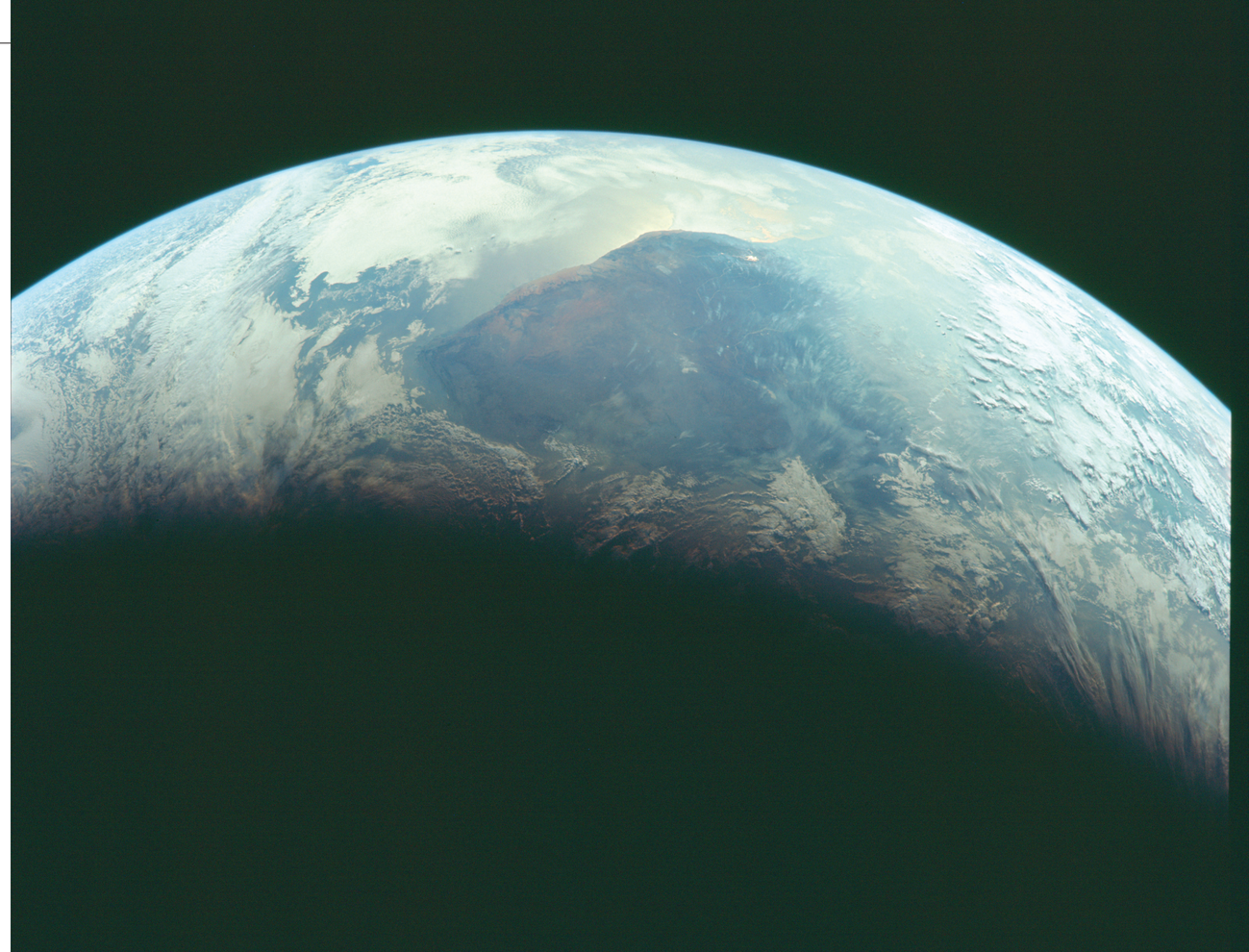


Reflections

As Apollo 11 drifts towards Earth, the astronauts deliver their final television transmission from the spacecraft. Each astronaut shares his reflections on the historic voyage. Neil Armstrong uses this time to thank everyone involved in the mission's success:

The responsibility for this flight lies first with history and with the giants of science who have preceded this effort. Next with the American people, who have through their will, indicated their desire. Next, to four administrations, and their Congresses, for implementing that will. And then, to the agency and industry teams that built our spacecraft, the Saturn, the Columbia, the Eagle, and the little EMU; the space suit and backpack that was our small spacecraft out on the lunar surface. We'd like to give a special thanks to all those Americans who built those spacecraft, who did the construction, design, the tests, and put their - their hearts and all their abilities into those craft. To those people, tonight, we give a special thank you, and to all the other people that are listening and watching tonight, God bless you. Good night from Apollo 11.

