“The Right Stuff”
Apollo Exploration Station

Space Odyssey
Volunteer Training Manual

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I. Background Information

1.1 Project Mercury

From https://www.nasa.gov/mission_pages/mercury/missions/program-toc.html

Initiated in 1958, completed in 1963, Project Mercury was the United States' first man-in-space program. The objectives of the program, which made six manned flights from 1961 to 1963, were specific:

- To orbit a manned spacecraft around Earth
- To investigate man's ability to function in space
- To recover both man and spacecraft safely

1.2 Project Gemini

From: https://www.nasa.gov/specials/gemini_gallery/

Just as Orion and the International Space Station are helping NASA learn how to go to Mars, the Gemini program defined and tested the skills NASA would need to go to the Moon in the 1960s and '70s. Gemini had four main goals: to test an astronaut's ability to fly long-duration missions (up to two weeks in space); to understand how spacecraft could rendezvous and dock in orbit around the Earth and the Moon; to perfect re-entry and landing methods; and to further understand the effects of longer space flights on astronauts.

Similar in design to the Mercury capsule but much larger, the new Gemini spacecraft was designed to carry two astronauts into Earth orbit to test long-duration flight, rendezvous and docking and other techniques needed for journeys to the moon. To lift the heavier spacecraft, NASA turned to the powerful Titan II rocket.

On June 3, 1965, Gemini IV astronaut Edward H. White II became the first American to step outside his spacecraft and let go, effectively setting himself adrift in the zero gravity of space. For 23 minutes, White floated and maneuvered himself around the spacecraft, logging 6,500 miles during his orbital stroll. White was attached to the spacecraft by a 25-foot umbilical line. In his right hand, White carried a Hand Held Self Maneuvering Unit (HHSMU), which he used to move about the weightless environment of space. The visor of his helmet was gold-plated to protect him from the unfiltered rays of the sun.

The program ended with Gemini XII's splashdown on Nov. 15, 1966, and NASA moved on to Apollo.
1.3 Overview of the Apollo Program

From: https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-was-apollo-program-58.html

Apollo was the NASA program that resulted in American astronauts' making a total of 11 spaceflights and walking on the moon. The first four flights tested the equipment used in the Apollo Program. Six of the other seven flights landed on the moon. The first Apollo flight happened in 1968. The first moon landing took place in 1969. The last moon landing was in 1972. A total of 12 astronauts walked on the moon. The astronauts conducted scientific research and studied the lunar surface. They collected moon rocks to bring back to Earth.

From https://history.nasa.gov/SP-4402/ch4.htm

Abe Silverstein, Director of Space Flight Development, proposed the name "Apollo" because it was the name of a god in ancient Greek mythology with attractive connotations and the precedent for naming manned spaceflight projects for mythological gods and heroes had been set with Mercury. Apollo was god of archery, prophecy, poetry, and music, and most significantly, he was god of the sun. In his horse-drawn golden chariot, Apollo pulled the sun in its course across the sky each day. NASA approved the name and publicly announced "Project Apollo" at the July 28-29 conference.

From https://www.nasa.gov/specials/apollo50th/missions.html

Apollo 1

Before any Apollo mission flew with a crew onboard, NASA dealt with a major tragedy on Jan. 27, 1967. As the first Apollo crew – Gus Grissom, Ed White and Roger Chaffee – were conducting a launch simulation on the launch pad in Florida, a flash fire broke out in their capsule. In the 100 percent oxygen atmosphere NASA was then using, the fire spread quickly and killed all three. The disaster caused NASA to re-examine all aspects of the program and rework many of the spacecraft’s systems. That spring, the mission for which the crew had been training was officially named Apollo 1.

