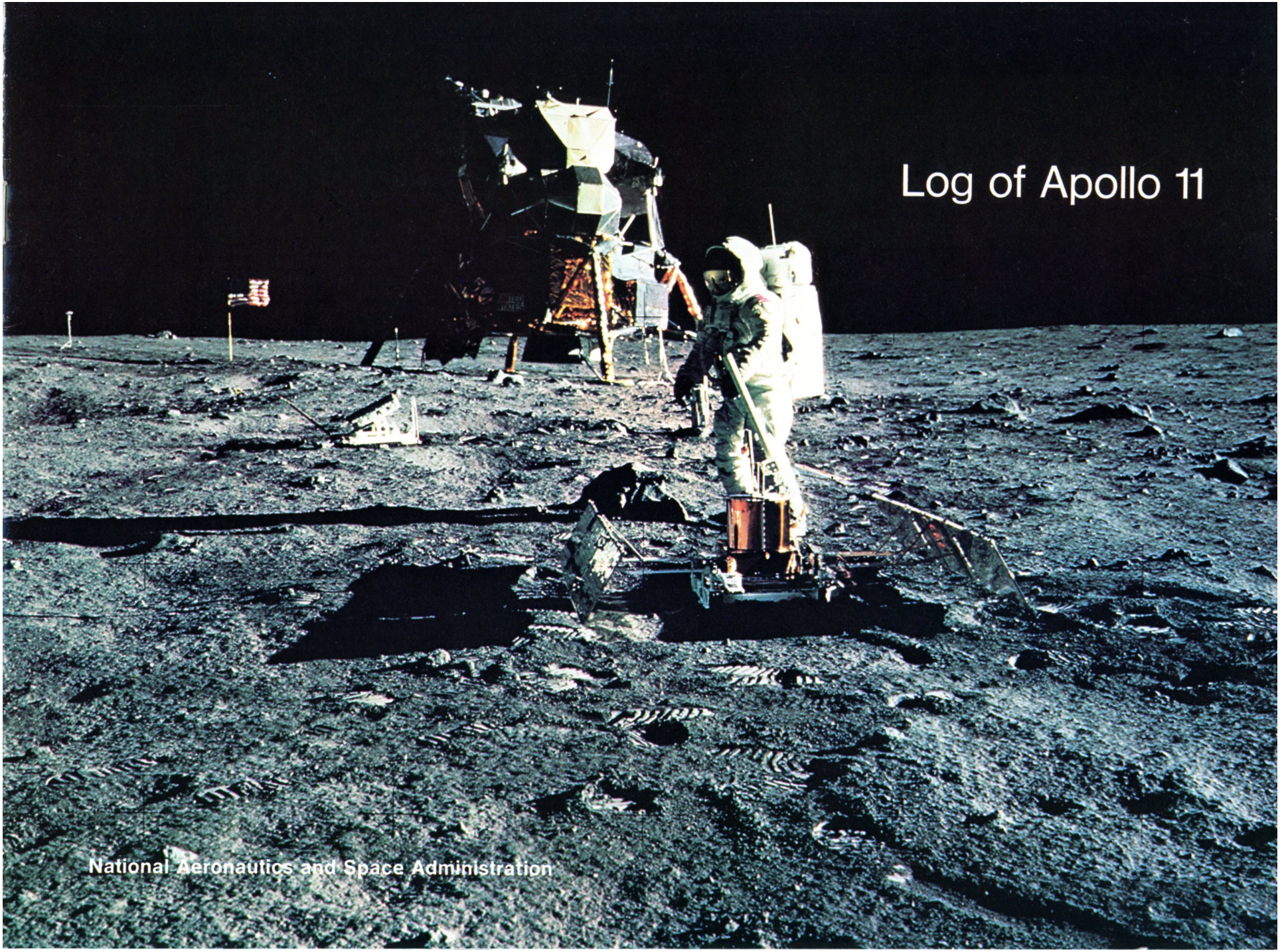
APOLLO 11
FIFTY-STATE TOUR
1970-1971

APOLLO 11 SPACECRAFT AND LUNAR ROCK MOBILE EXHIBIT

PRESS KIT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • HEADQUARTERS • WASHINGTON, D.C. 2054


Log of Apollo 11
National Aeronautics and Space Administration

Cover: Aldrin stands by deployed experiment package, with lunar module, flag and TV camera breaking the monotony of the lunar surface in the background.

Apollo 11 Crew: (left to right) Commander Neil A. Armstrong, Command Module Pilot Michael Collins, and Lunar Module Pilot Edwin E. (Buzz) Aldrin, Jr.

JULY 16

9:32 a.m. EDT–On schedule to within less than a second, Apollo 11 blasts off from Launch Pad 39A at Cape Kennedy, Florida to start what is looked upon as the greatest single step in human history—a trip to the Moon, a manned landing and return to Earth.

Watching is a world-wide television audience and an estimated million eyewitnesses. Standing three and one-half miles away on the sandflats or seated in grandstands are half the members of the United States Congress and more than 3,000 newsmen from 56 countries.

Strapped to their couches in the command module atop the 363-foot, 7.6-million-pound thrust space vehicle are three astronauts, each born in 1930, each weighing 165 pounds, all within an inch of the same height—five feet, 11 inches. They are Commander Neil A. Armstrong, civilian and ex-test pilot; Command Module Pilot Michael Collins, and Lunar Module Pilot Edwin E. (Buzz) Aldrin, Jr., the latter two, officers of the U. S. Air Force.

The launch comes after a 28-hour countdown. It takes place in highly suitable weather, with winds 10 knots from the southeast, temperature in the mid-80's, and clouds at 15,000 feet.

At 4:15 a.m., the astronauts had been awakened. After a breakfast of orange juice, steak, scrambled eggs, toast and coffee, they began suiting up at 5:35 a.m. At 6:27 a.m., they left in an air-conditioned van for the launch pad eight miles away. At 6:54 a.m., Armstrong entered the command module and took position on the left. He was followed five minutes later by Collins, on the right, and Aldrin, in the center.

Two minor problems that developed in the ground equipment, a leaky valve and a faulty signal light were corrected while the astronauts were en route to the pad.

The Apollo access arm retracted at 9:27 a.m. Eight and nine-tenths seconds before launch time, the first of the Saturn V's first stage engines ignited. From the viewing stands, the flame appeared as a bright yellow-orange star on the horizon. Soon the other four engines fired and the light of the first engine became a huge fireball that lit the scene like a rising Sun. No sound was heard. For two seconds the vehicle built up thrust. The hold down clamps were released and the space vehicle began moving slowly upward from the pad, as near 9:32 a.m. as human effort could make it.

As it reached the top of the service tower, the hard-edged clattering thunder of the firing engines

rolled over the scrubby Florida landscape and engulfed the viewers like a tidal wave. They witnessed the beginning of the fifth manned Apollo flight, the third to the vicinity of the Moon and the first lunar landing mission.

From Launch Control the last words were: "Good luck and Godspeed." Commander Armstrong replied, "Thank you very much. We know this will be a good flight."

9:35 a.m.–The spacecraft is 37 nautical miles high, downrange 61 nautical miles and traveling at 9,300 feet per second or about 6,340 miles per hour. Armstrong confirms the engine skirt and launch escape tower separations.
9:44 a.m.–With the three Saturn stages fired one after another and the first two jettisoned, Apollo 11 enters a 103 nautical mile-high Earth orbit, during which the vehicle is carefully checked by the astronauts and by the ground control crew.
12:22 p.m.–Another firing of the third-stage engine, still attached to the command service module, boosts Apollo 11 out of orbit midway in its second trip around the Earth and onto its lunar trajectory at an initial speed of 24,200 miles an hour.
12:49 p.m.–While the spacecraft moves farther and farther from Earth, the lunar landing craft, code-named Eagle, is unpacked from its compartment atop the launch rockets. The astronauts first fire some explosive bolts. These cause the main spaceship, given the name Columbia, to separate from the adapter and blow apart the four panels that make up its sides, exposing the lunar module (LM) tucked inside. They stop the spacecraft about 100 feet away —34 feet farther than they were supposed to—turn the ship around, facing the landing craft, and dock head-to-head with it. The docking complete, the LM's connections with the adapter are blown loose and the mated command/service and lunar modules separate from the rocket and continue alone toward the Moon.
2:38 p.m.–By dumping its leftover fuel the third rocket stage is fired into a long solar orbit to remove it from Apollo 11's path.
2:43 p.m.–With the flight on schedule and proceeding satisfactorily, the first scheduled midcourse correction is considered unnecessary.
2:54 p.m.–The spacecraft is reported 22,000 nautical miles from Earth and traveling at 12,914 feet per second. Crew members keep busy with housekeeping duties.
8:52 p.m.–Mission Control at Houston, Texas, says good night to the crew as they prepare to go to sleep two hours early.
10:59 p.m.–Because of the pull of Earth's gravity, the spacecraft has slowed to 7,279 feet per second at a distance of 63,880 nautical miles from Earth.

JULY 17

8:48 a.m.–Mission Control gives Apollo crew a brief review of the morning news, including sports developments. They are informed about the progress of the Russian space ship Lunar 15 and that Vice President Spiro T. Agnew, ranking government official at the Apollo 11 blastoff, has called for putting a man on Mars by the year 2000.
12:17 p.m.–Midcourse correction is made with a three-second burn, sharpening the course of the spacecraft and testing the engine that must get them in and out of lunar orbit.
7:31 p.m.–Astronauts begin first scheduled color telecast from spacecraft, showing view of the Earth from a distance of about 128,000 nautical miles. During the 36-minute transmission, views are also shown of the inside of the command module.
9:42 p.m.–Mission control bids the crew goodnight.

JULY 18

9:41 a.m.–Mission Control lets Astronauts sleep an hour later than scheduled on the third day of the outward journey. After breakfast, they begin housekeeping chores, such as charging batteries, dumping waste water, and checking fuel and oxygen reserves. Announcement is made to them that course corrections scheduled for afternoon will not be necessary.
2:57 p.m.–Astronauts are given report on day's news.
4:40 p.m.–One of the clearest television transmissions ever sent from space is begun, with the spacecraft 175,000 nautical miles from Earth and 48,000 from the Moon. It lasts an hour and 36 minutes. While in progress, the hatch to the LM is opened and Armstrong squeezes through the 30-inch-wide tunnel to inspect it. He is followed by Aldrin.
10:00 p.m.–Mission Control tells the crew goodnight.
11:12 p.m.–Velocity of spacecraft has slowed to 2,990 ft. per second just before entering the Moon's sphere of influence at a point 33,823 nautical miles away from it.

JULY 19

6:58 a.m.–Astronauts call Mission Control to inquire about scheduled course correction and are told it has been cancelled. They are also advised they may go back to sleep.
8:32 a.m.–Mission Control signals to arouse crew and to start them on breakfast and housekeeping chores.
10:01 a.m.–Astronauts are given review of day's news and are told of worldwide interest in Moon mission.
10:31 a.m.–Collins reports: "Houston, it's been a real change for us. Now we are able to see stars again and recognize constellations for the first time on the trip. The sky is full of stars, just like the nights on Earth. But all the way

here we have just been able to see stars occasionally and perhaps through monoculars, but not recognize any star pattern."

10:42 a.m.–Armstrong announces: "The view of the Moon that we've been having recently is really spectacular. It fills about three-quarters of the hatch window and, of course, we can see the entire circumference, even though part of it is in complete shadow and part of it's in earth-shine. It's a view worth the price of the trip."

12:58 p.m.–The crew is informed by Mission Control: "We're 23 minutes away from the LOI (Lunar Orbit Insertion) burn. Flight Director Cliff Charlesworth is polling flight controllers for its status now." Then quickly, seconds later: "You are go for LOI." Aldrin replies: "Roger, go for LOI."

1:13 p.m.–Spacecraft passes completely behind the Moon and out of radio contact with the Earth for the first time.

1:28 p.m.–The spacecraft's main rocket, a 20,500-pound-thrust engine, is fired for about six minutes to slow the vehicle so that it can be captured by lunar gravity. It is still behind the Moon. The resulting orbit ranges from a low of 61.3 nautical miles to a high of 168.8 nautical miles.

1:55 p.m.–Armstrong tells Mission Control: "We're getting this first view of the landing approach. This time we are going over the Taruntius crater and the pictures and maps brought back by Apollos 8 and 10 give us a very good preview of what to look at here. It looks very much like the pictures, but like the difference between watching a real football game and watching it on TV—no substitute for actually being here."

About 15 minutes later he adds: "It gets to be a lighter gray, and as you get closer to the subsolar point, you can definitely see browns and tans on the ground."

And a few moments still later: "When a star sets up here, there's no doubt about it. One instant it's there and the next instant it's just completely gone."

3:56 p.m.–A 35-minute telecast of the Moon's surface begins. Passing westward along the eastern edge of the Moon's visible side, the camera is focused especially on the area chosen as a landing site.

5:44 p.m.–A second burn of the spacecraft's main engine, this one for 17 seconds, is employed while the spacecraft is on the back side of the Moon to stabilize the orbit at about 54 by 66 nautical miles.

6:57 p.m.–Armstrong and Aldrin crawl through the tunnel into the lunar module to give it another check. The spacecraft is orbiting the Moon every two hours.

JULY 20

9:27 a.m.—Aldrin crawls into the lunar module and starts to power-up the spacecraft. About an hour later, Armstrong enters the LM and together they continue to check the systems and deploy the landing legs.

1:46 p.m.–The landing craft is separated from the command module, in which Collins continues to orbit the Moon.

2:12 p.m.–Collins fires the command ship's rockets and moves about two miles away.

3:08 p.m.–Armstrong and Aldrin, flying feet first and face down, fire the landing craft's descent engine for the first time.

3:47 p.m.–Collins, flying the command ship from behind the Moon, reports to Earth that the landing craft is on its way down to the lunar surface. It is the first Mission Control has heard of the action. "Everything's going just swimmingly. Beautiful!" Collins reports.

4:05 p.m.–Armstrong throttles up the engine to slow the LM before dropping down on the lunar surface. The landing is not easy. The site they approach is four miles from the target point, on the southwestern edge of the Sea of Tranquility. Seeing that they are approaching a crater about the size of a football field and covered with large rocks, Armstrong takes over manual control and steers the craft to a smoother spot. His heartbeat has risen from a normal 77 to 156.

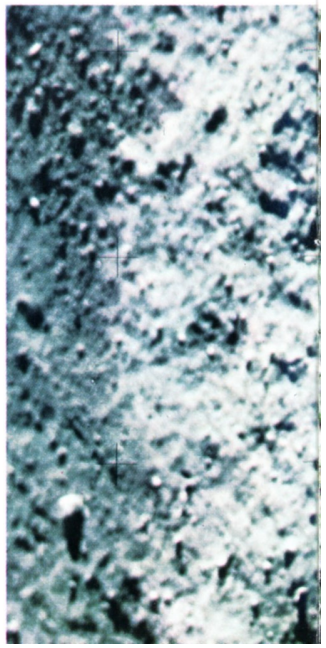
While Armstrong flies the landing craft, Aldrin gives him altitude readings: "Seven hundred and fifty feet, coming down at 23 degrees . . . 700 feet, 21 down . . . 400 feet, down at nine . . . Got the shadow out there . . . 75 feet, things looking good . . . Lights on . . . Picking up some dust . . . 30 feet, 2½ down . . . Faint shadow . . . Four forward. Four forward, drifting to the right a little . . . Contact light. Okay, engine stop."

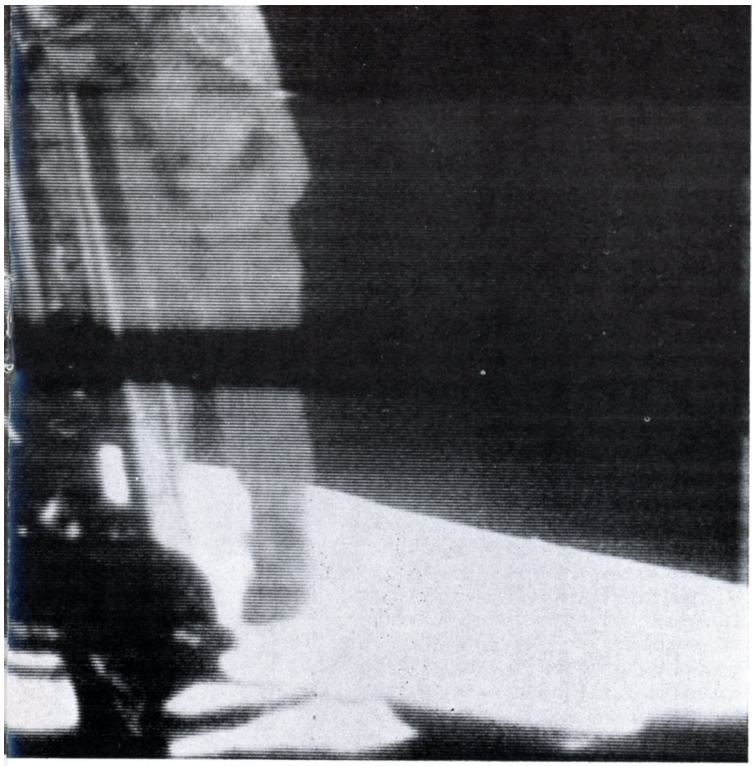
When the 68-inch probes beneath three of the spacecraft's four footpads touch down, flashing a light on the instrument panel, Armstrong shuts off the ship's engine.

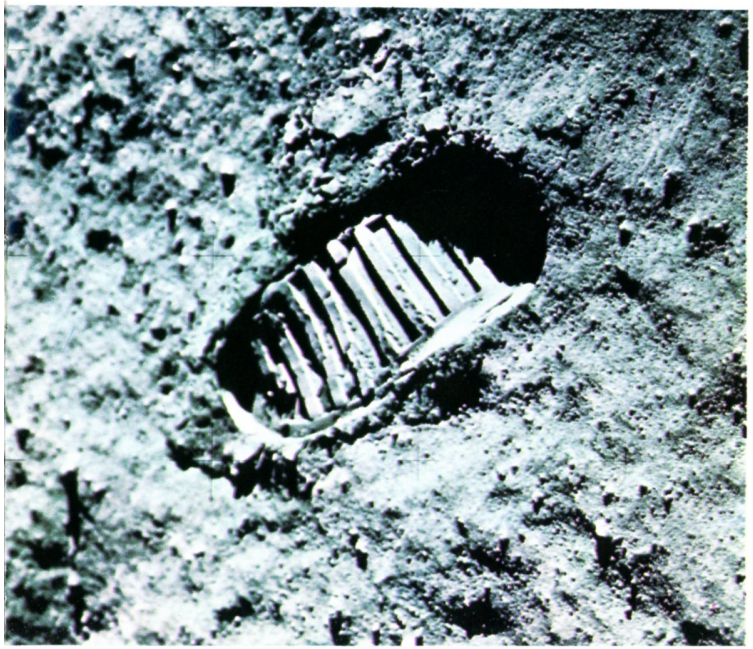
4:18 p.m.–The craft settles down with a jolt almost like that of a jet landing on a runway. It is at an angle of no more than four or five degrees on the right side of the Moon as seen from Earth. Armstrong immediately radios Mission Control: **"The Eagle has landed."**

Aldrin, looking out of the LM window, reports: "We'll get to the details around here, but it looks like a collection of just about every variety of shapes, angularities and granularities, every variety of rock you could find. The colors vary pretty much depending on how you're looking. . . . There doesn't appear to be much of a general color at all; however, it looks as though some of the rocks and boulders, of which there are quite a few in the near area . . . are going to have some interesting colors to them."

A few moments later he tells of seeing numbers of craters, some of them 100 feet across, but the largest number







Left: This is the scene on television witnessed by millions on Earth as Armstrong descends the LM ladder just prior to becoming the first human being to set foot on the Moon.

Below: The footprint on the Moon, something new in man's long stretch of history.

only one or two feet in diameter. He sees ridges 20 or 30 feet high, two-foot blocks with angular edges, and a hill half a mile to a mile away.

Finally, in describing the surface, Aldrin says: "It's pretty much without color. It's gray and it's a very white, chalky gray, as you look into the zero phase line, and it's considerably darker gray, more like ashen gray as you look up 90 degrees to the Sun. Some of the surface rocks close in here that have been fractured or disturbed by the rocket engine are coated with this light gray on the outside, but when they've been broken they display a dark, very dark gray interior, and it looks like it could be country basalt."

The first task after landing is that of preparing the ship for launching, of seeing that all is in readiness to make the ascent back to a rendezvous with the command spacecraft orbiting above.

6:00 p.m.–With everything in order, Armstrong radios a recommendation that they plan to start the EVA (Extra Vehicular Activity), earlier than originally scheduled, at about 9:00 p.m. EDT. Mission Control replies: "We will support you anytime."

10:39 p.m.–Later than proposed at 6:00 p.m., but more than five hours ahead of the original schedule, Armstrong opens the LM hatch and squeezes through the opening. It is a slow process. Strapped to his shoulders is a portable life support and communications system weighing 84 pounds on Earth, 14 on the Moon, with provision for pressurization; oxygen requirements and removal of carbon dioxide.

Armstrong moves slowly down the 10-foot, nine-step ladder. On reaching the second step, he pulls a "D-ring," within easy reach, deploying a television camera, so arranged on the LM that it will depict him to Earth as he proceeds from that point.

Down the ladder he moves and halts on the last step. "I'm at the foot of the ladder," he reports. "The LM footpads are only depressed in the surface about one or two inches . . . the surface appears to be very, very finegrained, as you get close to it, it's almost like a powder."

10:56 p.m.–Armstrong puts his left foot to the Moon. It is the first time in history that man has ever stepped on anything that has not existed on or originated from the Earth.

"That's one small step for a man, one giant leap for mankind," Armstrong radios. Aldrin is taking photographs from inside the spacecraft.