177:41:42 Armstrong:
Good night from Apollo 11.



Landing

Apollo 11 lands in the Pacific Ocean at 12:50 P.M. on July 24, 1969. The crew is is quickly recovered by the recovery ship, USS Hornet.

The astronauts spend five days in mobile quarantine as the USS Hornet transports them to Hawaii. Once in Hawaii, the unit is lifted into a plane to be flown to Houston, TX where it will connect to a larger living space at Johnson Space Center.

195:18:18 Swim 1:
Splashdown! Apollo has splashdown.

Welcome Home

Astronauts Neil A. Armstrong, Michael Collins, and Edwin “Buzz” Aldrin are welcomed by President Richard M. Nixon aboard the USS Hornet.

The ending of the successful mission marks the start of a new world. The technological demands of the Apollo missions have helped feed the growing industry of integrated circuits; for decades to come, people will look past the Moon and strive for even greater accomplishments.

President Nixon:
This is the greatest week in the history of the world since Creation.

Sources

All transmissions taken from NASA's extensive The Apollo 11 Flight Journal by David Woods, Ken MacTaggart and Frank O'Brien.
http://history.nasa.gov/ap11fj/index.htm
1 March 2016

1. Book Cover
   AS11-44-6598
   Lunar module viewed from CM "Columbia" after undocking
   July 20, 1969
   http://www.apolloarchive.com/apollo_gallery.html
   http://www.hq.nasa.gov/office/pao/History/alsj/a11/AS11-44-6598HR.jpg
2. KSC-69PC-442
   Launch of Apollo 11
   http://www.apolloarchive.com/apollo_gallery.html
   http://www.hq.nasa.gov/office/pao/History/alsj/a11/ap11-KSC-69PC-442.jpg
3. AS11-36-5293
   view from Earth orbit
   http://www.apolloarchive.com/apollo_gallery.html
   http://www.hq.nasa.gov/office/pao/History/alsj/a11/AS11-36-5293HR.jpg
4. Inside the LM 2
   Image Number: SI 99-15229
   Credit: Image by Mark Avino, National Air and Space Museum, Smithsonian Institution
   https://airandspace.si.edu/explore-and-learn/multimedia/detail.cfm?id=1441
5. AS11-44-6609
   JSC scan
   view of Daedalus crater from lunar orbit
   http://www.apolloarchive.com/apollo_gallery.html
   http://www.hq.nasa.gov/office/pao/History/alsj/a11/AS11-44-6609HR.jpg
6. AS11-40-5844
   Crater Hartmann, and beyond it, crater Green from the LM.
   Image credit: Image Science and Analysis Laboratory, NASA-Johnson Space Center.
7. AS11-40-5851
   JSC scan
   lunar surface
   http://www.apolloarchive.com/apollo_gallery.html
   http://www.hq.nasa.gov/office/pao/History/alsj/a11/AS11-40-5851HR.jpg
8. AS11-40-5877
   JSC scan
   Aldrin's bootprint in the lunar soil
   http://www.apolloarchive.com/apollo_gallery.html
   http://www.hq.nasa.gov/office/pao/History/alsj/a11/AS11-40-5877HR.jpg
9. AS11-40-5952
   JSC scan
   Laser reflector
   http://www.apolloarchive.com/apollo_gallery.html
   http://www.hq.nasa.gov/office/pao/History/alsj/a11/AS11-40-5952HR.jpg
10. AS11-40-5873
    JSC scan
    Aldrin beside solar wind experiment
    http://www.apolloarchive.com/apollo_gallery.html
    http://www.hq.nasa.gov/office/pao/History/alsj/a11/AS11-40-5873HR.jpg
11. AS11-44-6642
    LM approaches CSM for docking / earthrise in b.g.

July 21, 1969
http://www.apolloarchive.com/apollo_gallery.html
http://www.hq.nasa.gov/office/pao/History/alsj/a11/AS11-44-6642HR.jpg

12. AS11-44-6626
JSC scan
LM ascent stage returns from the moon's surface
July 21, 1969
http://www.apolloarchive.com/apollo_gallery.html
http://www.hq.nasa.gov/office/pao/History/alsj/a11/AS11-44-6626.jpg
13. S69-21698
Apollo 11 crewmen await pickup by helicopter following splashdown
July 24, 1969
http://www.apolloarchive.com/apollo_gallery.html
http://www.hq.nasa.gov/office/pao/History/alsj/a11/ap11-S69-21698HR.jpg
14. S69-21365
President Nixon greets the Apollo 11 astronauts aboard the U.S.S. Hornet
http://www.apolloarchive.com/apollo_gallery.html
http://www.hq.nasa.gov/office/pao/History/alsj/a11/ap11-S69-21365HR.jpg