Apollo 7 – October 1968

The first crewed Apollo mission to get to space was Apollo 7. During the 11-day flight, the crew conducted a number of tests on the spacecraft systems and conducted the first live TV program from an American spacecraft. All three crewmembers – Wally Schirra, Walt Cunningham and Donn Eisele – developed bad head colds early in the mission. Despite the discomfort, the astronauts completed their mission objectives, demonstrating the resilience and adaptability needed by humans in space.
Apollo 8 – December 1968

The success of Apollo 7 and earlier test flights, problems in the development of the lunar module and concerns that the Soviet Union might be ready to launch astronauts around the Moon led NASA to change the flight plan for the next Saturn V mission. NASA ultimately changed from an unpiloted, Earth-orbiting mission to a crewed flight around the Moon. Frank Borman, Jim Lovell and Bill Anders were the first crew to fly atop the powerful Saturn V booster, ultimately spending 20 hours orbiting the Moon. On Christmas Eve, 1968, the crew gave a memorable reading from the Book of Genesis, and while in orbit Anders took the iconic "Earthrise" photo.

Apollo 9 – March 1969

With a trip around the Moon completed, it was time for NASA to start seriously planning to land astronauts there. The next step was the Apollo 9 mission, the first to carry a lunar module into orbit space. Though the mission stayed in Earth orbit, Commander James McDivitt and Lunar Module Pilot Rusty Schweickart separated the lunar module from the command module and flew independently for six hours, testing the lunar module’s systems. Schweickart conducted a spacewalk on the lunar module’s “porch” to test the spacesuit astronauts would wear on the Moon.

Apollo 10 – May 1969

The next test of the lunar module was conducted in lunar orbit. Apollo 10 was a full dress rehearsal for the first lunar landing. The crew tested all aspects of the mission, even showing the initial docking with the lunar module on the first color television transmission from space. Commander Thomas Stafford and Lunar Module Pilot Eugene Cernan flew the lunar module for eight hours, coming within 10 miles of the lunar surface and passing over the Sea of Tranquility, where Apollo 11 would land.
1.2 Saturn V Rocket and Apollo Spacecraft

From https://airandspace.si.edu/stories/editorial/looking-closer-saturn-v

The manned Apollo missions were each launched aboard a Saturn V (pronounced “Saturn Five”) launch vehicle. The Roman numeral “V” comes from the five F-1 engines that powered the first stage of the rocket. Almost five decades later, the Saturn V remains the United States’ largest and most powerful launch vehicle ever built. (Yes, even more than Space-X’s Falcon Heavy!)

The Saturn V launch vehicle had three stages:

- **First Stage**: The five F-1 engines, burning liquid oxygen and kerosene, generated nearly 7.7 million pounds of thrust. These powerful engines were required to lift the heavy rocket fast enough to escape Earth’s gravity. The first stage engines were ignited at liftoff and operated for about 2.5 minutes, taking the vehicle and payload to an altitude of 38 miles. Then, the first stage separated and dropped into the ocean.

- **Second Stage**: The five J-2 engines burned liquid oxygen and liquid hydrogen. After the first stage was discarded, the second stage burned for approximately 6 minutes, taking the vehicle and payload to a 115-mile altitude. The second stage was then discarded and broke up in the atmosphere.

- **Third Stage**: The one J-2 engine was the same as those used on the second stage. This engine burned for 2.75 minutes, boosting the spacecraft to an orbital velocity of about 17,500 mph. The third stage was shut down with fuel remaining and remained attached the spacecraft while in Earth orbit. The J-2 engine reignited to propel the spacecraft into a translunar trajectory, which allowed the spacecraft and crew to reach to the Moon.
The Apollo spacecraft was made up of several components:

**The Command Module:** The living quarters for the crew during most of the first manned lunar landing mission. The Command Module is the only portion of the spacecraft to return to Earth.

**The Service Module:** Housed a liquid-fueled rocket engine propulsion system (the Service Propulsion System or SPS) which astronauts used to steer the spacecraft toward the Moon, place it into lunar orbit, and propel it back toward Earth.

**The Lunar Module:** A two-stage vehicle (a descent stage and an ascent stage) that brought two crew members (Neil Armstrong and Buzz Aldrin) from lunar orbit, to the Moon’s surface, and back.

