

Apollo 11

The Eagle Has Landed

On July 20, 1969, for the first time in history, human beings stepped onto the Moon. They were American astronauts Neil Armstrong and Edwin "Buzz" Aldrin. "That's one small step for a man... one giant leap for mankind," Armstrong said as he stepped off the ladder. His boots made marks in the dusty grit of the Moon.

The astronauts had brought a television camera with them. So 242,000 miles away, the world heard Armstrong speak those unforgettable words. People watched in amazement as Armstrong took the first

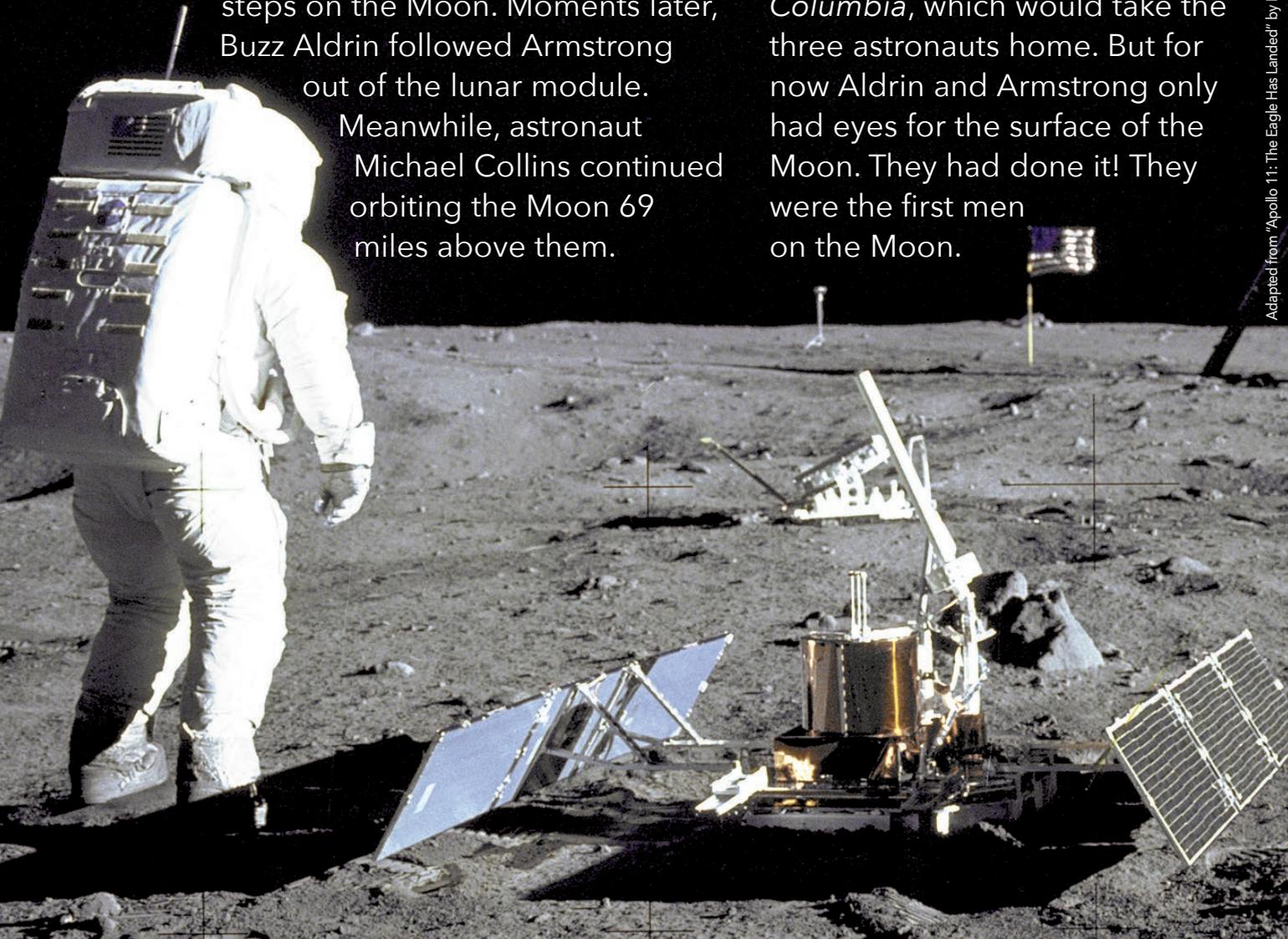
steps on the Moon. Moments later, Buzz Aldrin followed Armstrong out of the lunar module.

Meanwhile, astronaut Michael Collins continued orbiting the Moon 69 miles above them.

He was in the command ship, *Columbia*, which would take the three astronauts home. But for now Aldrin and Armstrong only had eyes for the surface of the Moon. They had done it! They were the first men on the Moon.



Apollo 11 is the name of the mission that landed men on the Moon. The spacecraft that carried the three astronauts to the Moon had two parts: the command module, *Columbia*, and the lunar module, *Eagle*. (Lunar means having to do with the Moon.) Armstrong and Aldrin landed in the *Eagle*; Collins stayed in the *Columbia*.