The first print made by the weight of man on the Moon is that of a lunar boot which resembles an oversized galosh.

Its soles are of silicon rubber and its 14-layer sidewalls of aluminized plastic. Specially designed for super-insulation, it protects against abrasion and has reduced friction to facilitate donning. On Earth, it weighs four pounds, nine ounces; on the Moon, 12 ounces.

Armstrong surveys his surroundings for a while and then moves out, testing himself in a gravity environment one-sixth of that on Earth. "The surface is fine and powdery," he says. "I can pick it up loosely with my toe. It does adhere in fine layers like powdered charcoal to the sole and sides of my boots. I only go in a small fraction of an inch. Maybe an eighth of an inch, but I can see the footprints of my boots and the treads in the fine sandy particles.

"There seems to be no difficulty in moving around as we suspected. It's even perhaps easier than the simulations. . . ."

Feeling more confident, Armstrong begins making a preliminary collection of soil samples close to the landing craft. This is done with a bag on the end of a pole.

"This is very interesting," he comments. "It's a very soft surface, but here and there . . . I run into a very hard surface, but it appears to be very cohesive material of the same sort. . . . It has a stark beauty all its own. It's like much of the high desert of the United States."

He collects a small bagful of soil and stores it in a pocket on the left leg of his space suit. This is done early, according to plan, to make sure some of the Moon surface is returned to Earth in case the mission has to be cut short.

11:11 p.m.–After lowering a Hasselblad still camera to Armstrong, Aldrin emerges from the landing craft and backs down the ladder, while his companion photographs him.

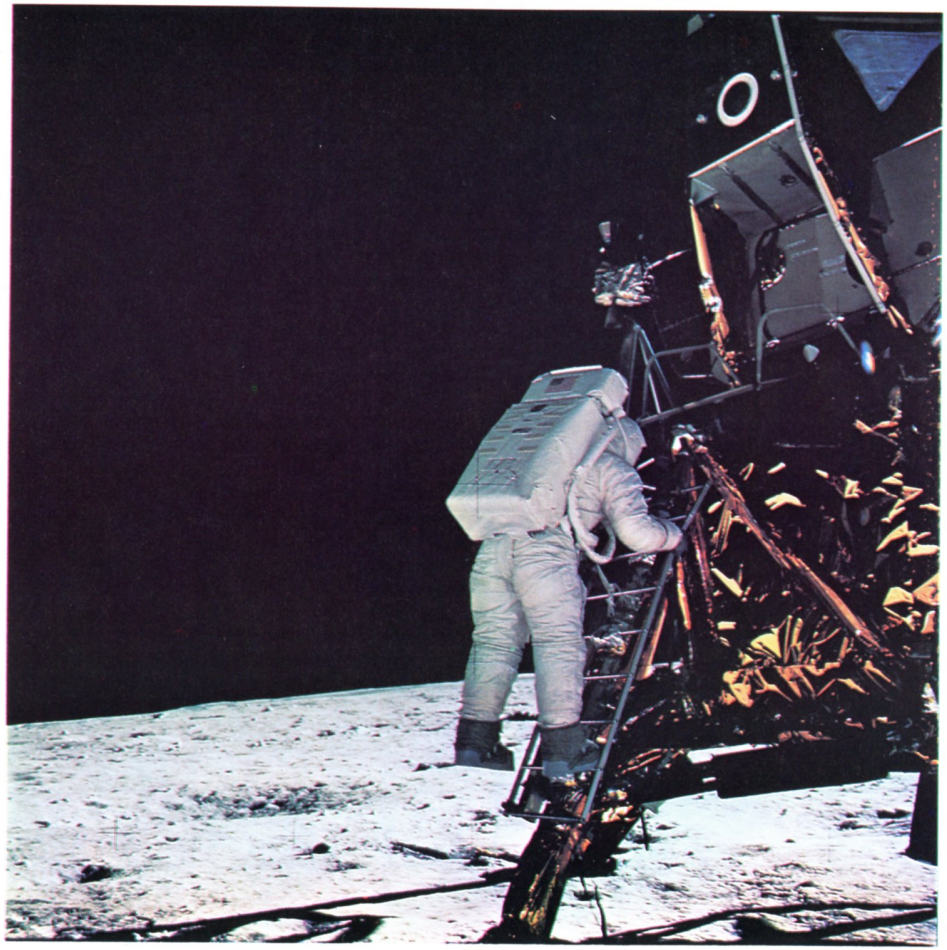
"These rocks . . . are rather slippery," Armstrong says. The astronauts report that the powdery surface seems to fill up the fine pores on the rocks, and they tend to slide over them rather easily.

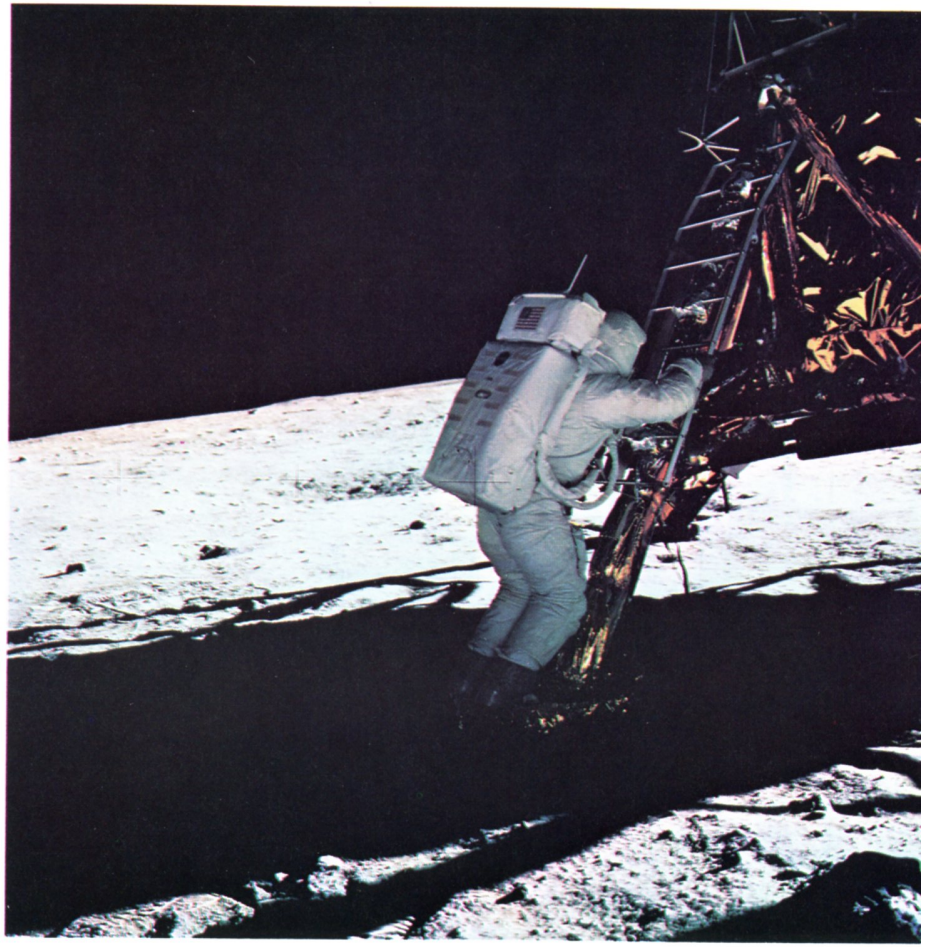
Armstrong fits a long focal length lens into position on the TV camera and trains it upon a small, stainless steel plaque on one of the legs of the landing craft. He reads: "Here men from the planet Earth first set foot on the Moon. July 1969 A.D. We came in peace for all mankind." Below the inscription are the names of the Apollo crew and President Nixon.

Armstrong next removes the TV camera from its fixed position on the LM and moves it away about 40 feet so it can cover the area in which the astronauts will operate.

As scheduled, the astronauts set up the first of three experiments. From an outside storage compartment in the LM, Aldrin removes a foot-long tube containing a roll of aluminum foil. Inside the roll is a telescoped pole that is driven into the lunar surface, after which the foil is

In this sequence of photographs taken by Armstrong, Aldrin is shown as he descends LM ladder.





suspended from it, with the side marked "Sun" next to the Sun. Its function will be to collect the particles of "solar wind" blowing constantly through space so that they can be brought back and analyzed in the hope they will provide information on how the Sun and planets were formed.

11:41 p.m.–From a leg of the spacecraft, the astronauts take a three-by-five-foot, nylon United States flag, its top edge braced by a spring wire to keep it extended on the windless Moon and erect it on a staff pressed into the lunar surface.

Taken to the Moon are two other U.S. flags, to be brought back and flown over the houses of Congress, the flags of the 50 States, the District of Columbia and U.S. territories, the United Nations flag, as well as those of 136 foreign countries.

11:47 p.m.–Mission Control announces: "The President of the United States is in his office now and would like to say a few words to you." Armstrong replies: "That would be an honor."

11:48 p.m.–The astronauts listen as the President speaks by telephone: "Neil and Buzz. I am talking to you from the Oval Room at the White House. And this certainly has to be the most historic telephone call ever made . . . . For every American this has to be the proudest day of our lives. And for people all over the world I am sure they, too, join with Americans in recognizing what a feat this is. Because of what you have done, the heavens have become a part of man's world. As you talk to us from the Sea of Tranquility, it inspires us to redouble our efforts to bring peace and tranquility to Earth. For one priceless moment, in the whole history of man, all the people on this Earth are truly one."

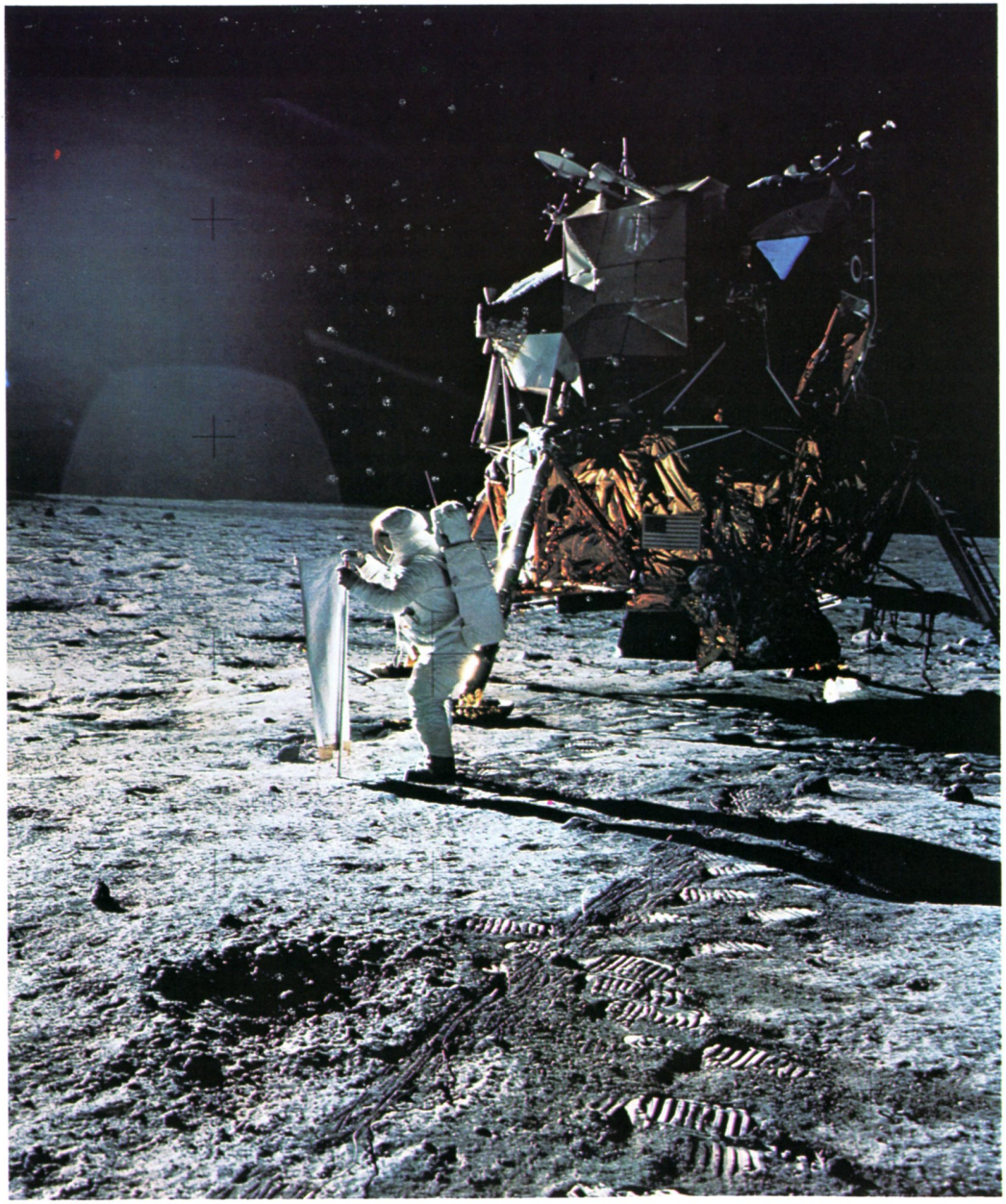
As the President finishes speaking, Armstrong replies: "Thank you, Mr. President. It's a great honor and privilege for us to be here representing not only the United States but men of peace of all nations. And with interest and a curiosity and a vision for the future. It's an honor for us to be able to participate here today."

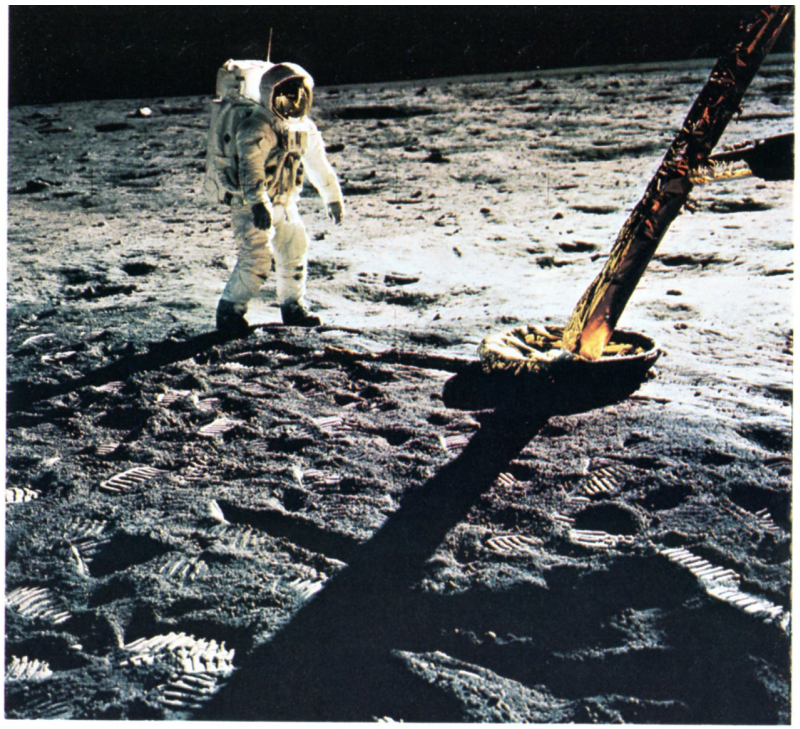
The two astronauts stand at attention, saluting directly toward the television as the telephone conversation concludes.

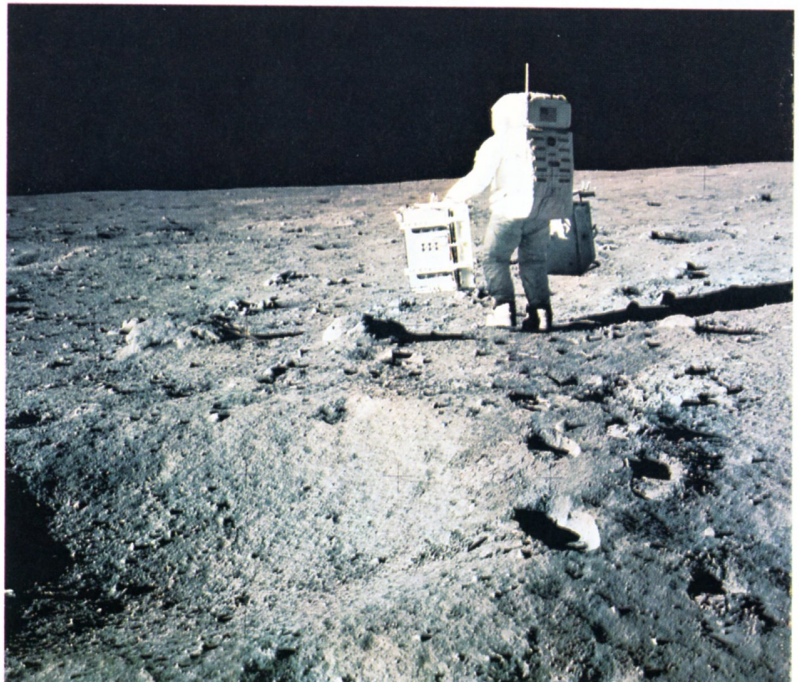
Armstrong next sets up a folding table and opens on it two specimen boxes. Using tongs and the lunar scoop, a quantity of rocks and soil are picked up and sealed in the boxes, preparatory to placing them in the ascent stage of the landing craft.

Aldrin, meanwhile, opens another compartment in the ship and removes two devices to be left on the Moon, taking each out about 30 feet from the ship. One is a seismic detector, to record moonquakes, meteorite impact, or volcanic eruption, and the other a laser-reflector, a device designed to make a much more precise measurement of Earth-Moon distances than has ever been possible before.

Aldrin deploys instruments to collect particles of "solar wind."



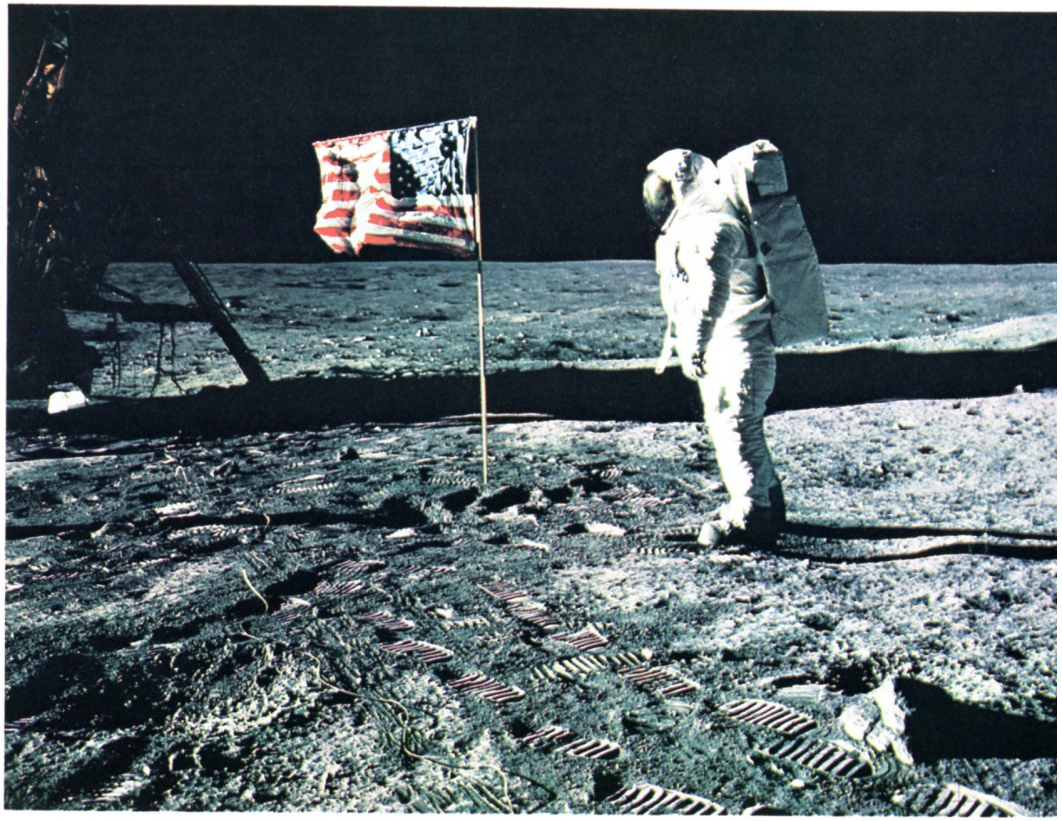




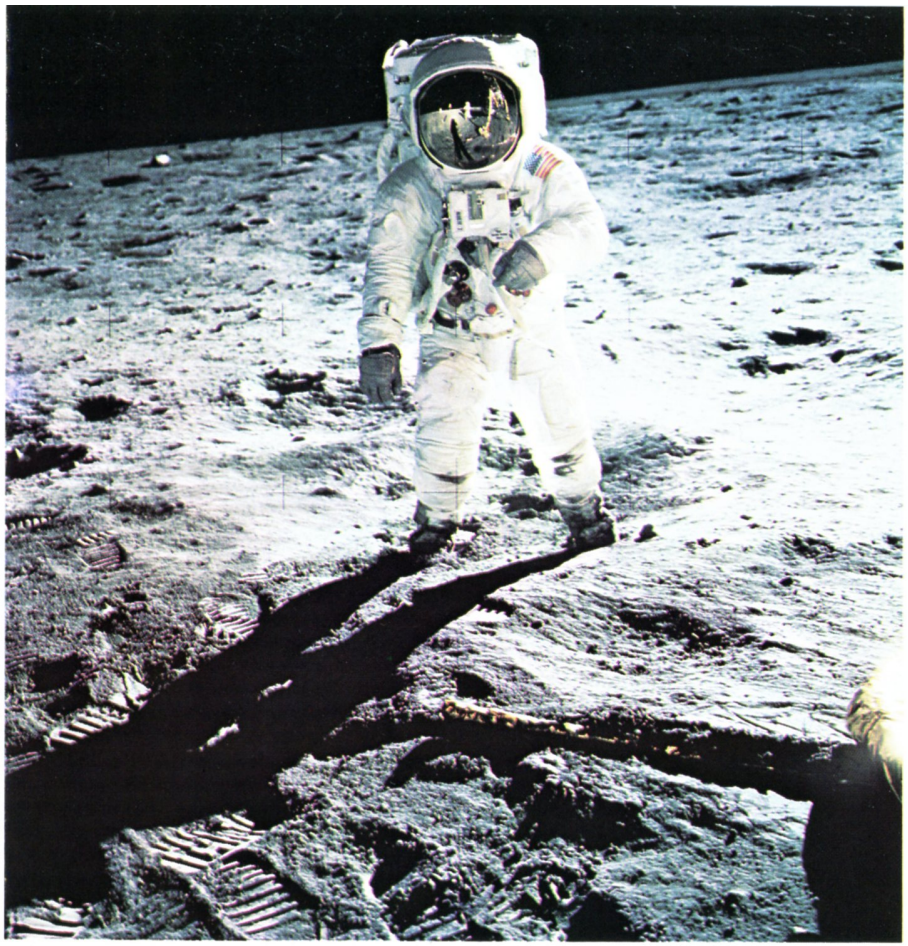
Left: Aldrin approaches leg of landing craft.