All together, the complete assembly (the Saturn V rocket, the Apollo spacecraft, and the emergency escape system at the top of the launch vehicle) stood over 360 feet tall, and weighed over 6 million pounds.
1.3 Apollo 11 Mission Goals


The primary objective of Apollo 11 was to complete a national goal set by President John F. Kennedy on May 25, 1961: perform a crewed lunar landing and return to Earth.

Additional flight objectives included scientific exploration by the lunar module, or LM, crew; deployment of a television camera to transmit signals to Earth; and deployment of a solar wind composition experiment, seismic experiment package and a Laser Ranging Retroreflector. During the exploration, the two astronauts were to gather samples of lunar-surface materials for return to Earth. They also were to extensively photograph the lunar terrain, the deployed scientific equipment, the LM spacecraft, and each other, both with still and motion picture cameras. This was to be the last Apollo mission to fly a "free-return" trajectory, which would enable a return to Earth with no engine firing, providing a ready abort of the mission at any time prior to lunar orbit insertion.

1.4 Apollo 11 Mission Overview


Apollo 11 launched from Cape Kennedy on July 16, 1969, carrying Commander Neil Armstrong, Command Module Pilot Michael Collins and Lunar Module Pilot Edwin "Buzz" Aldrin into an initial Earth-orbit of 114 by 116 miles. An estimated 530 million people watched Armstrong's televised image and heard his voice describe the event as he took "...one small step for a man, one giant leap for mankind" on July 20, 1969.

Two hours, 44 minutes and one-and-a-half revolutions after launch, the S-IVB stage reignited for a second burn of five minutes, 48 seconds, placing Apollo 11 into a translunar orbit. The command and service module, or CSM, Columbia separated from the stage, which included the spacecraft-lunar module adapter, or SLA, containing the lunar module, or LM, Eagle. After transposition and jettisoning of the SLA panels on the S-IVB stage, the CSM docked with the LM. The S-IVB stage separated and injected into heliocentric orbit four hours, 40 minutes into the flight.

The first color TV transmission to Earth from Apollo 11 occurred during the translunar coast of the CSM/LM. Later, on July 17, a three-second burn of the SPS was made to perform the second of four scheduled midcourse corrections programmed for the flight. The launch had been so successful that the other three were not needed.

On July 18, Armstrong and Aldrin put on their spacesuits and climbed through the docking tunnel from Columbia to Eagle to check out the LM, and to make the second TV transmission.

On July 19, after Apollo 11 had flown behind the moon out of contact with Earth, came the first lunar orbit insertion maneuver. At about 75 hours, 50 minutes into the flight, a retrograde firing of the SPS (Service Propulsion System) for 357.5 seconds placed the spacecraft into an initial, elliptical-lunar orbit of 69 by 190 miles. Later, a second burn of the SPS for 17 seconds placed the docked vehicles into a lunar orbit of 62 by 70.5 miles, which was calculated to change the orbit of the CSM piloted by Collins.
The change happened because of lunar-gravity perturbations to the nominal 69 miles required for subsequent LM rendezvous and docking after completion of the lunar landing. Before this second SPS firing, another TV transmission was made, this time from the surface of the moon.

On July 20, Armstrong and Aldrin entered the LM again, made a final check, and at 100 hours, 12 minutes into the flight, the Eagle undocked and separated from Columbia for visual inspection. At 101 hours, 36 minutes, when the LM was behind the moon on its 13th orbit, the LM descent engine fired for 30 seconds to provide retrograde thrust and commence descent orbit insertion, changing to an orbit of 9 by 67 miles, on a trajectory that was virtually identical to that flown by Apollo 10. At 102 hours, 33 minutes, after Columbia and Eagle had reappeared from behind the moon and when the LM was about 300 miles uprange, powered descent initiation was performed with the descent engine firing for 756.3 seconds. After eight minutes, the LM was at "high gate" about 26,000 feet above the surface and about five miles from the landing site.