Apollo 11 had blasted off from Cape Canaveral, Florida, four days earlier. As the rocket sped them into space, each astronaut's body weight increased to about 1,000 pounds. When the ship finally escaped Earth's gravity, the men became weightless, floating around if they weren't strapped in. It was strange to live in zero gravity—things floated away if they weren't attached to something.

The astronauts had to eat and drink through tubes and straws. They couldn't shower. And just imagine going to the bathroom! The men could brush their teeth, but they couldn't spit out the toothpaste. Their faces swelled because blood moved through their bodies in a different way. The astronauts said the ship stank, but no one cared. Only the Moon mattered.

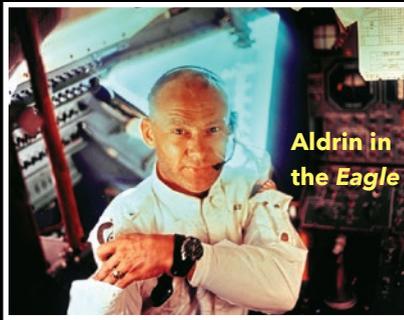
The crew of *Apollo 11* had a smooth flight into space. The astronauts had spent hundreds of hours training for this mission. They learned how to operate the equipment and what to do if something went wrong. And Neil Armstrong knew how much could go wrong. On an earlier space mission, his ship had spun wildly. He could have passed out, but he managed to fix the problem.

APOLLO GUIDANCE COMPUTER

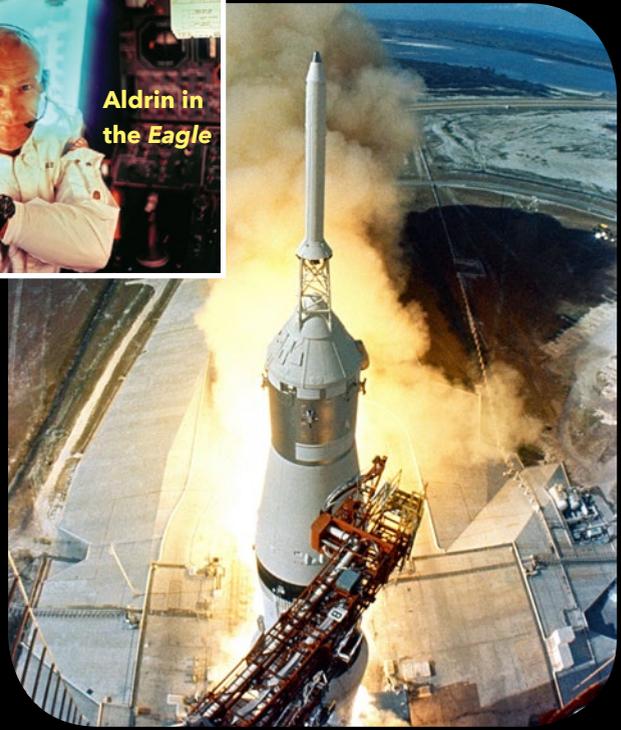
The term "coding" is well known today. It refers to the instructions entered into a computer telling it what to do. The term did not always exist, though. In the late 1960s, Margaret Hamilton began developing the software, or code, to run the Apollo Guidance Computer. This computer was a critical piece of equipment. It was meant to help the astronauts find their way to the Moon.

Many engineers at NASA and at the lab where Hamilton worked didn't know how hard it would be. Hamilton herself said, "Nobody knew what it was that we were doing." Hamilton led a team of more than 400 people. It took five years of work to develop the code for the computer. And it worked perfectly on every *Apollo* mission. As a result of the work, Hamilton and her team are credited with creating the profession we know as "software engineering."

Four days after leaving Earth, astronauts Armstrong and Aldrin climbed into the small, bug-like lunar module called the *Eagle*. They were ready to go down to the surface of the Moon. But an alarm began to sound. The ship's computer was overloaded with information, setting off the alarm. Then, from mission control back on Earth, the astronauts heard the words they were waiting for: "We're GO on that alarm," which provided approval for *Eagle* to continue its powered descent. But a new problem came up: the *Eagle* passed the landing site and approached a boulder field. Taking the controls, Armstrong coaxed the ship towards a clear area, trying to land before the engine drank the last bit of fuel.



Aldrin in the Eagle



Aldrin told Armstrong the *Eagle* was nearly out of fuel. With only 16 seconds of fuel left, Armstrong called the control center in Houston. "Tranquility Base here. The *Eagle* has landed!"



Buzz Aldrin and the U.S. flag on the Moon



THE APOLLO SPACESUIT

Once on the Moon, the astronauts would need to leave their spacecraft and explore the lunar surface. But how would they be protected?