Below: The flag that established Tranquility Base, Aldrin beside it.

Lower left: Aldrin, walking away from camera, prepares to set up two instruments from the experiment package.



Tranquility Base. Reflected in the golden face visor of Astronaut Aldrin are the Eagle, Commander Armstrong, the flag and deployed experiment instruments.



The commemorative plaque bearing the names of the crew members and President Nixon.

Right: Armstrong and Aldrin unfurl U.S. flag on Moon and are photographed by automatic camera in LM window.

JULY 21

12:54 a.m.–After checking with Mission Control to make sure all chores have been completed, experiments set up, and photographs taken, Aldrin starts back up the ladder to re-enter the LM.
1:09 a.m.–Armstrong joins Aldrin in the landing craft.
1:11 a.m.–The hatch is closed. The astronauts begin removing the portable life support systems on which they have depended for two hours and 47 minutes.
4:25 a.m.–Astronauts are told to go to sleep, after attending to final housekeeping details and answering a number of questions concerning the geology of the Moon.
9:44 a.m.–Shortly after arousing Collins, still circling the Moon in the Command/Service Module, Mission Control observes: "Not since Adam has any human known such solitude as Mike Collins is experiencing during this 47 minutes of each lunar revolution when he's behind the Moon with no one to talk to except his tape recorder aboard Columbia."
11:13 a.m.–The astronauts in Eagle are aroused. Aldrin announces: "Neil has rigged himself a really good hammock . . . and he's been lying on the hatch and engine cover, and I curled up on the floor."
12:42 p.m.–Answering a question raised before they went to sleep, Aldrin reports: "We are in a boulder field where boulders range generally up to two feet, with a few larger than that. . . . Some of the boulders are lying on top of the surface, some are partially exposed, and some are just barely exposed."
1:54 p.m.–Ascent engine is started and LM, using descent stage as a launch pad, begins rising and reaches a vertical speed of 80 feet per second at 1,000 feet altitude.

The astronauts take with them in the ascent stage the soil samples, the aluminum foil with the "solar wind" particles it has collected, the film used in taking photographs with still and motion picture cameras, the flags and other mementos to be returned to Earth. Behind they leave a number of items, reducing the weight of the ship from 15,897 pounds as it landed on the Moon to 10,821 pounds.

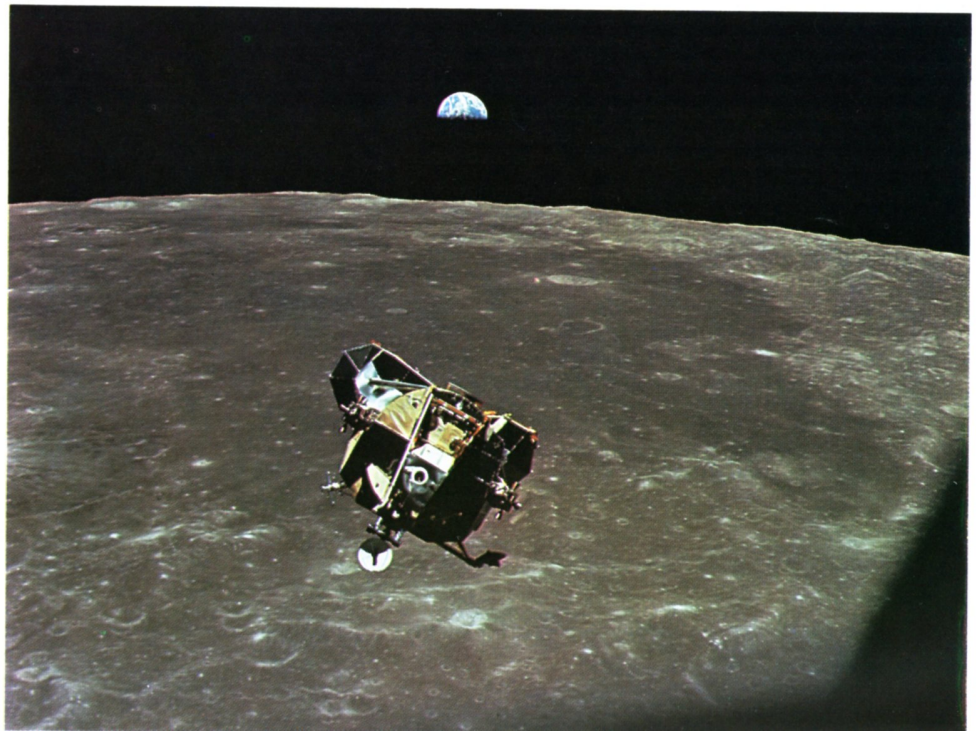
The largest item left behind is the descent stage, that part of the landing craft with the plaque on one of its spidery legs. Others include the TV camera, two still cameras, tools used in collecting samples, portable life support systems, lunar boots, American flag, rod support for the "solar wind" experiment instrument, laser beam reflector, seismic detector, and a gnomon, a device to verify colors of objects photographed.
5:35 p.m.–Eagle redocks with Columbia while circling on the back side of the Moon.
7:42 p.m.–The landing craft is jettisoned.

JULY 22

12:56 a.m.–While on the back side of the Moon, with the LM 20 miles behind the CSM, the transearth injection burn of Apollo 11 is begun, with the spacecraft traveling at 5,329 feet per second at an altitude of about 60 nautical miles.
4:30 a.m.–Astronauts start sleep period.
1:00 p.m.–Astronauts begin waking for first full day of return trip.
1:39 p.m.–Spacecraft passes point in space, 33,800 nautical miles from the Moon and 174,000 from the Earth, where the Earth's gravity takes over and begins drawing the astronauts homeward.
4:02 p.m.–Midcourse correction is made to readjust the flight path of the spacecraft.
9:08 p.m.–Eighteen minutes of live TV transmission to Earth begins.

JULY 23

2:14 a.m.–Crew starts sleep period.
12:20 p.m.–Crew awakens. Begins relaxed checking of systems and conversation with Mission Control.
3:56 p.m.–Spacecraft passes midway point of journey homeward, 101,000 nautical miles from splashdown.
7:03 p.m.–Final color television transmission begins.



Homeward bound. Armstrong and Aldrin, inside the ascent stage just after taking off from the Moon, start the first leg of their return trip to Earth, shown above the curving lunar surface.

JULY 24

6:47 a.m.–Crew awakens and begins to prepare for splashdown.
12:21 p.m.–Command and service modules are separated.
12:35 p.m.–Command module re-enters the Earth's atmosphere.
12:51 p.m.–Spacecraft splashes down 825 nautical miles southwest of Honolulu and about 13 nautical miles from the recovery ship, the U.S.S. Hornet.
1:20 p.m.–Hatch of command module opens and frogman hands in isolation suits.
1:28 p.m.–Astronauts emerge from the spacecraft in isolation suits and are sprayed with a disinfectant as a guard against the possibility of their contaminating the Earth with Moon "germs."
1:57 p.m.–Astronauts arrive by helicopter on the flight deck of the Hornet. Still inside the helicopter they ride an elevator to hangar deck and then walk immediately into the mobile quarantine trailer in which they will remain until they arrive at the Lunar Receiving Laboratory at Houston early July 27.
3:00 p.m.–President Nixon welcomes the astronauts, visible through a window of the trailer. Speaking over an intercom, he greets them, extends them an invitation to attend a dinner with him August 13. and tells them:

"This is the greatest week in the history of the world since the Creation. . . . As a result of what you have done, the world's never been closer together . . . . We can reach for the stars just as you have reached so far for the stars."

3:55 p.m.–The command module arrives on board the Hornet, after traveling 952,700 nautical miles since July 16.

So ends man's first mission to the Moon. It has lasted 195 hours, 18 minutes and 35 seconds or a little more than eight days. It is recognized as the most trouble-free mission to date, almost completely on schedule and successful in every respect.

Above: Pararescueman is shown after the splashdown spraying the astronauts, dressed in biological isolation garments, with disinfectant.

"A-Ok" is the theme of this mutual signalling through the window of the Mobile Quarantine Facility between President Nixon and the astronauts on board the U.S.S. Hornet.

EP-72
Produced by the Office of Public Affairs
National Aeronautics and Space Administration
Washington, D.C. 20546

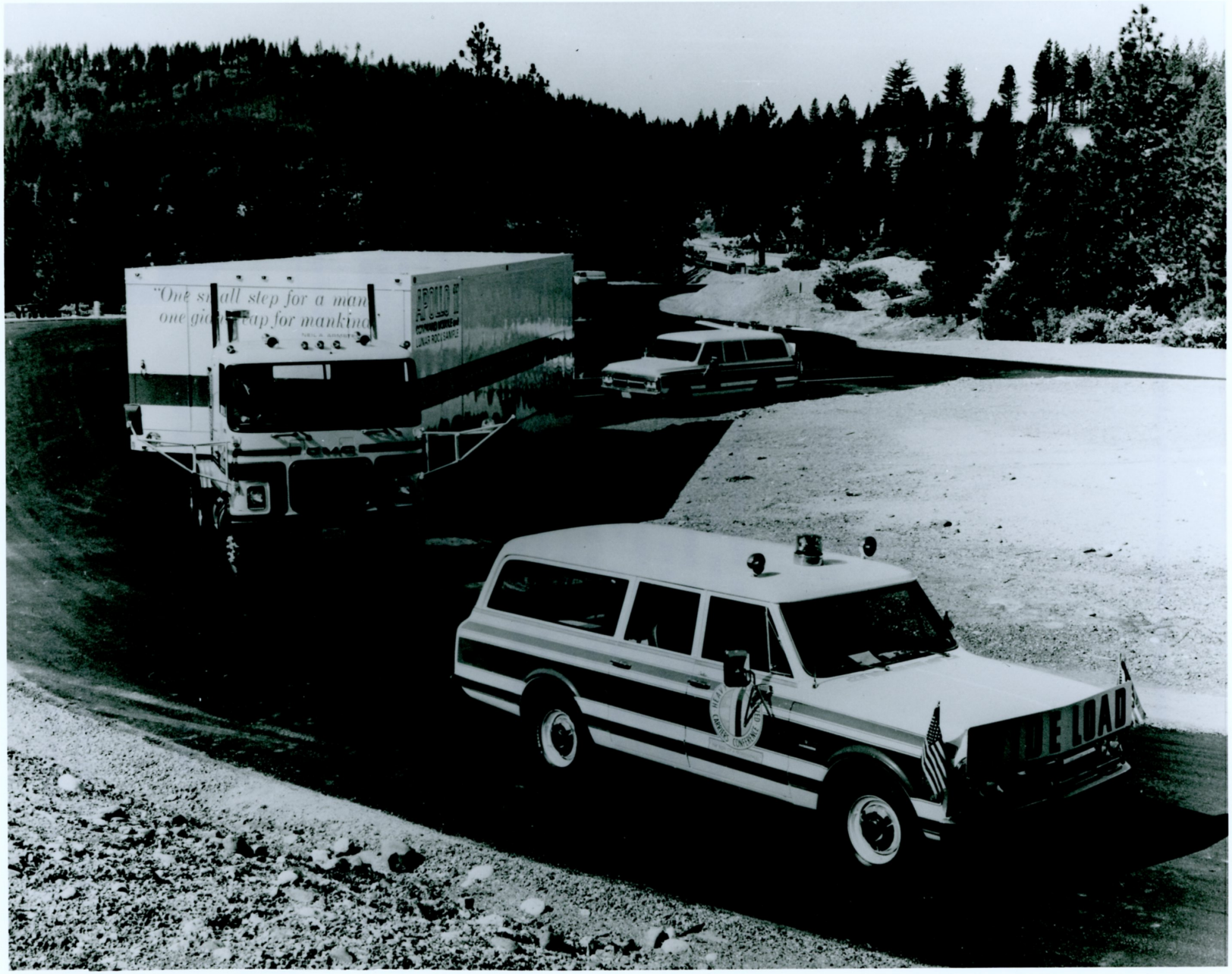
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402—Price 35 cents
☆ U.S. GOVERNMENT PRINTING OFFICE O—356-826

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D. C. 20546

FOR RELEASE: February 26, 1970

PHOTO NO. 69-H-1632
69-HC-967

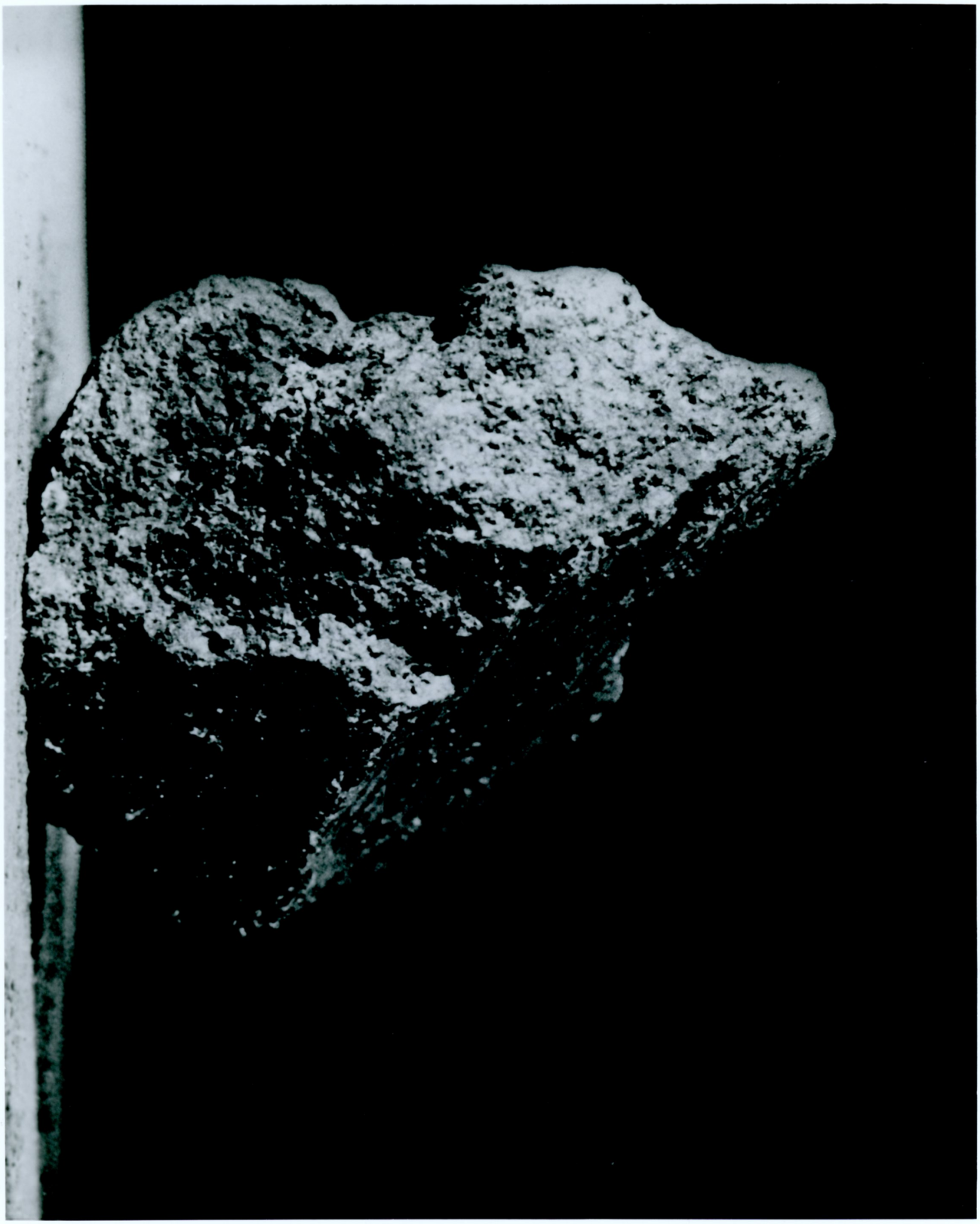
WASHINGTON, D. C. -- Apollo 11 Astronauts (L-R) Edwin E. Aldrin, Jr., Michael Collins, and Neil Armstrong inspect a Moon rock similar to the one which will be displayed in 50 state capitals during the tour of NASA's Mobile Display Van carrying the Apollo 11 spacecraft, lunar rock display and other exhibit items relating to the Apollo 11 mission to the Moon. Apollo 11 was a 9 day mission beginning July 16 through July 24.


"One small step for a man
one giant leap for mankind"
NEIL A. ARMSTRONG
APOLLO 11
LUNAR ROCK SAMPLE
E LOAD

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

FOR RELEASE: Filed May 14, 1970
PHOTO NO. 70-H-536

ON THE ROAD -- Touring the 50 state capitals this year and in 1971 is this 40 x 14 foot van carrying a Moon rock sample and the Apollo 11 command module which brought it back to Earth after the first United States lunar landing in July of 1969. The Heavy Specialized Carriers Conference, an American Trucking Association, Inc., affiliate, provided the big rig without cost to the government. The tour opened in Sacramento in April and the exhibit is working its way eastward on the visit to the length and breadth of the U.S.



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

FOR RELEASE: February 13, 1970
PHOTO NO. 70-H-232

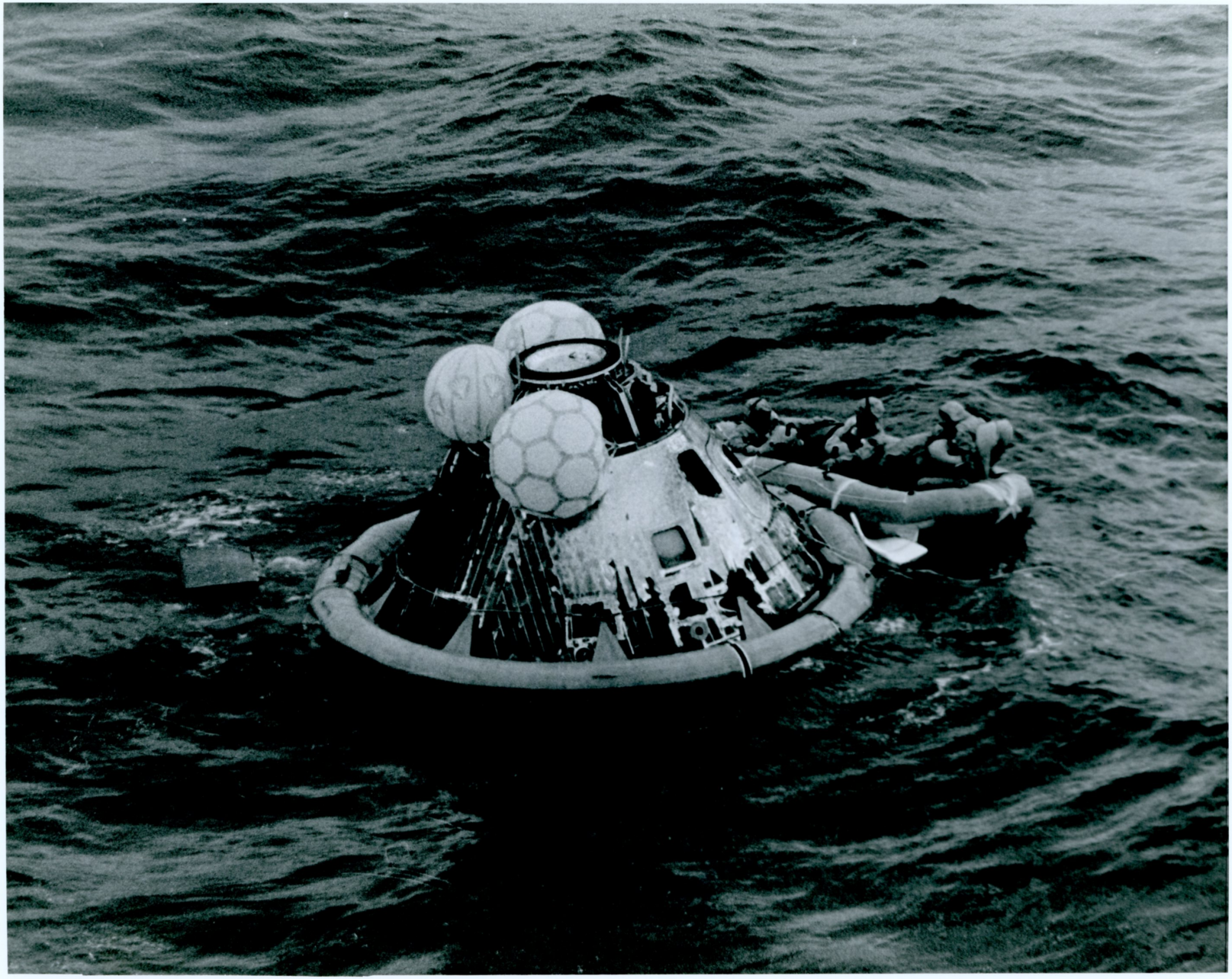
MANNED SPACECRAFT CENTER, HOUSTON, TEXAS -- APOLLO 11 LUNAR SAMPLE -- Close-up surface view of Apollo 11 lunar sample No. 10,047, which was returned in the bulk sample box by Astronauts Neil A. Armstrong, Michael Collins and Edwin E. Aldrin Jr., the crewmen for the Apollo 11 mission. The sample has been brushed slightly to remove some of the surface dust. The holocrystalline granular texture and the large grain size (relative to many of the other samples) are clearly visible. Armstrong and Aldrin collected the many Apollo 11 rocks while Collins remained with the Command and Service Modules in lunar orbit.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

FOR RELEASE: Filed May 28, 1970
PHOTO NO. 70-H-827

NASA APOLLO 11 EXHIBIT VAN AT CARSON CITY, NEVADA -- The mobile exhibit van is scheduled for a tour of the nation's 50 state capitals during 1970 and early 1971. The van will carry the Apollo 11 capsule, the spacecraft that carried the first men from Earth to set foot on the Moon. One of the principal features of the exhibit will be a Moon rock collected on the lunar surface by Astronauts Neil A. Armstrong and Edwin E. Aldrin. The big touring display unit measures 40 feet long and 14 feet wide. During its stay in each state capital, the van opens out to accommodate a walk-through ramp in each side, permitting thousands of visitors to see its exhibits daily. The Heavy Specialized Carriers Conference, affiliated with the American Trucking Associations, Inc., will provide the specialized transportation required by the Apollo 11 tour. Member companies of the conference will conduct the trip without charge as a public service.