The descent engine continued to provide braking thrust until about 102 hours, 45 minutes into the mission. Partially piloted manually by Armstrong, the Eagle landed in the Sea of Tranquility in Site 2 at 0 degrees, 41 minutes, 15 seconds north latitude and 23 degrees, 26 minutes east longitude. This was about four miles downrange from the predicted touchdown point and occurred almost one-and-a-half minutes earlier than scheduled. It included a powered descent that ran a mere nominal 40 seconds longer than preflight planning due to translation maneuvers to avoid a crater during the final phase of landing. Attached to the descent stage was a commemorative plaque signed by President Richard M. Nixon and the three astronauts.

The flight plan called for the first EVA to begin after a four-hour rest period, but it was advanced to begin as soon as possible. Nonetheless, it was almost four hours later that Armstrong emerged from the Eagle and deployed the TV camera for the transmission of the event to Earth. At about 109 hours, 42 minutes after launch, Armstrong stepped onto the moon. About 20 minutes later, Aldrin followed him. The camera was then positioned on a tripod about 30 feet from the LM. Half an hour later, President Nixon spoke by telephone link with the astronauts.

Commemorative medallions bearing the names of the three Apollo 1 astronauts who lost their lives in a launch pad fire, and two cosmonauts who also died in accidents, were left on the moon's surface. A one-and-a-half inch silicon disk, containing micro miniaturized goodwill messages from 73 countries, and the names of congressional and NASA leaders, also stayed behind.

During the EVA, in which they both ranged up to 300 feet from the Eagle, Aldrin deployed the Early Apollo Scientific Experiments Package, or EASEP, experiments, and Armstrong and Aldrin gathered and verbally reported on the lunar surface samples. After Aldrin had spent one hour, 33 minutes on the surface, he re-entered the LM, followed 41 minutes later by Armstrong. The entire EVA phase lasted more than two-and-a-half hours, ending at 111 hours, 39 minutes into the mission.

Armstrong and Aldrin spent 21 hours, 36 minutes on the moon's surface. After a rest period that included seven hours of sleep, the ascent stage engine fired at 124 hours, 22 minutes. It was shut down 435 seconds later when the Eagle reached an initial orbit of 11 by 55 miles above the moon, and when Columbia was on its 25th revolution. As the ascent stage reached apolune at 125 hours, 19 minutes, the reaction control system, or RCS, fired so as to nearly circularize the Eagle orbit at about 56 miles, some 13 miles below and slightly behind Columbia. Subsequent firings of the LM RCS changed the orbit to 57 by 72 miles. Docking with Columbia occurred on the CSM's 27th revolution at 128 hours, three minutes into the mission. Armstrong and Aldrin returned to the CSM with Collins. Four hours later, the LM jettisoned and remained in lunar orbit.
Trans-Earth injection of the CSM began July 21 as the SPS fired for two-and-a-half minutes when Columbia was behind the moon in its 59th hour of lunar orbit. Following this, the astronauts slept for about 10 hours. An 11.2-second firing of the SPS accomplished the only midcourse correction required on the return flight. The correction was made July 22 at about 150 hours, 30 minutes into the mission. Two more television transmissions were made during the trans-Earth coast.

Re-entry procedures were initiated July 24, 44 hours after leaving lunar orbit. The SM separated from the CM, which was re-oriented to a heat-shield-forward position. Parachute deployment occurred at 195 hours, 13 minutes. After a flight of 195 hours, 18 minutes, 35 seconds - about 36 minutes longer than planned - Apollo 11 splashed down in the Pacific Ocean, 13 miles from the recovery ship USS Hornet. Because of bad weather in the target area, the landing point was changed by about 250 miles. Apollo 11 landed 13 degrees, 19 minutes north latitude and 169 degrees, nine minutes west longitude July 24, 1969.