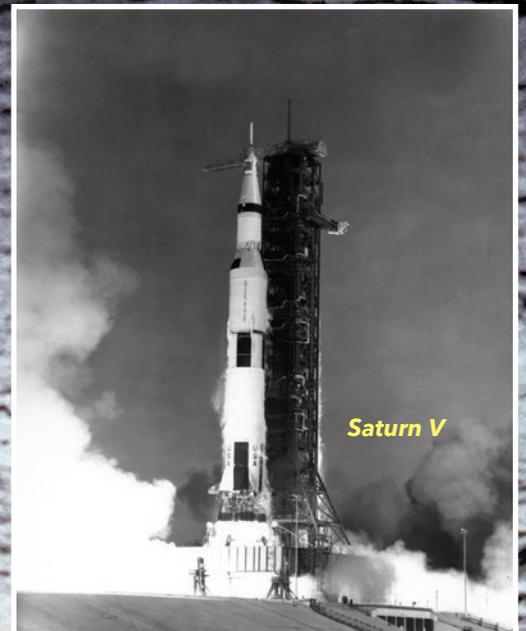
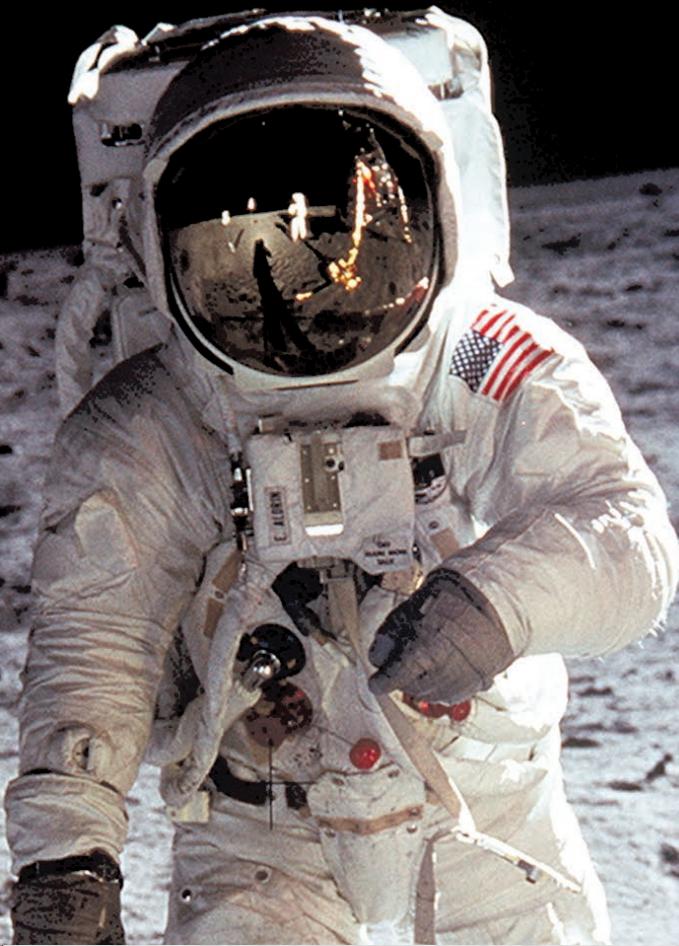
There is no air to breathe on the Moon. The temperatures could vary from very hot to very cold. They needed a spacesuit that would provide them with life support and oxygen. It would need to be a comfortable temperature. It would need to protect against micrometeoroids, which are very small pieces of material that move through space.

NASA asked two companies to develop the suits. International Latex Company (ILC) made ladies undergarments. Hamilton Standard was an aerospace contractor. The expert seamstresses at ILC created a lightweight flexible suit. The engineers at Hamilton Standard developed a portable life support system. With the suit, the astronauts successfully performed all of their moonwalks on six *Apollo* missions.

During their Moon walk, Armstrong and Aldrin took pictures and collected Moon rocks and dust. They placed scientific equipment on the Moon, and did some experiments. Because there was so little gravity, walking felt more like floating. The astronauts described the Moon as black and gray—

beautiful in a desert-like way. When their work was finished, Armstrong and Aldrin fired the rocket engine that lifted the *Eagle* off of the Moon. It was time to head back to the blue, brown, and green planet called home.

A few years later *Apollo 17* was the last manned mission to the Moon. Astronauts Gene Cernan and Harrison Schmitt landed on the Moon on December 19, 1972.



THE F-1 ENGINE

The *Apollo/Saturn V* Moon rocket weighed 6.1 million pounds. To power this giant rocket, NASA developed the F-1 engine. This was the most powerful liquid fueled rocket engine ever. It took five of these engines, each producing 1.5 million pounds of thrust, to lift the *Saturn V* during launch. The combined 7.5 million pounds of thrust is equivalent to 160,000,000 million horsepower, or about 500,000 cars. It took engineers at NASA and Rocketdyne, the company that built the engine,

many years to make sure it worked correctly. The engine is very large, 19 feet tall by 12 feet wide. It weighs over 18,000 pounds. The heart of the engine was the thrust chamber. This mixed and burned the fuel and oxidizer in a controlled explosion to produce thrust. Many engines were destroyed in explosions during testing. The engineers were able to solve all of the problems and the *Saturn V* had 13 successful launches, including the historic *Apollo 11* Moon landing.