PHOTO CREDIT--NASA or National Aeronautics and Space Administration



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

FOR RELEASE: July 24, 1969
PHOTO NO. 69-H-1217
160-KSC-537-673

KENNEDY SPACE CENTER, FLA.-- Apollo 11 astronauts Neil A. Armstrong, Michael Collins and Edwin E. Aldrin, Jr., wearing Biological Isolation Garments, await pickup by helicopter at the completion of their historical lunar landing mission. They splashed down in the Pacific Ocean at 12:50 p.m. EDT, July 24, 1969, 900 miles southwest of Hawaii, 13 miles from the USS Hornet, prime recovery ship. They entered the Mobile Quarantine Facility aboard the recovery ship and will remain in the trailer until it is flown to the Manned Spacecraft Center in Houston, Texas.

PHOTO CREDIT--NASA or National Aeronautics and Space Administration


for a man,
for mankind"
NEIL A. ARMSTRONG
TRANQUILITY BASE
JULY 20, 1969
COMMAND MODULE and
LUNAR ROCK SAMPLE
GMC

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

FOR RELEASE: Filed May 28, 1970
PHOTO NO. 70-H-828

NASA APOLLO 11 EXHIBIT VAN AT CARSON CITY, NEVADA -- The mobile exhibit van is scheduled for a tour of the nation's 50 state capitals during 1970 and early 1971. The van will carry the Apollo 11 capsule, the spacecraft that carried the first men from Earth to set foot on the Moon. One of the principal features of the exhibit will be a Moon rock collected on the lunar surface by Astronauts Neil A. Armstrong and Edwin E. Aldrin. The big touring display unit measures 40 feet long and 14 feet wide. During its stay in each state capital, the van opens out to accommodate a walk-through ramp in each side, permitting thousands of visitors to see its exhibits daily. The Heavy Specialized Carriers Conference, affiliated with the American Trucking Associations, Inc., will provide the specialized transportation required by the Apollo 11 tour. Member companies of the conference will conduct the trip without charge as a public service.

PHOTO CREDIT--NASA or National Aeronautics and Space Administration

MR-5

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

mission report

APOLLO 11

"Old Glory" flies on the lunar surface. Astronaut Edwin Aldrin at right.

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price 10 cents

14 August 1969

"We stand here in the dusk, the cold, the silence and here, as at the first of time, we lift our heads."
(From his poem Voyage To The Moon) Archibald MacLeish

At 10:56 P.M. EDT, Sunday, July 20, Astronaut Neil A. Armstrong, spacecraft commander of Apollo 11, set foot on the moon. His descent from the lowest rung of the ladder which was attached to a leg of the lower stage of the Lunar Module (LM), to the footpad, and then to the surface of earth's only natural satellite constituted the climax of a national effort that began in 1961. It was an effort that involved, at its peak, more than 300,000 people in industry, the universities and in government.

As he took his epochal step, Armstrong commented, "That's one small step for a man, one giant leap for Mankind."

Sharing this electric moment with Armstrong and Edwin "Buzz" Aldrin, the LM pilot, were an estimated half-billion TV watchers in most of the earth's nations. As the astronaut descended the ladder, he pulled, a "D" ring that deployed a black and white television camera which was focused to record the event. Framed by parts of the LM's under-carriage, Armstrong's heavily-booted left foot descended across millions of TV tubes until his boot sole made contact.

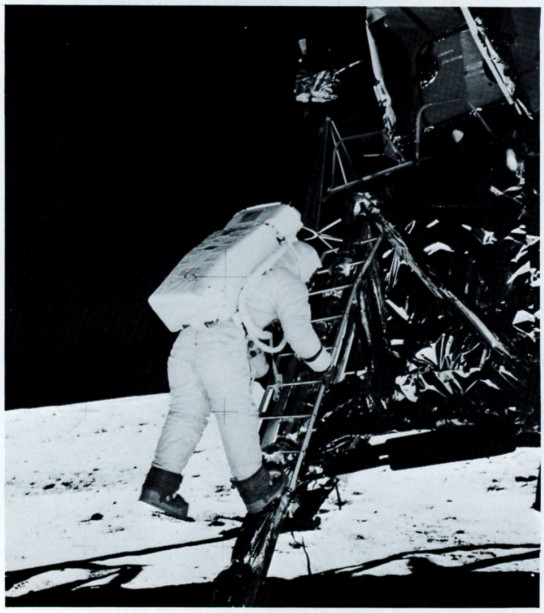
Work on The Moon

With the post landing checks completed, Armstrong climbed out of the LM and descended to the lunar surface. The moon walk began more than five hours ahead of schedule as a result of deciding not to have a rest period on schedule. Armstrong's attention was first directed at the nature of the surface material. He reported that the top layer was a fine, powdery material. He noted that he sunk in only a quarter of an inch or less, and that the footpads of the LM, which are convex discs 32 inches in diameter, had penetrated only a few inches. He also observed that the exhaust of the descent engine had not cratered the area directly below the LM engine nozzle.

After a quick visual check of the LM, Armstrong went ahead with his scheduled task of collecting the contingency sample – several pounds of lunar surface material which he stowed in a spacesuit pocket. In the course of his collecting, he noted that as he dug down five or six inches below the surface, he encountered hard, cohesive material. Armstrong had been assigned this collection as a first task to make sure that there would be samples aboard in case an early abort of the mission was necessary.

Aldrin Leaves the LM

Once the LM inspection and the sample collection were completed, Aldrin got out of the LM and climbed down the ladder, with Armstrong providing voice guidance. Armstrong was taking pictures of the event at



"Buzz" Aldrin descending the ladder of the LM.

Astronaut footprint on the moon.

the same time. The two then "unveiled" the plaque mounted on the strut behind the ladder by removing a protective covering. They read the inscription for the benefit of their world audience.

"Here Men From Planet Earth
First Set Foot Upon The Moon
July 1969 A.D.
We Came In Peace For All Mankind"

Report On The Lunar Surface

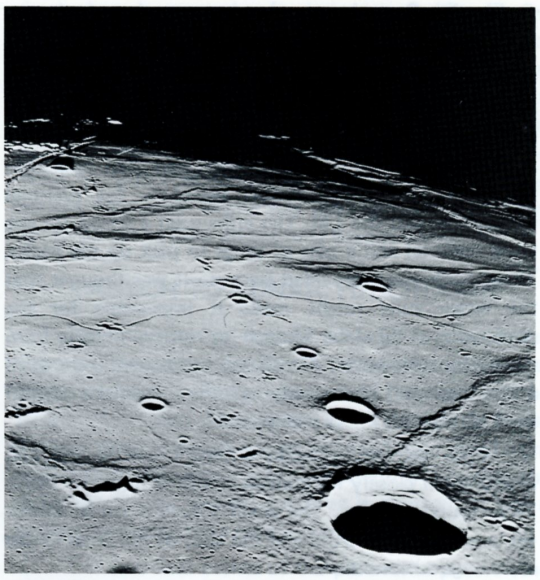
Armstrong removed the TV camera that had covered his first step on the moon and transmitted several panoramic shots of the area surrounding the LM. The pictures came through with remarkably good definition and showed a fairly level area pitted with small craters. There was a scattering of boulders of varying sizes and shapes, some of them as large as two feet in their biggest visible dimension.

The astronauts described the surface color as varying from a very light to a dark grey. When in the spacecraft, Armstrong reported seeing some boulders that had apparently been fractured by the exhaust of the descent engine. Their surface was a light grey – perhaps coated with the powdery surface material. The fractures were very much darker. From the astronauts' comments, it appeared that the sun angle was a factor in color. When the variation between the sun angle and the viewing angle was zero, the surface looked almost white. The brilliance of the sun made the astronauts careful not to look in its direction. Conversely, the depth of the shadows made it difficult for Armstrong to watch his footing. It was evident that the wide swing in temperature between the 180 degrees F in the sun and the -160 degrees in shadow created no problems. At one point, Aldrin reported being cool and corrected the problem with an adjustment of the thermal control on his suit.

Armstrong set the TV camera on a tripod some 40 feet from the LM and adjusted its field of view so that it would encompass their subsequent operations. Mission Control suggested an adjustment to the left so that the camera's field of view centered on the LM in the background with a viewing angle wide enough to cover the area in which most of the activities would take place.

Setting Up The Experiments

Aldrin then took the solar wind experiment and set it up. This was a narrow rectangle, about 4 feet long, of a foil-like material suspended from a rod that extended horizontally from the top of an aluminum staff. Aldrin forced the staff far enough into the moon's surface so that it would stand alone. He adjusted the



Approach to Landing Site #2 taken from lunar orbit. Crater Maskelyne at lower right. Shadow at lower left thrown by part of spacecraft.

rectangle so that it was aligned with the sun. After sufficient exposure, it would be taken down and brought back to earth.

The crew next deployed a specially structured 3' x 5' American flag. They fitted together its two-piece aluminum staff and deployed a support along its upper edge so that it would remain unfurled in the lunar vacuum.

A Phone Call From The White House

With this task completed, Mission Control put through to the crew the longest long-distance telephone call in man's history. It originated in the White House and was relayed by the facilities at Mission Control to one of the giant dish antennas handling ground-moon communications, and thence to the LM crew. Advised that President Nixon wanted to talk to them, Armstrong responded, "That would be an honor."

President Nixon told the astronauts, "As you talk from the Sea of Tranquility, it inspires us to double our efforts to bring peace and tranquility to earth. For one priceless moment in the whole history of man, all the people on this earth are truly one."

When the conversation was finished, Armstrong and Aldrin faced the camera and saluted.

Collecting Samples

The collecting of samples in bulk went forward without incident. Armstrong and Aldrin between them bagged upwards of 50 pounds (earth weight) of the loose surface material and selected rocks. These were stowed in small beta cloth bags and sealed and then packed in two large containers – also sealed – for eventual stowage aboard the LM. The crew used a scoop for the loose material and a pair of tongs to pick up the rocks. These tools were provided because it was thought that the space suits might make it impossible for the astronauts to bend far enough to retrieve objects from the surface. However, Armstrong subsequently dropped a film case and, after steadying himself against a strut of the LM, bent his knees and picked it up.

Both astronauts made a slow circle of the LM, examining it closely for damage resulting from the flight. They found nothing. The small thrusters called quads, the antennas, the struts and the skin of the lunar lander were in good condition.

The two main experiments were taken out of the LM and set up approximately 70 and 80 feet south of the LM. The distance was a safeguard against damage to the instruments by the ascent engine exhaust at take-off. The seismometer, designed to record and report events affecting the physical structure of the moon, began returning data immediately. It was sensitive enough to record the impact of the astronauts' feet on the moon's surface as they walked. The laser reflector which was to provide very precise information on the moon's distance from earth and its orbital path did not immediately function. The reason for this is not clear. A few days later it commenced operating.

Ease Of Movement

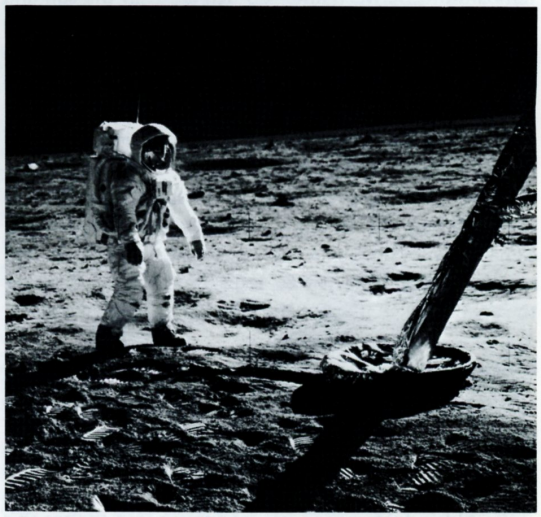
In the long prelude to the flight, scientists had reservations about man's ability to move around in the lunar environment. The space suit, with its back pack of life support equipment, has an earth weight of 180 pounds. Moreover, in the lunar vacuum, the suit's internal pressure inflates it – a condition that substantially reduces its flexibility. There were also doubts as to human ability to adapt to the one-sixth gravity of the moon. It was feared that there might be a disorientation that would make movement awkward.

Armstrong and Aldrin quickly demonstrated that these fears were groundless, and enjoyed themselves thoroughly in doing so. Armstrong reported that movement on the moon was easier than it had been in the one-sixth G simulator in which they practiced at Houston. Both observed that the back pack tended to tip them backwards. Aldrin went through a series of movements, with a running commentary, to show TV watchers what could be done. He noted that it was important to know where the body's center of mass was and to keep a foot under it. He found it helped to lean in the direction of the movement and that turns were made easier by "cutting" in the manner of a running back in football. The "kangaroo lope", which some scientists thought might be the best method of lunar locomotion, worked – as the astronauts demonstrated – but not as well as the time-tested earthly method of simply putting one foot in front of the other.

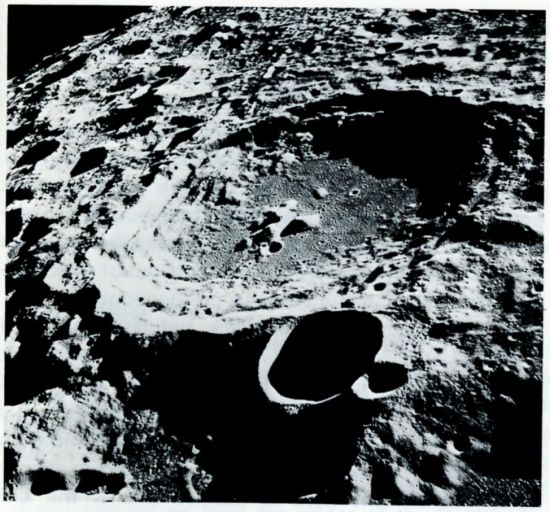
The ease of movement on the moon's surface was attested to by the fact that the astronauts ignored the rest periods that had been scheduled for them during the moon walk. Despite this, at no time during the exercise was there any heavy breathing. For the most part, the astronauts' heartbeat was lower than expected – lower, in some cases, than that of those at Mission Control who were watching. Armstrong's heart rate at one point reached 160 beats a minute, twice normal, but this was at the end of the walk when he was loading the rock samples into the LM. Pulse rates for both men were within the acceptable range throughout.

As he moved around, Aldrin commented that the rocks were rather slippery. "The powdery surface fills up the fine pores on the rocks," he said, "and we tend to slide over them rather easily."

During the moon walk, the TV transmission had a ghostly quality. The astronauts' white space suits, the grey tones of the moon's surface, the buoyancy of their movements, and the strange configuration of "Eagle" combined to give the impression that what viewers were seeing was truly from another world.



"Buzz" Aldrin walking in vicinity of Lunar Module. Footpad of Module is at right.



Oblique view of the lunar far side from lunar orbit. Large central crater is International Astronomical Union #308. It has a diameter of about 50 statute miles.

Besides the TV camera, the astronauts used a trio of other cameras for surface photography. They got both still and sequence coverage with a Hasselblad still camera, a Maurer data acquisition camera and the Apollo Lunar Surface Close-up camera.

Re-entering The LM

After assurance from Mission Control that all assigned tasks had been completed, the astronauts prepared to re-enter the LM. Aldrin went in first and Armstrong transferred up to him the lunar samples and the film packs. At 1:09 A.M. EDT, Armstrong climbed the ladder and went through the hatch. Two minutes later, the hatch was secured. Armstrong had walked on the moon for 2 hours, 31 minutes and 37 seconds; Aldrin roughly 40 minutes less.

After removing the life support systems that had sustained them on the lunar surface, the two astronauts began a rest period lengthened beyond plan by the addition of the pre-walk rest that had been omitted after they first touched down. Armstrong rigged himself a hammock and Aldrin curled up on the LM floor. Neither slept well.

Shortly after 11 A.M. EDT, Ground Control roused the astronauts, and they began the last phase of their housekeeping in preparation for return to lunar orbit.

A tense countdown began and at 1:54 P.M. EDT, the LM ascent engine roared to life and propelled the LM upper stage upward on a vertical course at a rate that reached 54 mph at the thousand foot level. A burn of roughly 7 minutes of the ascent engine placed the LM in an elliptical orbit of approximately 9 nm by 45 nm. A short phase burn nearly circularized it at 49 x 45 nm, and four short additional burns of the reaction control thrusters brought the LM to the rendezvous with Collins in the Command and Service Module (CSM). Save for a brief and unwanted burn by a thruster, docking was accomplished without incident on the far side of the moon at 5:35 P.M. EDT. The LM was cast off and the Service Propulsion engine was fired at 12:56 A.M., July 22, to place the CSM on the long voyage home.

LAUNCH TO LUNAR TOUCHDOWN

Four days earlier at 9:32 A.M. EDT, July 16, the five great engines of the Saturn V first stage ignited precisely on time, flaring a huge skirt of flame around the base of the rocket. After several static seconds for thrust buildup, the six-million-pound Saturn/Apollo lifted from the launch pad and moved purposefully up past the retracted gantry, gaining speed as it climbed. It was a perfect beginning for a nearly flawless flight.

The technical events of the pre-orbital phase – the roll sequence, jettison of the launch escape tower, first stage cut-off, second stage burn, second stage cut-off and third stage burn – took place with clockwork precision. With the shutdown of the third stage engine, both spacecraft and the stage entered a 103 nautical mile circular orbit exactly as planned.

On Course To The Moon

The crew spent the next full orbit and part of the second in an engineering, communication and equipment checkout. Over a point northeast of Australia, Ground Control gave them "go" for insertion into their translunar course. Re-firing the third stage engine increased velocity to roughly 24,200 mph – sufficient to break out of low-earth orbit into a free-return trajectory, an elliptical course that if undisturbed, would loop the spacecraft around the moon and bring it back to earth.

Once on course, the crew set about separating the CSM from the third stage which still housed the LM in the protective shelter of the panelled adapter section. The CSM was pitched 180 degrees, the adapter panels were disposed of and the CSM was flown slowly back for docking with the LM. The latter was separated from the third stage and the newly joined components moved a safe distance from the stage. Ground Control ordered the stage to dump its fuel – a move that propelled it into a course around the moon and thence into solar orbit. The spacecraft continued its outward coast to the moon.

Though it left its earth orbit speeding at more than 24,000 mph, relative to earth, the gravitational pull of the home planet steadily slowed the spacecraft until its

Astronaut Edwin Aldrin is in the process of taking a lunar soil sample. In the background is the solar wind experiment.

velocity had been cut to slightly over 2,000 mph. At this low point, the Apollo was approximately 34,000 nm from the moon, a zone where the pull of the moon's gravitational field is stronger than that of earth and the spacecraft, accordingly, began to pick up speed.

The acceleration continued until, at the point of insertion into lunar orbit, the spacecraft was travelling roughly 4,000 mph relative to the moon.

Into Lunar Orbit

When Ground Control had given "go" for insertion into lunar orbit, the crew braked the spacecraft with a retrograde burn of the Service Propulsion engine and slipped into an egg-shaped orbit of 61.3 nm at low point and a high point of 168.8 nm. A short retrograde burn at the low point altered the orbit's dimensions to the nearly circular course of 65.7 nm by 53.8 nm. After the LM had separated for its descent to the lunar surface, Collins in the Command Module (CM), would remain in this orbit, a lonely monitor of surface operations, until Armstrong and Aldrin flew the LM up to rejoin the mother ship.

Following the orbital correction, Armstrong and Aldrin crawled through the docking tunnel into the LM for housekeeping and a systems and equipment checkout in preparation for their descent to the moon's surface. At 1:46 P.M. EDT, the LM undocked from the CSM.