1.5 Apollo 11 Astronauts

From: https://www.nasa.gov/feature/50-years-ago-nasa-names-apollo-11-crew

On Jan. 9, 1969, NASA formally announced the crew for the Apollo 11 mission, scheduled for July of that year. Planned as the fifth crewed Apollo mission, if all went well on the two flights preceding it, Apollo 11 would attempt the first human lunar landing, fulfilling President John F. Kennedy’s goal of landing a man on the Moon and returning him safely to the Earth. The next day, NASA introduced the Apollo 11 crew during a press conference at the Manned Spacecraft Center, now the Johnson Space Center in Houston.
The prime crew consisted of Commander Neil A. Armstrong, Command Module Pilot (CMP) Michael Collins, and Lunar Module Pilot (LMP) Edwin E. “Buzz” Aldrin. All three were experienced astronauts, each having flown one Gemini mission. Armstrong and Aldrin had served on the backup crew for Apollo 8 the previous December and Collins was initially a member of that crew until a bone spur in his spine requiring surgery sidelined him. Fully recovered from the operation, NASA added him to the Apollo 11 crew. The Apollo 11 backup crew of Commander James A. Lovell, CMP William A. Anders, and LMP Fred W. Haise, would be ready to fly the mission in case something happened to the prime crew. Lovell and Anders had just completed the Apollo 8 lunar orbit mission and Haise was a backup crewmember on that flight. When Anders announced that he would retire from NASA in August 1969 to join the National Space Council (TBC), Thomas K. “Ken” Mattingly began training in parallel with Anders in case the mission slipped past that date.

1.6 Apollo 17, Scott Carpenter, and His Moon Rock

Scott Carpenter was one of the original seven astronauts selected in 1959 for Project Mercury, NASA’s entry into the space race. Carpenter was the second American to orbit the Earth and the fourth American in space.

Scott grew up in Boulder, CO and graduated from Boulder High School in 1943. Upon graduating, he joined the U.S. Navy beginning a 20-year naval career. He had three distinct periods of naval service each associated with a war: World War II, the Korean conflict, and the Cold War. It was in between these periods of service that he returned to Boulder to study aeronautical engineering at the University of Colorado.

During his third period of naval service, he was chosen for Project Mercury, U.S.’s first human spaceflight program in 1959. On May 24, 1962, Scott Carpenter lifted off onboard the spacecraft he dubbed Aurora 7 sitting atop the Mercury-Atlas 7 rocket. His spacecraft achieved a maximum altitude of 164 miles and an orbital velocity of 17,532 miles per hour. His primary goal during the three-orbit mission was to determine whether an astronaut could work in space, a major stepping-stone toward a lunar landing. He landed in the ocean after a flight of 4 hours, 53 minutes, and 47 seconds.

Scott Carpenter left NASA in 1967 and worked with the Navy on Sealab II. This project was responsible for developing deep-ocean research, rescue, salvage, and ocean engineering capabilities. Scott Carpenter has the unique distinction of being the first person ever to penetrate both inner and outer space. He participated as an aquanaut in an experiment living and working on the ocean floor for 30 days in Sealab II at a depth of 200 feet. Scott Carpenter was inducted into the U.S. Astronaut Hall of Fame on May 11, 1990.
To recognize the astronauts of the Mercury, Gemini and Apollo missions, these Ambassadors of Exploration were awarded a moon rock in a special ceremony at the National Air and Space Museum. Carpenter’s moon rock is on permanent loan to the Denver Museum of Nature & Science. The rock is part of a sample returned by the crew of the Apollo 17 mission from the Moon.

Apollo 17 mission was the sixth and final lunar landing in December 1972. Apollo 17 astronauts Eugene Cernan and Harrison Schmitt walked on the Moon while Ronald Evans (back left) orbited in the command module. The basic objective of the Apollo 17 mission was to sample basin-rim highland material and adjacent mare material and investigate the geological evolutionary relationship between them. The Apollo 17 lunar module landed on the Taurus-Littrow Valley floor amongst several large craters. 243.6 pounds of rock were taken from the Moon during three moonwalks during this mission.
II. Exploration Station

2.1 Item Touch Codes

On this exploration station, you will see objects primarily that have three touch codes: Green, Yellow, and Blue.

- **Green** touch items: Please pick up. Touch, Discover, and Explore.
- **Yellow** touch items: Careful Touch. Please only use 1 or 2 fingers to interact with this object.
- **Blue** touch items: Do Not open this box or touch the object

Not all objects are labeled, or may not have an the typical object label, since they are not all officially part of Education Collections or are difficult to label so please read the manual carefully for their touch code. For more in depth descriptions of each of the touch codes, please refer to the Exploration Station Care Sheet on the Volunteer Portal.
### Prototype Core Drill

This core drill was made by Colorado company Martin Marietta (now known as Lockheed Martin). Apollo astronauts used it in New Mexico before a nearly identical drill was used on the moon for the Apollo 15, 16, and 17 missions.

This drill consists of a battery operated motor and specialized drill bits and modular core stems. Each core stem was rigid but hollow and about 16 inches long. These stems could be combined to collect a core sample that was approximately ¾ of an inch in diameter and up to 10 feet long. The drill was used to collect core samples, which give geologists a history of the rock and regolith at that location, as well as create holes for the placement of two heat flow probes into the lunar surface.

This electric drill was a big improvement from the manual drill that had been used on previous Apollo missions. During the Apollo 12 mission, astronauts used a hammer to pound tubes that were 2 – 4 centimeters in diameter up to 70 centimeters (27 inches) deep. This required 50 hammer strikes.

**Note:** This is a Yellow Touch Code item. Please have guests touch with 1 finger only. This item is tied and bolted to the cart. Do not remove these attachments.

### Rock Collecting Tongs (replica)

Apollo astronauts used tongs similar to these to collect individual rock samples on the Moon. When time permitted, samples would be photographed before being collected. They were then stored in sample collection bags and assigned unique identification numbers.

**Note:** This is a Green Touch Code item.
### July 21, 1969 Rocky Mountain News

_The Rocky Mountain News_ was a daily newspaper published in Denver, Colorado between 1859 and 2009. It was one of Colorado’s first newspapers.

This 112-page edition was published the day after the moon landing and commemorated the historic event.

**Note:** This is a Blue Touch Code item. Please do not remove it from the box or protective Mylar covering. You cannot open this newspaper and all contact with the newsprint should be minimized since it can degrade quickly with contact and movement.

### Apollo 11 Envelope and Stamp

Information from:  
[https://www.mysticstamp.com/Products/United-States/C76/USA/FDC/](https://www.mysticstamp.com/Products/United-States/C76/USA/FDC/)

**U.S. #C76; 1969 10¢ Moon Landing**  
Issue Date: September 9, 1969  
City: Washington, DC  
Quantity: 152,364,800  
Printed By: Bureau of Engraving and Printing  
Printing Method: Lithographed and Engraved (Giori) printing

This cover (commemorative envelope and stamp) celebrates humanity’s first footprint on the lunar surface by Neil Armstrong, Commander of the _Apollo 11_ mission. This First Man on the Moon issue was the first jumbo-size American commemorative. The engraved master die to this stamp accompanied the astronauts all the way to the moon’s surface.

This item is on loan from Thurs. AM SO Volunteer, Ken Rutledge

**Note:** This is a Blue Touch Code item. This cannot be removed from its board or protective Mylar cover.
### We Came In Peace For All Mankind Record (1969)

“This recording is the story of Apollo 11 and the events that led up to it, told in the actual words and sounds of the men and machines that made it possible.” It begins with John F. Kennedy’s address to Congress and the nation “to take a leading role in space achievement” and concludes on side 2 with a “suspenseful, tightly edited summary of the historic Apollo 11 flight...”

This item is a part of the DMNS Gates Planetarium collection. It might have been used for programming here at DMNS after the lunar landing, but we are not sure.