To The Surface Of The Moon

An hour and 22 minutes later, the descent maneuver began with a retrograde burn of the LM's descent engine that placed the LM in an elliptical orbit with a low point 8.5 nm above the moon. When the orbital low point was reached, the powered-descent stage started. This involved dropping the LM out of orbit into an arching glide with a terminus on the moon's surface. The glide path had two check points: one called "hi-gate" at an altitude of 7,600 feet and 26,000 feet laterally from "lo-gate," 500 feet in altitude and adjacent to the landing zone. During the glide the spacecraft's velocity would be cut from 342 miles an hour to about 50 miles an hour and eventually to almost zero. The descent went as planned and as the LM reached "lo-gate," its attitude approached the vertical to the moon's surface. As the LM dropped below 500 feet in altitude, the crew transmitted a staccato numerical report to Ground Control on its rate of drop and lateral movement.

A few seconds from touchdown, there was a break in communications providing a few tense moments. The next thing heard from the crew was:

"Houston. Tranquility Base here. The Eagle has landed."

During the communications break, the crew saw that their line of approach would take them into a crater the size of a football field covered with large rocks. Armstrong took manual control and flew the LM to a site four miles away and then gently set the LM on the lunar surface. When he cut off the descent engine, he had 30 seconds worth of fuel remaining. During this maneuver, Armstrong's heartbeat went from a normal 75 to 150. Point of touchdown was estimated to be about 120 miles southwest of the crater Maskelyne, although for a considerable period no one was sure of Eagle's exact location.

Aldrin immediately began describing the view from his window. ". . . . it looks like a collection of just about every variety of shapes, angularities and granularities, every variety of rock you could find. . . . it looks as though they're going to have some interesting colors to them."

HEADING FOR HOME

Compared to the earlier stages of the flight, the return leg of the mission was routine. So precise had been the Service Propulsion engine firing that only one of several planned midcourse corrections was needed, and that a velocity change of only 4.7 feet per second.

The astronauts busied themselves with housekeeping chores and rested. Early on July 24th, the crew began make ready for re-entry and splashdown. Rough weather in the planned landing area forced a shift to an alternate aiming point 215 miles down range. The spacecraft re-entered the atmosphere at 400,000 feet at 12:35 P.M. EDT, and 13 minutes later splashed into the Pacific Ocean approximately 825 nm southwest of Hawaii. The landing was within 13 nm of the prime recovery ship *Hornet.*

A Scrubbing

A half-hour after splashdown, a frogman in an isolation suit passed three isolation suits through the spacecraft hatch. The only difference between the suits worn by the frogmen and those given the astronauts was in the helmet. The astronauts' exhalations and the frogmens' inhalations were filtered. With President Nixon looking on from the bridge of the *Hornet*, the astronauts climbed into a rubber boat and were scrubbed down with an iodine solution by a frogman. The astronauts, in turn, scrubbed down the frogman. After the crew had been lifted into the helicopter, the Apollo spacecraft got a similar scrubbing. The isolation garments and the scrubbing were phases of the elaborate precautions against possible, but unlikely, contamination by lunar organisms.

Aboard the carrier, the crew entered the mobile isolation unit where they remained until reaching Houston. At the Manned Spacecraft Center they were put into the more commodious Lunar Receiving Laboratory where they were to complete their 21-day period of quarantine (calculated from the time of their departure from the moon).

The President's greeting to the astronauts was delivered below decks on the *Hornet* to the trio who were clustered behind a small window in the rear of the mobile unit. In congratulating them he stated, "As I travel into Asia and Europe, I'm going to find that as a result of what you've done, the world's never been closer together. We can reach for the stars just as you have." The President also extended an invitation to dinner.

Safeguards Against Contamination

Precautions to ensure that the astronauts would not introduce to earth microorganisms peculiar to the moon began before the liftoff from the lunar surface. The crew left on the moon items that had sustained maximum exposure to lunar material such as their outer foot gear. Before rejoining Collins in the CSM, Armstrong and Aldrin gave themselves a thorough vacuuming with an attachment that hooked onto the air hose of their suits. The LM interior was also vacuumed, and the cabin atmosphere triple-filtered. As they crawled through the docking tunnel, Collins maintained higher atmospheric pressure in the CSM than in the LM which had the effect of erecting an air barrier against the LM atmosphere transferring to the CSM. Once in the CSM, with the tunnel sealed, the vacuuming operation was repeated.

Records and Firsts

As might be expected from the nature of the mission, Apollo 11 established a number of records and "firsts." It put the largest payload ever in lunar orbit. In the 8-day mission, the TV networks beamed abroad, via satellite, telecasts totaling 230 hours. Comsat estimated viewers totaled 500 million. It was the healthiest flight. None of the crew had to resort to the medical kit for any reason. All phases of the lunar touchdown, the moon walk, and the ascent to 50,000 feet were "firsts." A record number of people watched the launch. Local Civil Defense officials estimated 1,000,000. Watchers pitched tents on nearby beaches and dunes, filled the motels and hotels and created a massive traffic tie-up. More than 3,000 newsmen from 55 countries besides the U.S. were on hand to report the event. Japanese news media were represented by a press corps of more than 100 correspondents.

TV from Space

Highlighted by full *in situ* coverage of the moon walk in black and white, the astronauts' telecasts began with an unscheduled transmission on the second day of the flight, followed by a second scheduled effort lasting more than a half-hour. At 4:40 P.M. EDT on the third

Aldrin prepares to deploy two experiments: the seismometer and the laser reflector.

day, the crew put on a color telecast that lasted more than an hour and a half. Picture resolution and quality were exceptional. Coverage included the interior of both the CM and the LM. The opening of the docking tunnel was photographed and the astronauts were depicted at work in the LM. Exterior views of the spacecraft were also shown, as were views of the earth.

The telecast of the moon walk had a double value. It brought to the general audience a portrayal of humans in the lunar environment and gave, as well, scientists and mission planners a visual complement to the narrative provided by the astronauts on their capabilities to move and work on the moon.

On the return leg, two programs were transmitted. An eighteen-minute sequence featured a demonstration of the physics of weightlessness. Collins filled a teaspoon with water and demonstrated "pouring"; i.e., he turned the spoon upside down and the water remained in place. A spinning can of cheese served to illustrate how a gyroscope works. There was a lesson on how to drink water in space. Some final shots of the earth and the moon were included. The second transmission featured messages of appreciation from each crew member to all the people who helped make Apollo 11 possible.

Foreign Reaction

Interest in Apollo 11 was intense and worldwide. The heads of state of 74 nations sent message of Godspeed and good luck. By a microdot process, these were reduced 200 times so that they all fitted on a silicon disc about the size of a silver dollar. Although each message is no larger than the head of a common pin, they remain readable under a microscope. The disc was left on the moon.

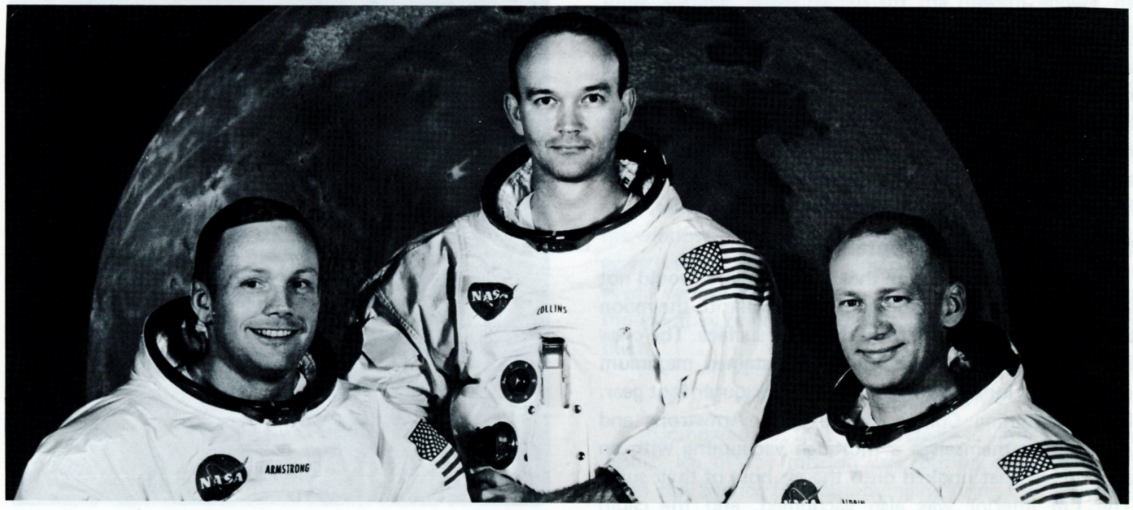
Besides three American flags, the crew carried with them the flags of the 50 states, of U. S. territories, of the United Nations and of each nation diplomatically recognized by the United States. Two American flags were brought back for presentation to the Senate and the House of Representatives.

The crew also had with them medals in memory of Astronauts Grissom, Chaffee and White who were to have been the crew of the first manned space flight in the Apollo program. They also left a memorial for the two Russian cosmonauts who were killed.

British insurance underwriters, Lloyds of London, rang the Lutine Bell, only done on rare occasions, to celebrate the success of the mission. Czechoslovakia and a number of other foreign nations, including the tiny Maldive Islands, issued special postage stamps. Several hundred Poles crowded into the lobby of the U.S. Embassy in Warsaw to watch the telecast of the moon walk. Applause was frequent during the transmission, and congratulations flowed freely. Among those cabling congratulations to President Nixon were Pope Paul VI, UN Secretary General U Thant, and Soviet President Nikolai V. Podgorny. Moscow radio began its 8 P.M. newscast with the term "Flash" and then reported that word of the completion of the Apollo mission had just come in and that "The courageous astronauts, Armstrong, Aldrin and Collins are again on our planet."

On the personal side, a Peruvian mother named her baby, born during the flight, after Neil Armstrong.

Thus, in 195 hours, 18 minutes and 35 seconds, Apollo 11 and Astronauts Armstrong, Aldrin and Collins moved the world into a new era.



Astronaut Neil A. Armstrong, Commander for Apollo 11

Astronaut Michael Collins, Command Module Pilot

Astronaut Edwin E. "Buzz" Aldrin, Lunar Module Pilot

☆ U. S. GOVERNMENT PRINTING OFFICE : 1969 O - 361-744

PRESIDENT'S COUNCIL ON YOUTH OPPORTUNITY
WASHINGTON 20006

June 19, 1970

MEMORANDUM

TO: Local NASA Program Coordinators

FROM: William M. Nugent Bill Nugent

SUBJECT: Additional NASA Resources

Enclosed is a press kit for the Apollo 11 50-state tour and a schedule of when it will be appearing in the capital of each state. The Apollo exhibit includes a walk-through van stuffed with memorabilia of that moon shot. Also enclosed is a schedule of lunar-rock samples exhibits appearing in cities throughout the nation.

This information is provided so that, if you wish, you may make appropriate arrangements to expose disadvantaged youngsters to these additional NASA resources.

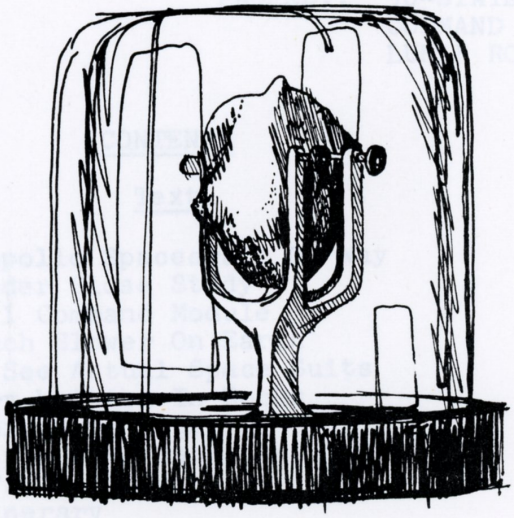
Enclosures

...FROM SPACE TO GRASS-ROOTS AMERICA

A

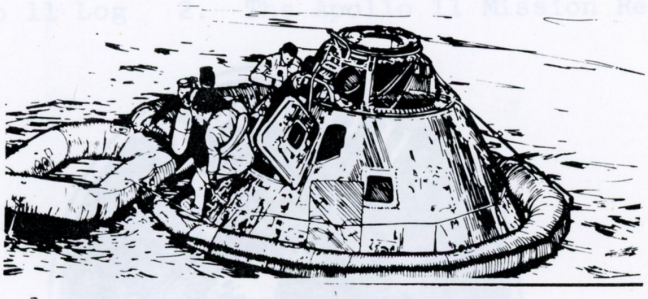
50-STATE TOUR

OF



one of the first rocks to be returned to Earth from the Moon's Sea of Tranquility

and



the Apollo 11 Spacecraft that brought it back to mankind

PRESS KIT

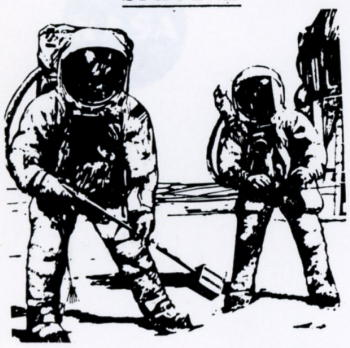
U.S. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NEWS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (202) 962-4155
WASHINGTON, D.C. 20546 TELS: (202) 963-6925

SPECIAL

FOR RELEASE: AT EACH STATE'S OPTION



PROJECT: 50-STATE TOUR OF APOLLO 11 COMMAND SPACE SHIP AND LUNAR ROCK SAMPLE.

CONTENTS

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Art

Booklets

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

IN REPLY REFER TO: FAE

June 12, 1970

We are enclosing your revised copy of the scheduled exhibit dates for the Apollo 11 Fifty-State Tour.

Experience with driving times between state capitols and the necessity for providing proper routine maintenance for the equipment have dictated these changes.

In most instances the revised schedule has the effect of reducing the visit in your state by only a single exhibit day. Normally this has been accomplished by eliminating the final exhibit day at your capital. In some instances the first exhibit day has been dropped and in a few others the exhibit schedule remains unchanged.

This new schedule should assure timely arrival at each capitol, afford our tour personnel more latitude for handling routine maintenance and repairs, and result in more realistic scheduling over the remainder of the fifty-state tour.

We are asking your cooperation in checking any schedule changes that affect your state and in making sure that all personnel connected with the tour in your capital are promptly advised of the changes. To accomplish this we are requesting that <u>all previous schedules be destroyed immediately</u> and <u>the new one substituted</u> in your discussions with the press and other personnel and agencies concerned.

Should you have any questions about these arrangements, they can be discussed with Tour Manager Donald L. Zylstra on his arrival in your capital four to six weeks in advance of the tour visit or, you can contact Mr. Ronald J. Tavares in our Washington, D.C. tour office by letter or telephone (AC 202/963-4904).

Sincerely yours,

Donald L. Zylstra
Manager
Apollo 11 Fifty-State Tour

Enclosure
Revised Schedule

NASA-HQ

SCHEDULE

STATE CAPITALS TOUR OF APOLLO 11 SPACECRAFT AND LUNAR SAMPLE

NOTE: Revised June 6, 1970

STOP NO.	STATE	CAPITAL	GOVERNOR	EXHIBIT DATES
1	California	Sacramento	Ronald Reagan	Apr 17 - 22
2	Nevada	Carson City	Paul Laxalt	Apr 24 - 27
3	Oregon	Salem	Tom McCall	May 1 - 5
4	Washington	Olympia	Daniel J. Evans	May 8 - 10
5	Idaho	Boise	Don Samuelson	May 15 - 18
6	Utah	Salt Lake City	Calvin L. Rampton	May 22 - 24
7	Wyoming	Cheyenne	Stanley K. Hathaway	May 29 - Jun 2
8	Colorado	Denver	John A. Love	Jun 5 - 7
9	Montana	Helena	Forrest H. Anderson	Jun 12 - 14
10	North Dakota	Bismarck	William L. Guy	Jun 19 - 23

STOP NO	STATE	CAPITAL	GOVERNOR	EXHIBIT DATES
11	South Dakota	Pierre	Frank L. Farrar	Jun 26 - 29
12	Nebraska	Lincoln	Norbert T. Tiemann	Jul 3 - 8
13	Kansas	Topeka	Robert Docking	Jul 10 - 14
14	Missouri	Jefferson City	Warren E. Hearnes	Jul 17 - 20
15	Iowa	Des Moines	Robert D. Ray	Jul 24 - 27
16	Minnesota	St.Paul	Harold Levander	Jul 31 - Aug 3
17	Wisconsin	Madison -	Warren P. Knowles	Aug 7 - 10
18	Illinois	Springfield	Richard B. Ogilvie	Aug 14 - 17
19	Indiana	Indianapolis	Edgar D. Whitcomb	Aug 21 - 24
20	Michigan	Lansing	Wm. G. Milliken	Aug 28 - 31
21	Ohio	Columbus	James A. Rhodes	Sep 4 - 8

STOP NO.	STATE	CAPITAL	GOVERNOR	EXHIBIT DATES
22	Kentucky	Frankfort	Louie B. Nunn	Sep 11 - 14
23	Tennessee	Nashville	Buford Ellington	Sep 18 - 21
24	West Virginia	Charleston	Arch A. Moore, Jr.	Sep 25 - 27
25	Pennsylvania	Harrisburg	Raymond P. Shafer	Oct 2 - 5
26	New York	Albany	Nelson A. Rockefeller	Oct 9 - 13
27	Vermont	Montpelier	Deane C. Davis	Oct 16 - 19
28	Maine	Augusta	Kenneth M. Curtis	Oct 23 - 27
29	New Hampshire	Concord	Walter Peterson	Oct 30 - Nov 3
30	Massachusetts	Boston	Francis W. Sargent	Nov 5 - 11
31	Rhode Island	Providence	Frank Licht	Nov 14 - 17
32	Connecticut	Hartford	John Dempsey	Nov 20 - 23

STOP NO.	STATE	CAPITAL	GOVERNOR	EXHIBIT DATES
33	New Jersey	Trenton	William T. Cahill	Nov 26 - Dec 1
34	Delaware	Dover	Russell W. Peterson	Dec 4 - 7
35	Maryland	Annapolis	Marvin Mandel	Dec 10 - 14
36	Washington, D.C.		Mayor Walter E. Washington	Dec 17 - 20
37	Virginia	Richmond	Linwood Holton	Dec 23 - 27
38	North Carolina	Raleigh	Robert W. Scott	Dec 31 - Jan 4, 1971
39	South Carolina	Columbia	Robert E. McNair	Jan 8 - 12
40	Georgia	Atlanta	Lester G. Maddox	Jan 15 - 19
41	Florida	Tallahassee	Claude R. Kirk, Jr.	Jan 22 - 26
42	Alabama	Montgomery	Albert P. Brewer	Jan 29 - Feb 2

STOP NO.	STATE	CAPITAL	GOVERNOR	EXHIBIT DATES
43	Mississippi	Jackson	John Bell Williams	Feb 5 - 9
44	Louisiana	Baton Rouge	John J. McKeithen	Feb 12 - 15
45	Arkansas	Little Rock	Winthrop Rockefeller	Feb 19 - 22
46	Oklahoma	Oklahoma City	Dewey F. Bartlett	Feb 26 - Mar 1
47	Texas	Austin	Preston Smith	Mar 5 - 7
48	New Mexico	Santa Fe	David F. Cargo	Mar 13 - 15
49	Arizona	Phoenix	Jack Williams	Mar 19 - 22
50	Hawaii	Honolulu	John A. Burns	Apr 1971
51	Alaska	Juneau	Keith H. Miller	May 1971

FEATURE NASA NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D. C. 20546
TELS. WO 3-6926
WO 3-6928

FOR RELEASE: (AT EACH STATE'S OPTION)

50-STATE
SPECIAL #11

APOLLO GLOSSARY

Ablating Materials--Special heat-dissipating materials on the surface of a spacecraft that vaporize during reentry.

Abort--The unscheduled termination of a mission prior to its completion.

Accelerometer--An instrument to sense accelerative forces and convert them into corresponding electrical quantities usually for controlling, measuring, indicating or recording purposes.

Adapter Skirt--A flange or extension of a stage or section that provides a ready means of fitting another stage or section to it.

-more-

Antipode--Point on surface of planet exactly 180 degrees opposite from reciprocal point on a line projected through center of body. In Apollo usage, antipode refers to a line from the center of the Moon through the center of the Earth and projected to the Earth surface on the opposite side. The antipode crosses the mid-Pacific recovery line along the 165th meridian of longitude once each 24 hours.

Apocynthion--Point at which object in lunar orbit is farthest from the lunar surface -- object having been launched from body other than Moon. (Cynthia, Roman goddess of Moon)

Apogee--The point at which a Moon or artificial satellite in its orbit is farthest from Earth.

Apolune--Point at which object launched from the Moon into lunar orbit is farthest from lunar surface, e.g.: ascent stage of lunar module after staging into lunar orbit following lunar landing.

Attitude--The position of an aerospace vehicle as determined by the inclination of its axes to some frame of reference; for Apollo, an inertial, space-fixed reference is used.

Burnout--The point when combustion ceases in a rocket engine.

Canard--A short, stubby wing-like element affixed to the launch escape tower to provide CM blunt end forward aerodynamic capture during an abort.

Celestial Guidance--The guidance of a vehicle by reference to celestial bodies.

Celestial Mechanics--The science that deals primarily with the effect of force as an agent in determining the orbital paths of celestial bodies.

Cislunar--Adjective referring to space between Earth and the Moon, or between Earth and Moon.

Closed Loop--Automatic control units linked together with a process to form an endless chain.

Deboost--A retrograde maneuver which lowers either perigee or apogee of an orbiting spacecraft. Not to be confused with deorbit.

Declination--Angular measurement of a body above or below celestial equator, measured north or south along the body's hour circle. Corresponds to Earth surface latitude.

Delta V--Velocity change.

Digital Computer--A computer in which quantities are represented numerically and which can be used to solve complex problems.

Down-Link--The part of a communication system that receives, processes and displays data from a spacecraft.

Entry Corridor--The final flight path of the spacecraft before and during Earth reentry.

Ephemeris--Orbital measurements (apogee, perigee, inclination, period, etc.) of one celestial body in relation to another at given times. In spaceflight, the orbital measurements of a spacecraft relative to the celestial body about which it orbited.

Escape Velocity--The speed a body must attain to overcome a gravitational field, such as that of Earth; the velocity of escape at the Earth's surface is 36,700 feet-per-second.

Explosive Bolts--Bolts destroyed or severed by a surrounding explosive charge which can be activated by an electrical impulse.

Fairing--A piece, part or structure having a smooth, streamlined outline, used to cover a nonstreamlined object or to smooth a junction.

Flight Control System--A system that serves to maintain attitude stability and control during flight.

Fuel Cell--An electrochemical generator in which the chemical energy from the reaction of oxygen and a fuel is converted directly into electricity.

g or g Force--Force exerted upon an object by gravity or by reaction to acceleration or deceleration, as in a change of direction: one g is the measure of force required to accelerate a body at the rate of 32.16 feet-per-second.

Gimbaled Motor--A rocket motor mounted on gimbal; i.e.: on a contrivance having two mutually perpendicular axes of rotation, so as to obtain pitching and yawing correction moments.

Guidance System--A system which measures and evaluates flight information, correlates this with target data, converts the result into the conditions necessary to achieve the desired flight path, and communicates this data in the form of commands to the flight control system.

Heliocentric--Sun centered orbit or other activity which has the Sun at its center.

Inertial Guidance--Guidance by means of the measurement and integration of acceleration from on board the spacecraft. A sophisticated automatic navigation system using gyroscopic devices, accelerometers etc., for high-speed vehicles. It absorbs and interprets such data as speed, position, etc., and automatically adjusts the vehicle to a pre-determined flight path. Essentially, it knows where it's going and where it is by knowing where it came from and how it got there. It does not give out any radio frequency signal so it cannot be detected by radar or jammed.

Injection--The process of boosting a spacecraft into a calculated trajectory.

Insertion--The process of boosting a spacecraft into an orbit around the Earth or other celestial bodies.

Multiplexing--The simultaneous transmission of two or more signals within a single channel. The three basic methods of multiplexing involve the separation of signals by time division, frequency division and phase division.

Optical Navigation--Navigation by sight, as opposed to inertial methods, using stars or other visible objects as reference.

Oxidizer--In a rocket propellant, a substance such as liquid oxygen or nitrogen tetroxide which supports combustion of the fuel.

Penumbra--Semi-dark portion of a shadow in which light is partly cut off, e.g.: surface of Moon or Earth away from Sun where the disc of the Sun is only partly obscured.

Pericynthion--Point nearest Moon of object in lunar orbit--object having been launched from body other than Moon.

Perigee--Point at which a Moon or an artificial satellite in its orbit is closest to the Earth.

Perilune--The point at which a satellite (e.g.: a spacecraft) in its orbit is closest to the Moon. Differs from pericynthion in that the orbit is Moon-originated.

Pitch--The movement of a space vehicle about an axis (Y) that is Perpendicular to its longitudinal axis.

Reentry--The return of a spacecraft that reenters the atmosphere after flight above it.

Retrorocket--A rocket that gives thrust in a direction opposite to the direction of the object's motion.

Right Ascension--Angular measurement of a body eastward along the celestial equator from the vernal equinox (0 degrees RA) to the hour circle of the body. Corresponds roughly to Earth surface longitude, except as expressed in hrs:min:sec instead of 180 degrees west and east from 0 degrees (24 hours=360 degrees).

Roll--The movements of a space vehicle about its longitudinal (X) axis.

S-Band--A radio-frequency band of 1,550 to 5,200 megahertz.

Selenographic--Adjective relating to physical geography of Moon. Specifically, positions on lunar surface as measured in latitude from lunar equator and in longitude from a reference lunar meridian.

Selenocentric--Adjective referring to orbit having Moon as center. (Selene, Gr. Moon)

Sidereal--Adjective relating to measurement of time, position or angle in relation to the celestial sphere and the vernal equinox.

State vector--Ground-generated spacecraft position, velocity and timing information uplinked to the spacecraft computer for crew use as a navigational reference.

Telemetering--A system for taking measurements within an aerospace vehicle in flight and transmitting them by radio to a ground station.

Terminator--Separation line between lighted and dark portions of celestial body which is not self luminous.

Ullage--The volume in a closed tank or container that is not occupied by the stored liquid; the ratio of this volume to the total volume of the tank; also an acceleration to force propellants into the engine pump intake lines before ignition.

Umbra--Darkest part of a shadow in which light is completely absent, e.g.: surface of Moon or Earth away from Sun where the disc of the Sun is completely obscured.

Update pad--Information on spacecraft attitudes, thrust values, event times, navigational data, etc., voiced up to the crew in standard formats according to the purpose, e.g.: maneuver update, navigation check, landmark tracking, entry update, etc.

Up-Link Data--Information fed by radio signal from the ground to a spacecraft.

Yaw--Angular displacement of a space vehicle about its vertical (Z) axis.

# # #

FEATURE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D. C. 20546
TELS. WO 3-6926
WO 3-6928

FOR RELEASE: FOR IMMEDIATE RELEASE

50-STATE
SPECIAL #10

50-STATE ITINERARY, APOLLO 11, LUNAR ROCK TOUR

Place	Dates
Sacramento, Calif.	April 17-22, 1970
Carson City, Nev.	April 24-27, 1970
Salem, Ore.	May 1-6, 1970
Olympia, Wash.	May 8-11, 1970
Boise, Idaho	May 15-19, 1970
Salt Lake City, Utah	May 22-25, 1970
Cheyenne, Wyo.	May 29 - June 3, 1970
Denver, Colo.	June 5-7, 1970
Helena, Mont.	June 12-15, 1970
Bismarck, N.D.	June 19-24, 1970
Pierre, S.D.	June 26-29, 1970
Lincoln, Neb.	July 2-8, 1970
Topeka, Kan.	July 10-15, 1970
Jefferson City, Mo.	July 17-21, 1970

-more-

Place	Dates
Des Moines, Iowa	July 24-28, 1970
St. Paul, Minn.	July 31 - Aug. 4, 1970
Madison, Wis.	Aug. 7-11, 1970
Springfield, Ill.	Aug. 14-19, 1970
Indianapolis, Ind.	Aug. 21-25, 1970
Lansing, Mich.	Aug. 28 - Sept. 1, 1970
Columbus, Ohio	Sept. 4-9, 1970
Frankfort, Ky.	Sept. 11-15, 1970
Nashville, Tenn.	Sept. 18-22, 1970
Charleston, W.Va.	Sept. 25-28, 1970
Harrisburg, Pa.	Oct. 2-6, 1970
Albany, N.Y.	Oct. 9-14, 1970
Montpelier, Vt.	Oct. 16-21, 1970
Augusta, Me.	Oct. 23-28, 1970
Concord, N.H.	Oct. 30 - Nov. 4, 1970
Boston, Mass.	Nov. 6-11, 1970
Providence, R.I.	Nov. 13-18, 1970
Hartford, Conn.	Nov. 20-23, 1970
Trenton, N.J.	Nov. 25 - Dec. 2, 1970
Dover, Del.	Dec. 4-9, 1970
Annapolis, Md.	Dec. 11-16, 1970
Washington, D.C.	Dec. 18-21, 1970
Richmond, Va.	Dec. 23-28, 1970
Raleigh, N.C.	Dec. 30 - Jan. 6, 1971
Columbia, S.C.	Jan. 8-13, 1971

-more-

Place	Dates
Atlanta, Ga.	Jan. 15-19, 1971
Tallahassee, Fla.	Jan. 22-27, 1971
Montgomery, Ala.	Jan. 29 - Feb. 2, 1971
Jackson, Miss.	Feb. 5-10, 1971
Baton Rouge, La.	Feb. 12-16, 1971
Little Rock, Ark.	Feb. 19-23, 1971
Oklahoma City, Okla.	Feb. 26 - March 2, 1971
Austin, Texas	March 5-7, 1971
Santa Fe, N. Mex.	March 12-15, 1971
Phoenix, Arix.	March 19-22, 1971

The Apollo 11 display will leave Los Angeles by ship for Honolulu, Hawaii for exhibit there in April 1971, and thence to Juneau, Alaska for exhibit in May, 1971.

# # #

NASA-HQ

FEATURE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D. C. 20546

TELS. WO 3-6926
WO 3-6928

FOR RELEASE: (AT EACH STATE'S OPTION)

50-STATE
SPECIAL #9

APOLLO BRIEFS

The heat leak from the Apollo cryogenic tanks, which contain hydrogen and oxygen, is so small that if one hydrogen tank containing ice were placed in a room heated to 70 degrees F, a total of 8-1/2 years would be required to melt the ice to water at just above feeezing temperature. It would take approximately 4 years more for the water to reach room temperature. The gases in the cryogenic tanks are utilized in the production of electrical power by the Apollo fuel cell system and provide oxygen for the use of the crew.

***

When the Apollo spacecraft passed through the Van Allen belts on its way to the Moon, the astronauts were exposed to radiation roughly equivalent to that of a dental X-ray.

***

-more-

With gravity on the Moon only one-sixth as strong as on Earth, it is necessary that this difference be related to the Apollo vehicle. A structure 250 feet high and 400 feet long in which cables lift five-sixth of the spacecraft vehicle weight were used in tests to simulate lunar conditions and their effect on the vehicle.

***

The command module panel display includes 24 instruments, 566 switches, 40 event indicators (mechanical), and 71 lights.

***

The command module offers 73 cubic feet per man as against the 68 cubic feet per man in a compact car. By comparison, the Mercury spacecraft offered 55 cubic feet for its one traveler and Gemini provided 40 cubic feet per man.

***

If your car gets 15 miles to a gallon, you could drive 18 million miles or around the world about 400 times on the propellants required for the Apollo/Saturn lunar landing mission. The Saturn V launch vehicle contains 5.6 million pounds of propellant (or 960,000 gallons).

***

When the Apollo re-entered the atmosphere it generated energy equivalent to approximately 86,000 kilowatt hours of electricity - enough to light the city of Los Angeles for about 104 seconds; or the energy generated would lift all the people in the USA 10-3/4 inches off the ground.

***

The fully loaded Saturn V launch vehicle with the Apollo spacecraft stands 60 feet higher than the Statue of Liberty on its pedestal and weighs 13 times as much as the statue.

***

The engines of the Saturn V launch vehicle that propelled the Apollo spacecraft to the Moon have combined horsepower equivalent to 543 jet fighters.

***

The Apollo environmental control system has 180 parts in contrast to the 8 for the average home window air conditioner. The Apollo environmental control system performs 23 functions compared to 5 for the average home conditioner. There are 23 functions of the environmental control system, which include: air cooling, air heating, humidity control, ventilation to suits, ventilation to cabin, air filtration, CO_2 removal, odor removal, waste management functions, etc.

***

The 12-foot-high Apollo spacecraft command module contains about fifteen miles of wire, enough to wire 50 two-bedroom homes.

***

The astronaut controls and monitors the stabilization and control system by means of two handgrip controllers, 34 switches, and 6 knobs.

***

The command system of the acceptance checkout equipment can generate up to 2048 separate stimuli or 128 analog signals, or combinations of both, and route them to spacecraft and other checkout systems at a million bits per second. In contrast, hand-operated commercial teletype generates 45 bits per second and automatically, over voice channel, it generates 2400 bits per second.

***

The Apollo command module can sustain a hole as large as 1/4 inch in diameter and still maintain the pressure inside for 15 minutes, which is considered long enough for an astronaut to put on a spacesuit.

***

The boost protective cover will protect the command module from temperatures expected to reach 1,200 degrees during the launch phase.

***

Enough liquid oxygen is contained in the first stage tank to fill 54 railroad tank cars.

***

The Apollo spacecraft, including the command and service modules and the adapter which housed the lunar module, is 82 feet tall, only 13 feet shorter than the entire Mercury-Atlas space vehicle used in John Glenn's orbital mission.

***

The main computer in the command module occupies only one cubic foot.

***

While an automobile has less than 3,000 functional parts, the command module has more than 2,000,000 not counting wires and skeletal components.

# # #

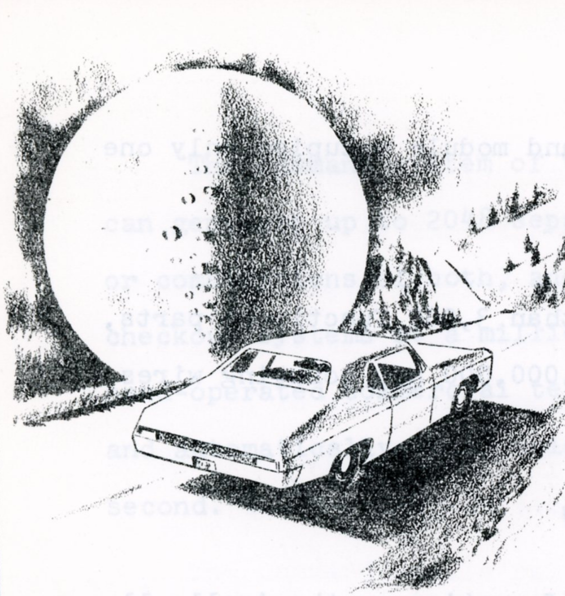
NOTE TO EDITORS: For additional information on the Apollo 11 mission and the lunar material it returned to Earth, editors may write or telephone:

Audio-visual Material Only

Les Gaver, Code FP, NASA Hq., Washington, D.C. 20546, Tel.: (202) 962-1721; Chief, Audio-Visual, PID

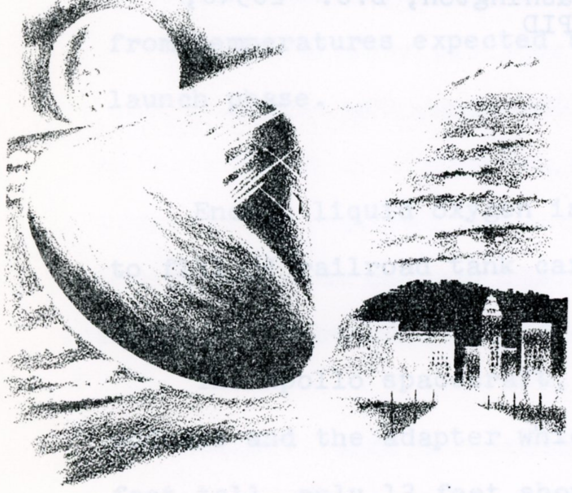
Text Only

Ralph Gibson, Code FP, NASA Hq., Washington, D.C. 20546, Tel.: (202) 963-6925; News Chief, PID



IF YOUR CAR GETS 15 MILES TO A GALLON, YOU COULD DRIVE 10 MILLION MILES OR AROUND THE WORLD ABOUT 400 TIMES ON THE PROPELLANTS REQUIRED FOR THE APOLLO/SATURN LUNAR LANDING MISSION

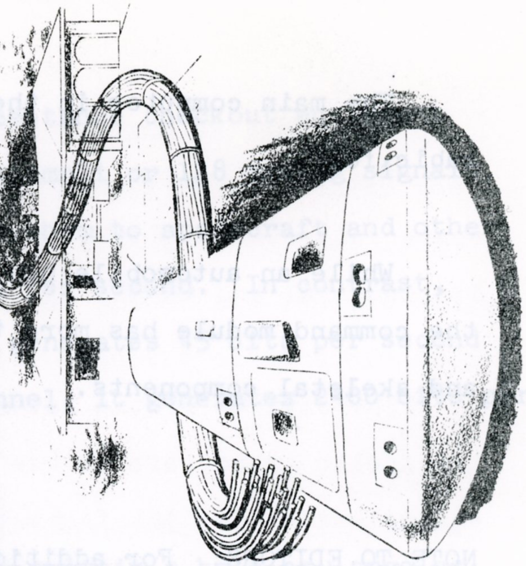
WHEN THE APOLLO REENTERS THE ATMOSPHERE, IT WILL DISSIPATE ENERGY EQUIVALENT



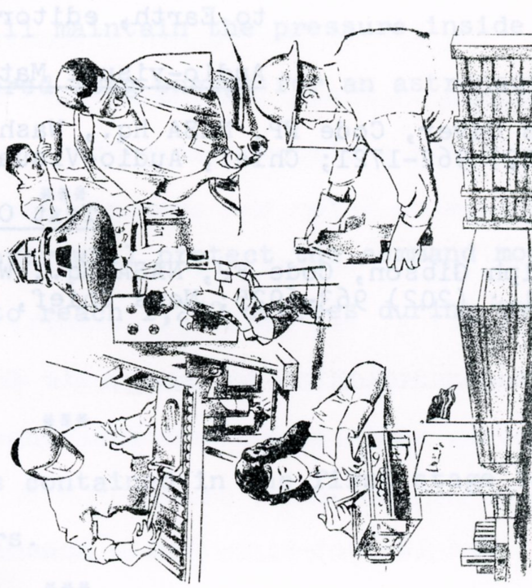
TO APPROXIMATELY 86,000 KILOWATT HOURS OF ELECTRICITY, ENOUGH TO LIGHT THE CITY OF LOS ANGELES FOR ABOUT 104 SECONDS

Apollo 11 CARTOONS

THE 12-FOOT-TALL APOLLO SPACECRAFT COMMAND MODULE CONTAINS

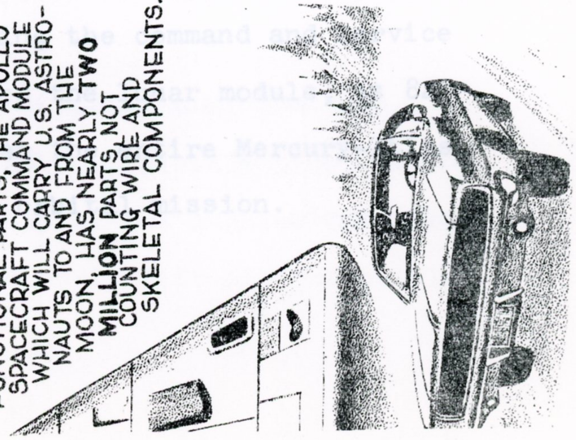


ALMOST 15 MILES OF WIRE, ENOUGH TO WIRE 50 TWO-BEDROOM HOMES



AT ITS PEAK, MORE THAN 20,000 INDUSTRIAL FIRMS, EMPLOYING MORE THAN 350,000 PERSONS, WERE PRODUCING EQUIPMENT FOR THE U.S. APOLLO/ SATURN SPACE PROGRAM UNDER CONTRACTS WITH THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION.

WHILE AN AUTOMOBILE HAS LESS THAN 2000 FUNCTIONAL PARTS, THE APOLLO SPACECRAFT COMMAND MODULE WHICH WILL CARRY U.S. ASTRONAUTS TO AND FROM THE MOON, HAS NEARLY **TWO MILLION** PARTS, NOT COUNTING WIRE AND SKELETAL COMPONENTS.



FEATURE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D. C. 20546
TELS. WO 3-6926
WO 3-6928

FOR RELEASE: (AT EACH STATE'S OPTION)

50-STATE
SPECIAL #8

50-STATE DISPLAY VAN HAS SPECIAL ESCORT

The Apollo 11 spacecraft with accompanying exhibits is being transported in a trailer van which is 14 feet wide and 40 feet long (58 feet long with the diesel tractor vehicle attached) for highway travel. Because it is much wider than the normal legal limit, it requires a special highway escort.

Side panels fold out of the van when the display is set up, making the exhibit 24 feet wide. Visitors pass over two walk-through ramps on either side of the Apollo 11 spacecraft to view the interior through hatch windows.

The Apollo 11 command space ship and one of the lunar rocks it returned from man's first Moon landing in July 1969 is on display in _____ from _____ to _____ during the hours _____, as part of a 50-state tour sponsored by the National Aeronautics and Space Administration.

-more-

Transportation costs of the Apollo 11 50-State Tour are being borne as a public service by the Specialized Heavy Carriers Conference, affiliated with the American Trucking Association. Fifty-state movement of the mobile display will be accomplished without cost to the Federal government. The display van portion of the trailer was built for NASA by Industrial Displays, Inc., Glendale, Calif.

Apollo 11 was launched from Kennedy Space Center on July 16, 1969, with Astronauts Neil A. Armstrong, Michael Collins and Edwin E. (Buzz) Aldrin, Jr. aboard. Armstrong commanded the historic mission and, Collins remained in lunar orbit aboard "Columbia," the Apollo 11 Command Module. Armstrong and Aldrin entered "Eagle," the Lunar Module, and descended to the Moon's surface for the first time, July 20, 1969 at 4:18 p.m. EDT.

After walking on the Moon, deploying flags and other memorabilia, and collecting lunar rocks, Armstrong and Aldrin returned to the lunar module and rejoined "Columbia" in lunar orbit.

After they transferred with their Moon rocks to "Columbia," the lunar module (Eagle) was detached to continue orbiting the Moon and the Apollo 11 Command Module, again manned by its full three-man crew, began its journey to Earth.

-more-

Apollo 11 splashed down in the Pacific ocean July 24, were recovered by the aircraft carrier, Hornet, aboard which President Nixon waited to greet them.

# # #

NOTE TO EDITORS: For additional information on the Apollo 11 mission and the lunar material it returned to Earth, editors may write or telephone:

Audio-Visual Material Only

Les Gaver, Code FP, NASA Hq., Washington, D.C. 20546, Tel.: (202) 962-1721; Chief, Audio-Visual, PID.