**Note:** This is a Blue Touch Code item. Please do not remove the record from the frame.

### Retroreflector

During the Apollo 11, 14, and 15 missions, astronauts deployed arrays of retroreflectors, also known as corner cube reflectors, on the Moon as part of the Lunar Laser Ranging Experiments. Retroreflectors are a special type of device that reflects incoming light back in the direction it came from. Here on Earth retroreflectors can be found on the reflectors on bikes, reflective safety clothing, road signs and even cat’s eyes.

Using telescopes here on Earth, we can now shoot high-powered lasers at these arrays of retroreflectors and get a signal back. Using the round-trip travel time for the light scientists can pinpoint the distance of the Moon within a few centimeters. This has allowed us to test Einstein’s theory of General Relativity, determine the Moon is spiraling away from Earth at 3.8 cm per year, determine the Moon probably has a liquid core, and more.

There is a DMNS connection to the Lunar Laser Ranging Experiments. The principle investigator (lead scientist) was University of Maryland physics professor Carroll Alley. His
daughter, Frances Kruger, works on our Exhibits team here at DMNS and was an original member of the Space Odyssey Core Team. You may have noticed the Gravity Well in Space Odyssey is dedicated to Dr. Alley.

**Note:** This is a Green Touch item.

### Lunar Meteorite

Lunar meteorites are meteorites from the Moon. In other words, they are rocks found on Earth that were ejected from the Moon by the impact of an asteroid, meteoroid or possibly a comet.

This is a small sample of lunar meteorite Northwest Africa (NWA) 4932. This 3.2-ounce meteorite was found in Algeria in October of 2007. With such a low total known weight, only a small handful of samples are available to collectors.

It is compositionally very similar to material brought back Apollo 16 in 1972.

**Note:** This is a Blue Touch Code item. The meteorite cannot be removed from its box.

### Getting a Feel for Lunar Craters Tactile Astronomy Book

This book is published by NASA and provides all guests a chance to experience NASA moon imagery in a different way by feeling the images. The book also includes braille for all text.

**Note:** This is a Green Touch item.
III. Resources

50 Years Later, NASA Just Handed Scientists Untouched Apollo Moon Rocks
http://blogs.discovermagazine.com/d-brief/2019/03/12/untouched-apollo-moon-rocks-will-be-studied-for-first-time/#.XM9D945KiUk

Adam Ruins Everything - Why the Moon Landing Couldn't Have Been Faked:
https://youtu.be/dWBYAxhH3u4

Apollo 11 Flight Plan

Apollo 11 HD Videos
https://www.nasa.gov/multimedia/hd/apollo11_hdpage.html

Apollo 11 Image Gallery
https://www.nasa.gov/apollo11-gallery
Apollo 11 Videos

Apollo 50th NASA Resources
https://www.nasa.gov/specials/apollo50th/

Bad Astronomy – Yes, We Really Did Go To the Moon
http://www.badastronomy.com/bad/misc/apollohoax.html

Familiarization and Support Manual for Apollo Lunar Surface Drill (ALSD)
(Original NASA and Martin Marietta Manual from November 1969)
https://www.hq.nasa.gov/alsj/ApolloLunarSurfaceDrill_19710014920.pdf

History of Apollo 11 Commemorative Cover (envelope and stamp) by American First Day Cover Society
http://www.afdcs.org/resources/c76-moon-landing.pdf

Lunar and Planetary Institute Apollo 50th Anniversary Website
https://www.lpi.usra.edu/apollo50/

Moon Rock at DMNS
http://spaceodyssey.dmns.org/exhibitsprograms/interactives-exhibits/moon-rock.aspx

Mythbusters Moon Landing Hoax Episode
https://www.dailymotion.com/video/x2m7k1z

NASA’s Mighty Saturn V Moon Rocket Explained (Infographic)

One Giant Leap for Mankind Video

Pioneering Physicist Carroll Alley Dies
https://www.nasa.gov/feature/pioneering-physicist-carroll-alley-dies

Retroreflectors: Common uses, uncommon applications and the Lunar Laser Ranging Experiment

Saturn V Rockets and Apollo Spacecraft
https://www.space.com/16698-apollo-spacecraft.html

What Neil and Buzz Left on the Moon