Text Only

Ralph Gibson, Code FP, NASA Hq., Washington, D.C. 20546, Tel.: (202) 963-6925; News Chief, PID.

NASA-HQ

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50-STATE
SPECIAL #7

MOON'S BIRTH TEMPERATURES HIGH

Most scientists agree that the Moon was not always the quiet, dead sphere it appears to be today. The birth of the Moon probably involved high temperatures. Studies of the rock samples indicate that they crystallized from a molten state at temperatures ranging from 1,940 to 2,210 degrees F. Early studies of the Moon materials indicate that it is probably as old as many scientists believe the Earth to be--about 4.6 billion years.

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The process of change and erosion on the atmosphereless, waterless Moon is vastly slower than on Earth where winds, water and other agents wear away and change its surface.

-more-

Locked in these lunar rocks scientists have a record that has long since been obliterated or covered on Earth.

The Moon rock in the Apollo 11 display van, carefully guarded against oxidation by an inert gas in its cylindrical container, can provide fascinating evidence of what has happened to the Moon during the last 3.7 billion years. One sample returned to Earth by Apollo 11 was calculated to be 4.4 billion years old. The oldest rocks found to date on Earth are about 3.4 billion years old.

Studies of the lunar rocks seem to indicate that there were molten rock or lava flows on the Moon 3.65 billion years ago. Whether this lava erupted from a hot molten interior or was produced by the heat from the impact of huge meteorites striking the Moon has not yet been established. Scientists are still in disagreement on this and many other points concerning the Moon's origin and geology.

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50-STATE
SPECIAL #5

VISITORS TO SEE ACTUAL SPACE SUITS

Manikins in Apollo 11's cabin are wearing the actual space suits worn by the crew on their historic first journey to the lunar surface. All components of the spacecraft are original flight hardware.

Apollo 11's blunt base or forward surface on the earthward descent, is covered by a heatshield which shows the effects of re-entering the atmosphere at 25,000 miles-per-hour. The heatshield was originally about two inches thick and carried away the heat of the blazing re-entry by charring or ablation, reducing its ceramic protective coating to a one and one-quarter inch thickness.

The Apollo 11 command space ship and one of the lunar rocks it returned from man's first Moon landing in July 1969 is on display in _____ from _____ to _____ during the hours _____, as part of a 50-state tour sponsored by the National Aeronautics and Space Administration.

-more-

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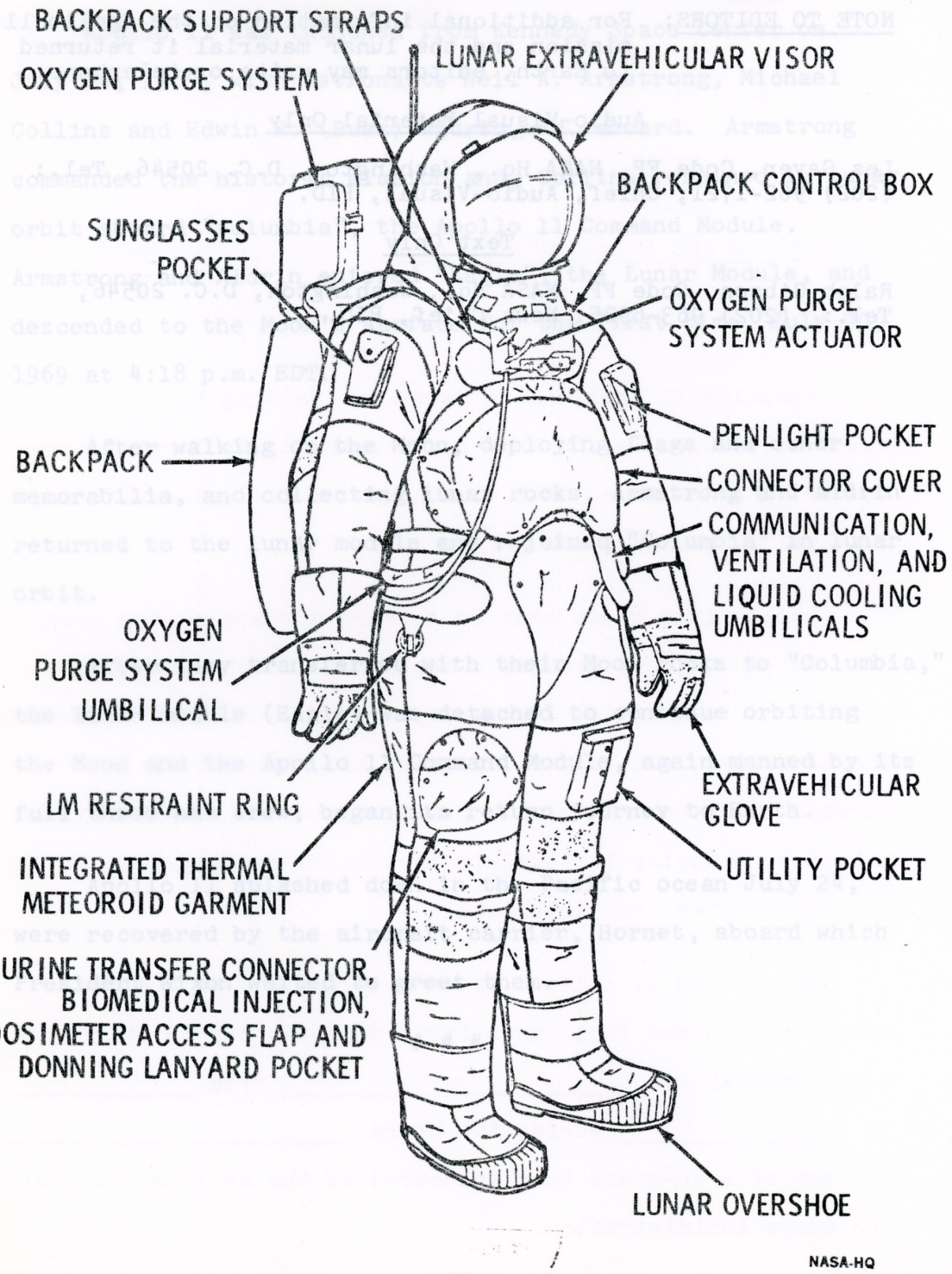
EXTRAVEHICULAR MOBILITY UNIT



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SPECIAL #4

APOLLO 11 MUCH SLOWER ON EARTH

Designed to achieve its maximum efficiency in space at speeds exceeding 24,000 miles per hour, the Apollo 11 Command Module is proceeding in its mobile display van at a much more sedate pace on its Earth-bound trip through 50 state capitals.

In contrast to its 1,096,362 statute-mile round trip to the Moon, the Apollo 11 spacecraft will move over 13,565 miles of highways in continental United States and travel more than 5,250 additional miles by sea (to Honolulu and Juneau).

The Apollo 11 command space ship and one of the lunar rocks it returned from man's first Moon landing in July 1969 is on display in _____ from _____ to _____ during the hours _____, as part of a 50-state tour sponsored by the National Aeronautics and Space Administration.

-more-

NASA officials said that, by conservative estimates, two million Americans will view the historic spacecraft and one of the lunar rocks it returned to Earth. Adults and children in every state will have a close-up look at the same spacecraft they watched at longer range on television during its pioneering flight totalling more than eight days in space.

This is the same Apollo 11 that rode into the Florida sky atop the huge fireball from its thundering engines, driving it away from Earth with a thrust totalling 7.6 million pounds. From this spacecraft the astronauts communicated directly to Americans in their living rooms at home. Apollo 11's picture and sound signals produced quality television from nearly a quarter of a million miles in space.

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-more-

After they transferred with their Moon rocks to "Columbia," the lunar module (Eagle) was detached to continue orbiting the Moon and the Apollo 11 Command Module, again manned by its full three-man crew, began its return journey to Earth.

Apollo 11 splashdown splashed down in the Pacific Ocean July 24, was recovered by the aircraft carrier, Hornet, aboard which President Nixon waited to greet them.

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50-STATE
SPECIAL #3

THE APOLLO 11 COMMAND AND SERVICE MODULE

The Apollo spacecraft for the Apollo 11 mission was comprised of Command Module 107, Service Module 107, Lunar Module 5, a spacecraft-lunar module adapter (SLA) and a launch escape system. The SLA serves as a mating structure between the instrument unit atop the S-IVB stage of the Saturn V launch vehicle and as a housing for the lunar module.

The Apollo 11 command module and one of the lunar rocks it returned from man's first Moon landing in July 1969 is on display in _____ from _____ to _____ during the hours _____, as part of a 50-state tour sponsored by the National Aeronautics and Space Administration. The descent stage of the Apollo command module was left on the Moon and the LM in lunar orbit.

-more-

The basic structure of the command module is a pressure vessel encased in heat shields, cone-shaped 11 feet 5 inches high, base diameter of 12 feet 10 inches, and launch weight 12,250 pounds.

The command module consists of the forward compartment which contains two reaction control engines and components of the Earth landing system; the crew compartment or inner pressure vessel containing crew accomodations, control and displays, and many of the spacecraft systems; and the aft compartment housing 10 reaction control engines, propellant tankage, helium tanks, water tanks, and the CSM umbilical cable. The crew compartment contains 210 cubic feet of habitable volume.

Heat-shields around the three compartments are made of brazed stainless steel honeycomb with an outer layer of phenolic epoxy resin as an ablative material. Shield thickness, varying according to heat load, ranges from 0.7 inche at the apex to 2.7 inches at the aft end.

The spacecraft inner structure is of sheet-aluminum honeycomb bonded sandwich ranging in thickness from 0.25 inch thick at forward access tunnel to 1.5 inches thick at base.

-more-

The Apollo guidance, navigation and control systems measured and controlled spacecraft position, attitude, and velocity, calculated and displayed abort data. The guidance system consists of three subsystems: inertial, made up of an intertial measurement unit and associated power and data components; computer which processes information to or from other components; and optics, including scanning telescope and sextant for celestial and/or landmark spacecraft navigation. CSM 107 and subsequent modules are equipped with a VHF ranging device as a backup to the LM rendezvous radar.

The stabilization and control systems (SCS) controls spacecraft rotation, translation, and thrust vector and provides displays for crew-initiated maneuvers; backs up the guidance system. It has three subsystems; attitude reference, attitude control, and thrust vector control.

The service propulsion system (SPS) provides thrust for large spacecraft velocity changes through a gimbal-mounted 20,500-pound-thrust hypergolic engine using a nitrogen tetroxide oxidizer and a 50-50 mixture of unsymmetrical dimethylhydrazine and hydrazine fuel. This system is in the service module. The system responds to automatic firing commands from the guidance and navigation system or to manual commands from the crew. The engine provides a constant thrust level. The stabilization and control system gimbals the engine to direct the thrust vector through the spacecraft center of gravity.

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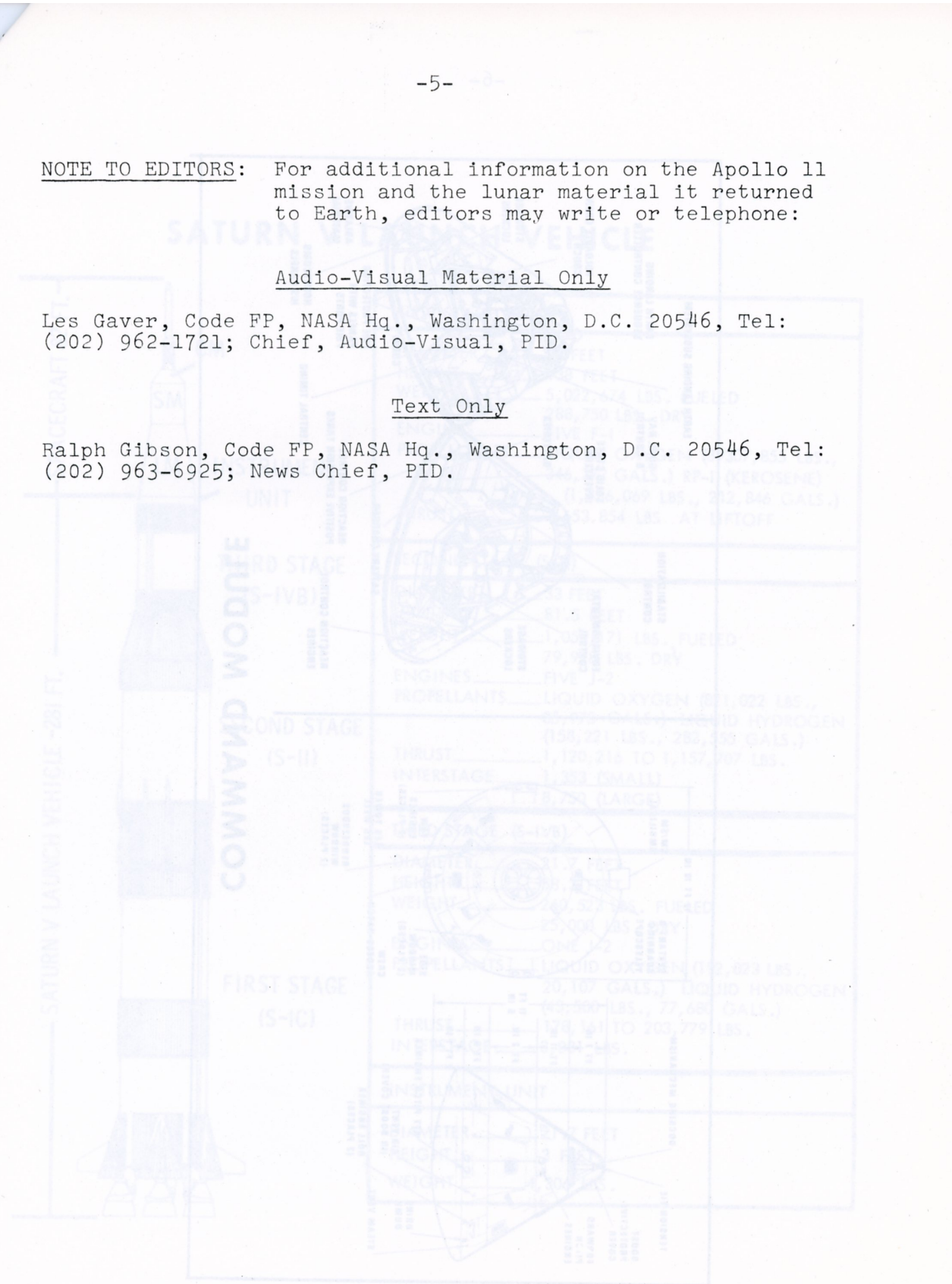
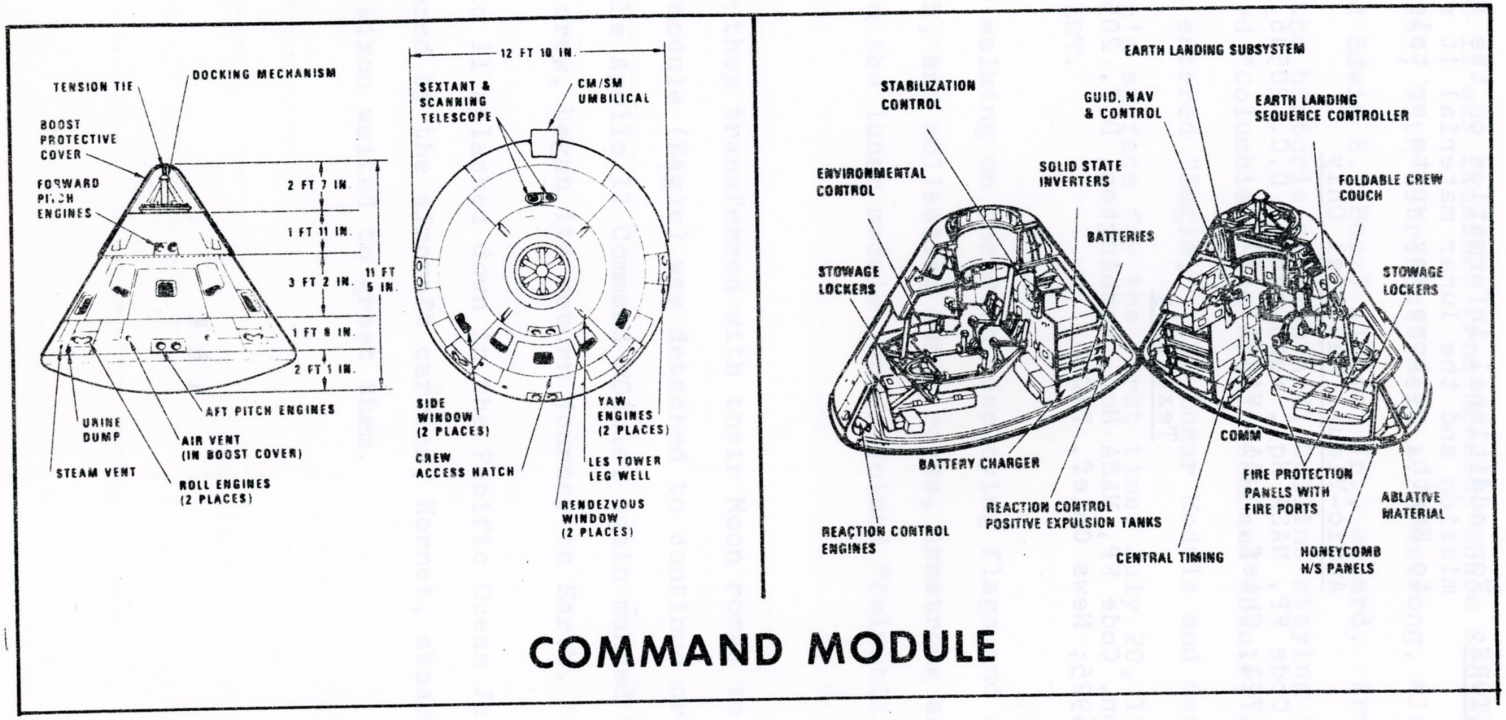
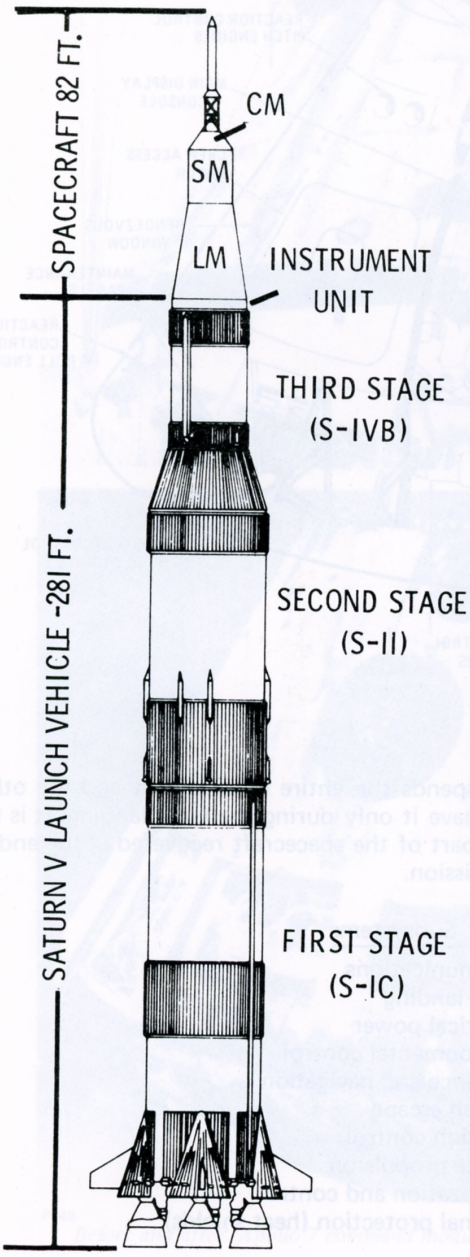




COMMAND MODULE

SATURN V LAUNCH VEHICLE



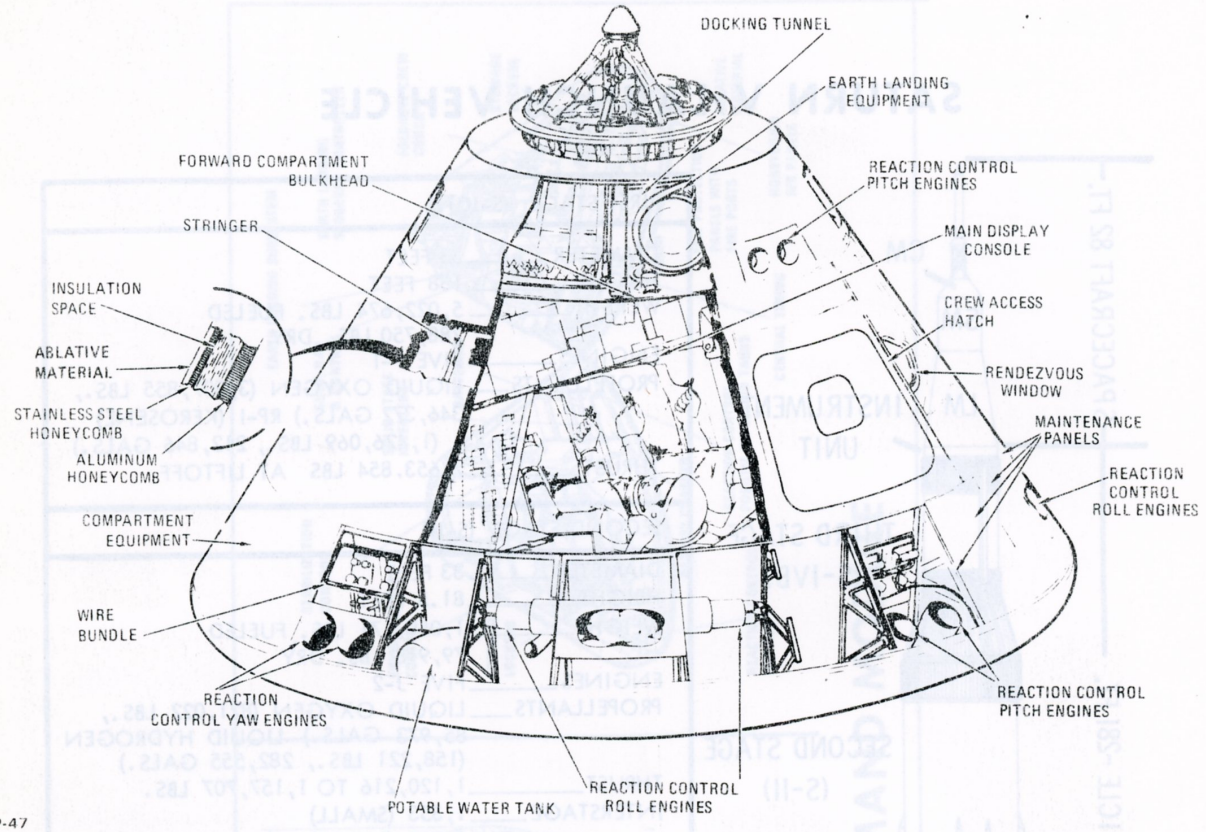
FIRST STAGE (S-IC)	
DIAMETER	33 FEET
HEIGHT	138 FEET
WEIGHT	5,022,674 LBS. FUELED 288,750 LBS. DRY
ENGINES	FIVE F-1
PROPELLANTS	LIQUID OXYGEN (3,307,855 LBS., 346,372 GALS.) RP-1 (KEROSENE) - (1,426,069 LBS., 212,846 GALS.)
THRUST	7,653,854 LBS AT LIFTOFF

SECOND STAGE (S-II)	
DIAMETER	33 FEET
HEIGHT	81.5 FEET
WEIGHT	1,059,171 LBS. FUELED 79,918 LBS. DRY
ENGINES	FIVE J-2
PROPELLANTS	LIQUID OXYGEN (821,022 LBS., 85,973 GALS.) LIQUID HYDROGEN (158,221 LBS., 282,555 GALS.)
THRUST	1,120,216 TO 1,157,707 LBS.
INTERSTAGE	1,353 (SMALL) 8,750 (LARGE)

THIRD STAGE (S-IVB)	
DIAMETER	21.7 FEET
HEIGHT	58.3 FEET
WEIGHT	260,523 LBS. FUELED 25,000 LBS. DRY
ENGINES	ONE J-2
PROPELLANTS	LIQUID OXYGEN (192,023 LBS., 20,107 GALS.) LIQUID HYDROGEN (43,500 LBS., 77,680 GALS.)
THRUST	178,161 TO 203,779 LBS.
INTERSTAGE	8,081 LBS.

INSTRUMENT UNIT	
DIAMETER	21.7 FEET
HEIGHT	3 FEET
WEIGHT	4,306 LBS.

COMMAND MODULE



P-47

Dimensions

Height	10 ft 7 in.
Diameter	12 ft 10 in.
Weight (including crew)	12,200 lb
Weight (splashdown)	11,700 lb

Propellant

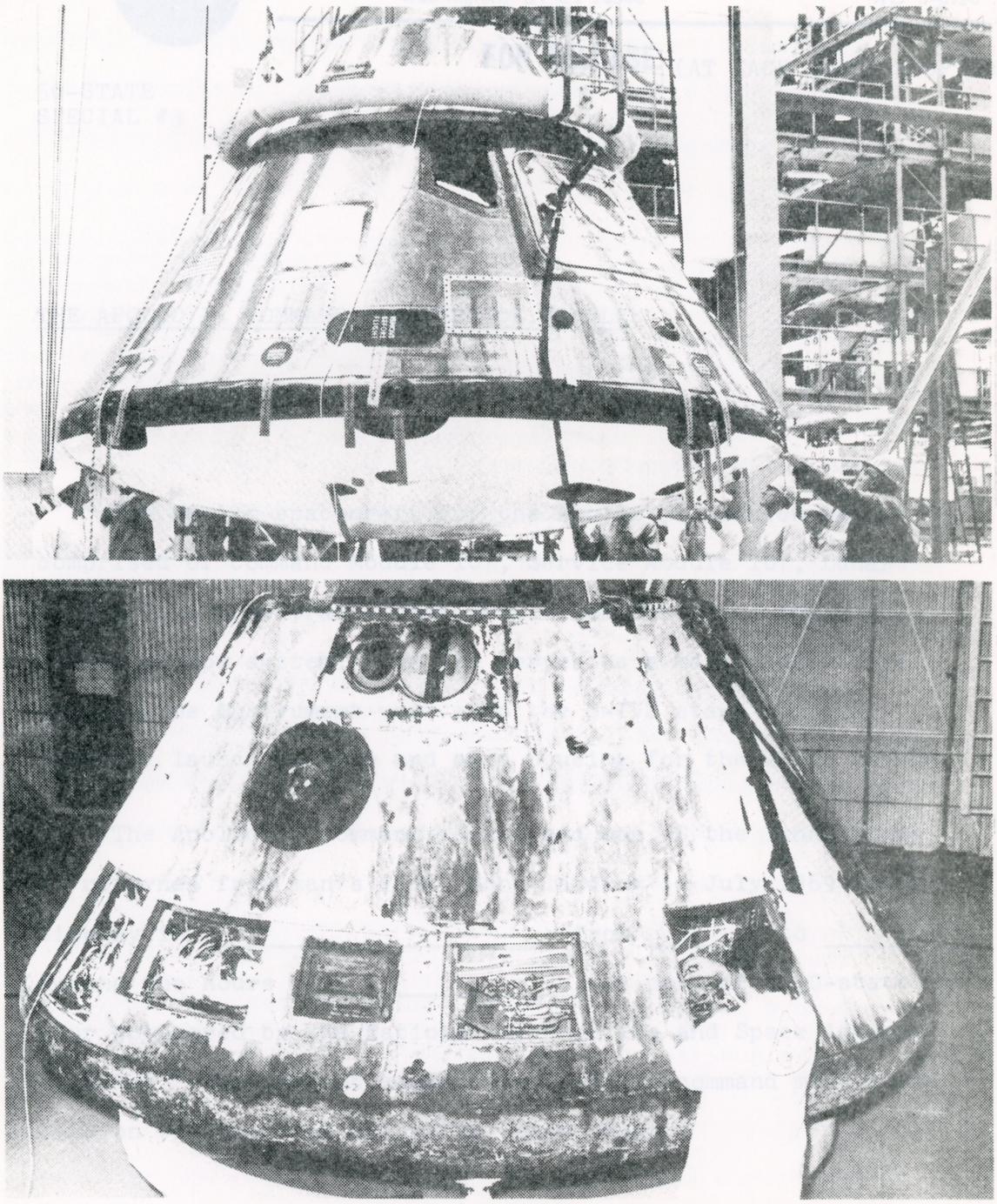
Reaction control subsystem (fuel—monomethylhydrazine; oxidizer—nitrogen tetroxide)	270 lb

Function

The command module is the control center and living quarters for most of the lunar mission; one man spends the entire mission in it and the other two leave it only during the lunar landing. It is the only part of the spacecraft recovered at the end of the mission.

Major Subsystems

Communications
Earth landing
Electrical power
Environmental control
Guidance and navigation
Launch escape
Reaction control
Service propulsion
Stabilization and control
Thermal protection (heat shields)



P-48

Before and after: Apollo 7 command module is okayed for Cape Kennedy shipment (top photo), is checked out upon return to Downey following first manned flight test (bottom photo)

NASA-HQ

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50-STATE
SPECIAL #2

MOON ROCK UNDER CLOSE STUDY

The dark, slate-colored lunar rock on display at the National Aeronautics and Space Administration touring exhibit is part of a larger collection totalling 47.6 pounds scooped up by Apollo astronauts during their brief stay on the Moon.

A portion of this small sampling from Tranquility Base has kept hundreds of the world's leading scientists busy in their laboratories, analyzing lunar rocks and soil for hints about the origins of the Moon, Earth and the solar system.

Did the Moon form at the same time as Earth, but independently? Was the Moon torn from the Earth -- possibly in the area of the Pacific Ocean? Or, having already been born in some location a great distance from Earth, did the Moon stray too close to this planet and remain to orbit the Earth, captured by its gravity?

-more-

The Apollo 11 command space ship and one of the lunar rocks it returned from man's first Moon landing in July 1969 is on display in _____ from _____ to _____ during the hours _____, as part of a 50-state tour sponsored by NASA.

Answers to these questions will probably not be firm until many more lunar samples reach Earth and additional Moon explorations are completed. But scientists believe that lunar samples already examined have advanced them several major steps in their search for the solution.

Because this lunar material was subjected to direct exposure to space, the record of eons of bombardment by minute particles, hurtling moonward as part of the Sun's radiation, survives virtually unimpaired in the rock samples. From the markings left by their collisions with the rocks, scientists hope to distinguish periods of vigorous and sparse Sun activity. From such determinations they hope to learn, for instance, whether Earth's ice ages could have been caused by periods of reduced solar output.

LUNAR DESCRIPTION

Terrain - Mountainous and crater-pitted, the former rising thousands of feet and the latter ranging from a few inches to 180 miles in diameter.

The craters are thought to be formed by the impact of meteorites. The surface is covered with a layer of fine-grained material resembling silt or sand, as well as small rocks and boulders.

Environment - No air, no wind, and no moisture. The temperature ranges from 243 degrees in the two-week lunar day to 279 degrees below zero in the two-week lunar night. Gravity is one-sixth that of Earth. Micrometeoroids pelt the Moon (there is no atmosphere to burn them up). Radiation might present a problem during periods of unusual solar activity.

Dark Side - The dark or hidden side of the Moon no longer is a complete mystery. It was first photographed by a Russian craft and since then has been photographed many times, particularly by NASA's Lunar Orbiter spacecraft and Apollo 8.

Origin - There is still no agreement among scientists on the origin of the Moon. The three theories: (1) the Moon once was part of Earth and split off into its own orbit, (2) it evolved as a separate body at the same time as Earth, and (3) it formed elsewhere in space and wandered until it was captured by Earth's gravitational field.

Physical Facts

Diameter	2,160 miles (about 1/4 that of Earth)
Circumference	6,790 miles (about 1/4 that of Earth)
Distance from Earth	238,857 miles (mean; 221,463 minimum to 252,710 maximum)
Surface temperature	+243°F (Sun at zenith) -279°F (night)
Surface gravity	1/6 that of Earth
Mass	1/100th that of Earth
Volume	1/50th that of Earth
Lunar day and night	14 Earth days each
Mean velocity in orbit	2,287 miles per hour
Escape velocity	1.48 miles per second
Month (period of rotation around Earth)	27 days, 7 hours, 43 minutes

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50-STATE
SPECIAL #1

MOON ROCK, APOLLO SPACECRAFT ON WAY

The command ship that carried the first astronauts to land on the surface of the Moon and one of the rocks they brought back from that historical journey will be on display _____ in _____.

To be exhibited at _____, during the hours _____ to _____, "Columbia" and the lunar rock will arrive aboard a 14-foot-wide van which, opened and expanded, serves as the showcase for the six-ton Apollo space module and the Moon rock sample.

Visitors will have an opportunity to view close-up the vehicle in which astronauts Neil A. Armstrong, Michael Collins and Edwin E. Aldrin, Jr., hurtled into lunar orbit last July and from which Armstrong and Aldrin detached themselves July 20 in the lunar module,"Eagle," to become the first men from Earth to set foot on another celestial body.

-more-

During the remainder of this year and in 1971 the mobile display van will visit the other 49 state capitals to give every American a first-hand change to share in the first lunar landing.

The conical-shaped spacecraft inside the mobile exhibit is packed with electronic "black boxes", an inertial guidance system, communications gear and life support systems. Three couches, visible through the spacecraft hatches, served for eight days as living room, bedroom and dining room for the Apollo 11 crew.

Apollo 11 was launched from Kennedy Space Center on July 16, 1969, atom a Saturn V booster, with astronauts Neil A. Armstrong, Michael Collins and Edwin E. (Buzz) Aldrin, Jr., aboard. Armstrong commanded the historic mission, and Collins remained in lunar orbit aboard "Columbis," the Apollo 11 Command Module while Armstrong and Aldrin entered "Eagle," the Lunar Module and descended to the Moon's surface for the first time, July 20, 1969, at 4:18 p.m. EDT.

After walking on the Moon, deploying flags and other memorabilia, and collecting lunar rocks, Armstrong and Aldrin returned to the lunar module and rejoined "Columbia" in lunar orbit.

-more-

After they transferred with their Moon rocks to "Columbia," the lunar module (Eagle) was detached where it is still orbiting the Moon and the Apollo 11 Command Module, again manned by its full three-man crew, began its return journey to Earth.

Apollo 11 splashed down in the Pacific Ocean July 24, was recovered by the aircraft carrier, Hornet, aboard which President Nixon waited to greet them.

The six-ton Apollo 11 Command Module and a lunar rock sample it returned will visit all the nation's state capitals on a tour requiring more than a year to complete, beginning in Sacramento, April 17, 1970, and finishing in Juneau, Alaska in May 1971.

"Columbia" is the crew cabin portion of the Apollo spacecraft and the only part which returned to Earth. The lunar module, "Eagle," in which Apollo Astronauts Neil Armstrong and Edwin Aldrin made man's first landing on the Moon, is still in lunar orbit.

Apollo 11 and its three-man astronaut crew met President Kennedy's national goal of landing men on the Moon and returning them safely to Earth before the end of the 1960s decade. Nine lunar landings have been scheduled in the Apollo program, with the last Apollo 19, in 1974. Apollo 11 was the first of these.

-more-

The Apollo command module was built by North American Rockwell, Space Division, Downey, Calif., and the lunar module by Grumman Aircraft Engineering Corp., Bethpage, L. I., N.Y.

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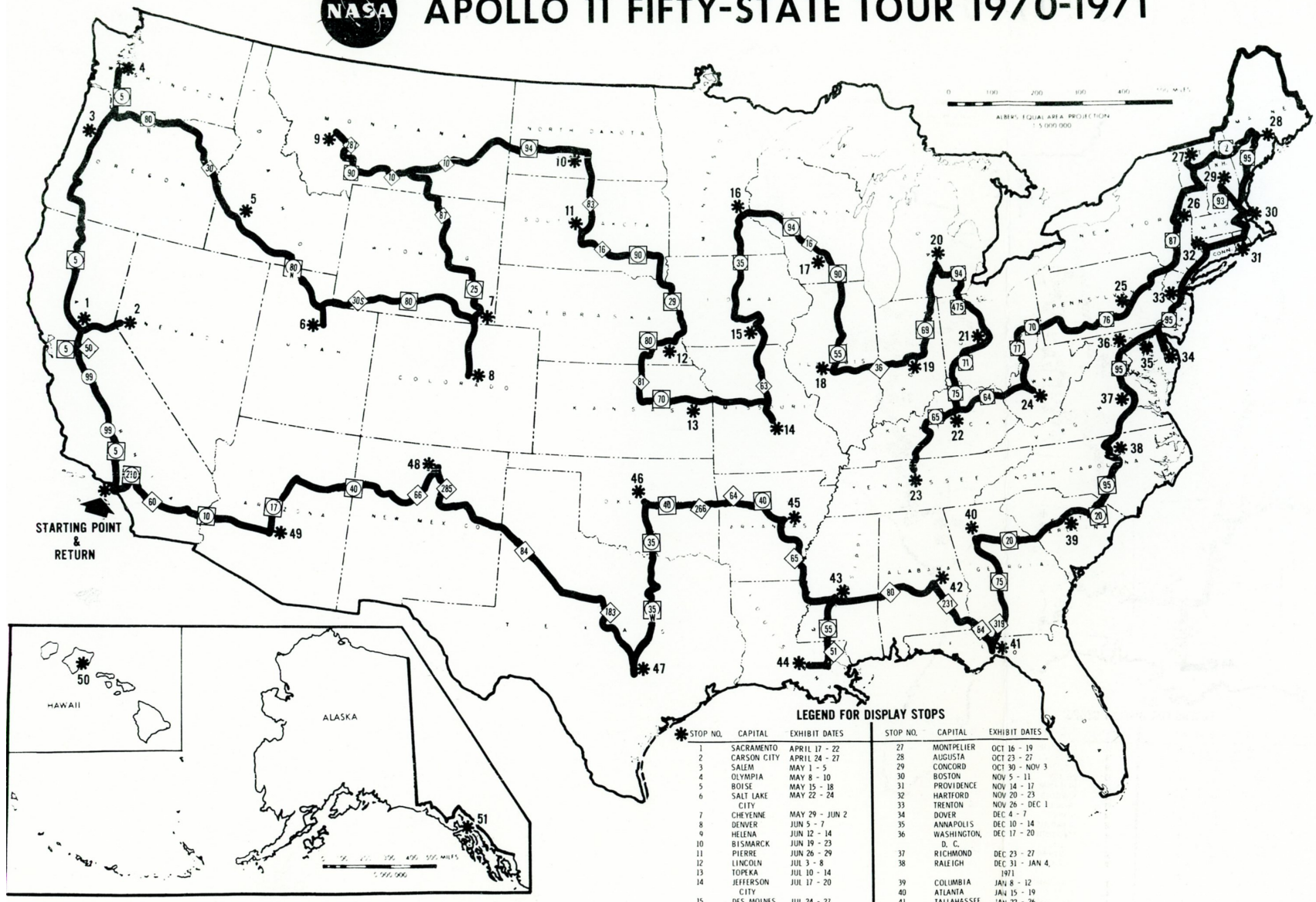
APOLLO 11 FIFTY-STATE TOUR 1970-1971



LEGEND FOR DISPLAY STOPS

STOP NO.	CAPITAL	EXHIBIT DATES
1	SACRAMENTO	APRIL 17 - 22
2	CARSON CITY	APRIL 24 - 27
3	SALEM	MAY 1 - 5
4	OLYMPIA	MAY 8 - 10
5	BOISE	MAY 15 - 18
6	SALT LAKE CITY	MAY 22 - 24
7	CHEYENNE	MAY 29 - JUN 2
8	DENVER	JUN 5 - 7
9	HELENA	JUN 12 - 14
10	BISMARCK	JUN 19 - 23
11	PIERRE	JUN 26 - 29
12	LINCOLN	JUL 3 - 8
13	TOPEKA	JUL 10 - 14
14	JEFFERSON CITY	JUL 17 - 20
15	DES MOINES	JUL 24 - 27
16	ST. PAUL	JUL 31 - AUG 3
17	MADISON	AUG 7 - 10
18	SPRINGFIELD	AUG 14 - 17
19	INDIANAPOLIS	AUG 21 - 24
20	LANSING	AUG 28 - 31
21	COLUMBUS	SEP 4 - 8
22	FRANKFORT	SEP 11 - 14
23	NASHVILLE	SEP 18 - 21
24	CHARLESTON	SEP 25 - 27
25	HARRISBURG	OCT 2 - 5
26	ALBANY	OCT 9 - 13
27	MONTPELIER	OCT 16 - 19
28	AUGUSTA	OCT 23 - 27
29	CONCORD	OCT 30 - NOV 3
30	BOSTON	NOV 5 - 11
31	PROVIDENCE	NOV 14 - 17
32	HARTFORD	NOV 20 - 23
33	TRENTON	NOV 26 - DEC 1
34	DOVER	DEC 4 - 7
35	ANNAPOLIS	DEC 10 - 14
36	WASHINGTON, D. C.	DEC 17 - 20
37	RICHMOND	DEC 23 - 27
38	RALEIGH	DEC 31 - JAN 4, 1971
39	COLUMBIA	JAN 8 - 12
40	ATLANTA	JAN 15 - 19
41	TALLAHASSEE	JAN 22 - 26
42	MONTGOMERY	JAN 29 - FEB 2
43	JACKSON	FEB 5 - 9
44	BATON ROUGE	FEB 12 - 15
45	LITTLE ROCK	FEB 19 - 22
46	OKLAHOMA CITY	FEB 26 - MAR 1
47	AUSTIN	MAR 5 - 7
48	SANTA FE	MAR 13 - 15
49	PHOENIX	MAR 19 - 22
50	HONOLULU	APR 1971
51	JUNEAU	MAY 1971

LOCATIONS OF LUNAR SAMPLE EXHIBITS

Lunar Sample Number	February March	April May	June July	August September	October November
1	Cincinnati, Ohio Cincinnati Science Center	Pittsburgh, Pa. Buhl Planetarium	Omaha, Nebraska Josyln Art Museum	Rochester, N.Y. Strasenburgh Planetarium of the Rochester Museum	Baltimore, Md. Maryland Academy of Sciences
2	Milwaukee, Wisc. Milwaukee Public Museum	Seattle, Wash. Pacific Science Center	San Francisco, Cal. California Academy of Sciences	Portland, Oregon Oregon Museum of Science & Industry	Carson City, Nev. Nevada State Museum
3	Kennedy Space Center, Florida Visitor Information Center	Miami, Florida Museum of Science & Natural History	Nashville, Tenn. Children's Museum	Oklahoma City, Okla. Oklahoma Science & Arts Foundation, Inc.	
4	Ft. Worth, Texas Ft.Worth Children's Museum	Roswell, N.M. Robert Goddard Museum	Denver, Colo. Denver Museum of Natural History	Salt Lake City, Utah Hansen Planetarium	Flagstaff, Arizona Museum of Northern Arizona
5	Marshall Space Flight Center, Alabama	Cleveland, Ohio Supplementary Educational Center	Chapel Hill, N.C. Morehead Planetarium	Detroit, Michigan Detroit Historical Museum	St. Louis, Missouri McDonnell Planetarium

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