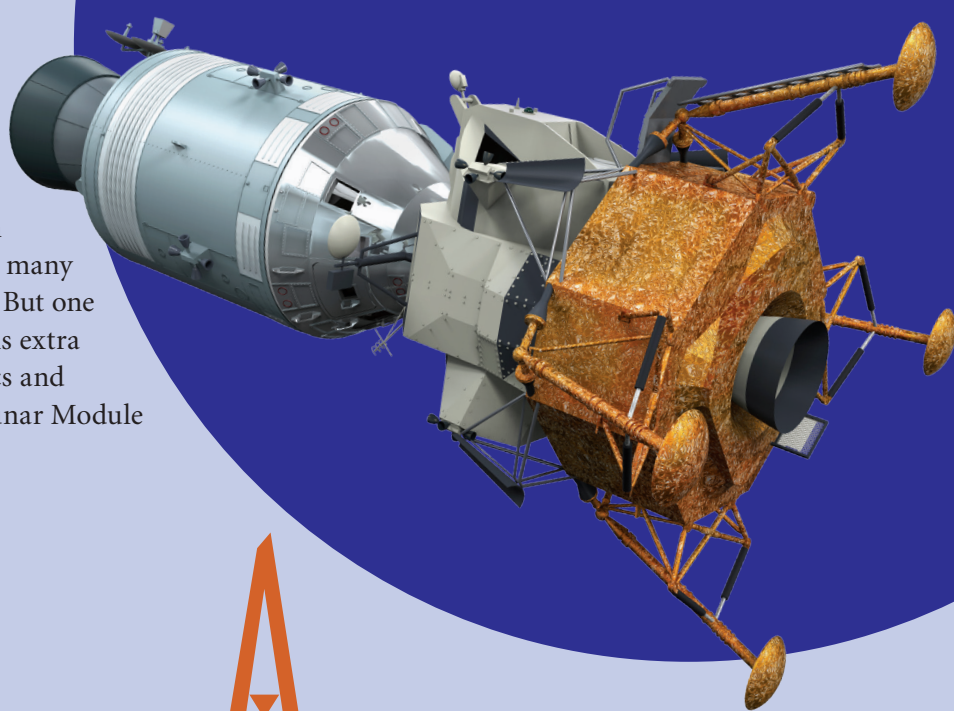


Long Island's Cradle of Aviation Museum in New York displays many historic air and space vehicles. But one craft in the museum's collection is extra special. It's a National Aeronautics and Space Administration (NASA) Lunar Module (LM).

"All the LMs were built right here on Long Island," explains museum curator Joshua Stoff, an expert on early space travel. "In those days, engineers and scientists had to learn everything about landing on the Moon."

The spacecraft used to carry astronauts into space and to orbit the Moon—the Command and Service Module (CSM)—was not designed to land on the Moon. NASA sent the astronauts with a second complete spacecraft—the Lunar Module—to reach the lunar surface.

The LM actually functioned like two craft. "Its bottom half is called the descent stage," Stoff said. "It carried a rocket engine that the astronauts fired to descend to the lunar surface. Its top half is called the ascent stage. It carried more rockets, which the astronauts used to leave the Moon and return to the



# A SPECIAL SPACECRAFT

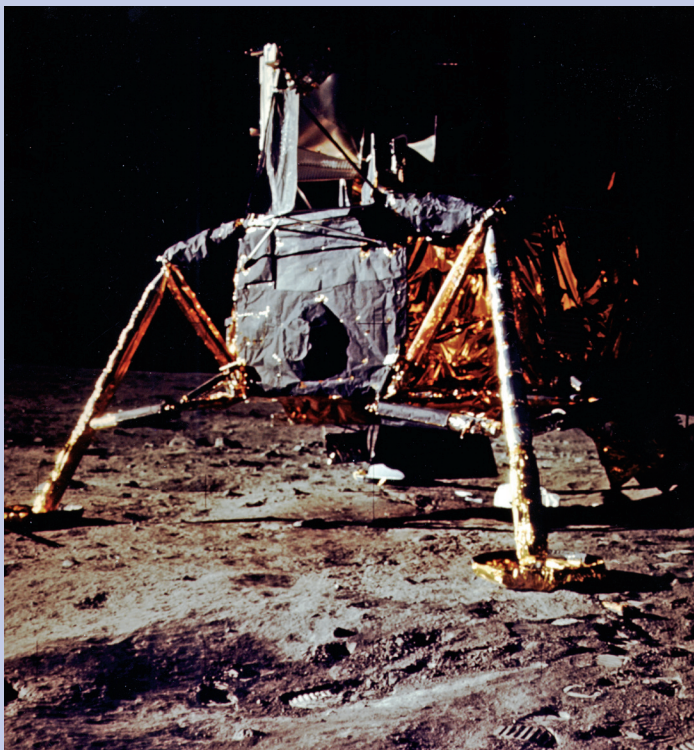
by Nick D'Alto

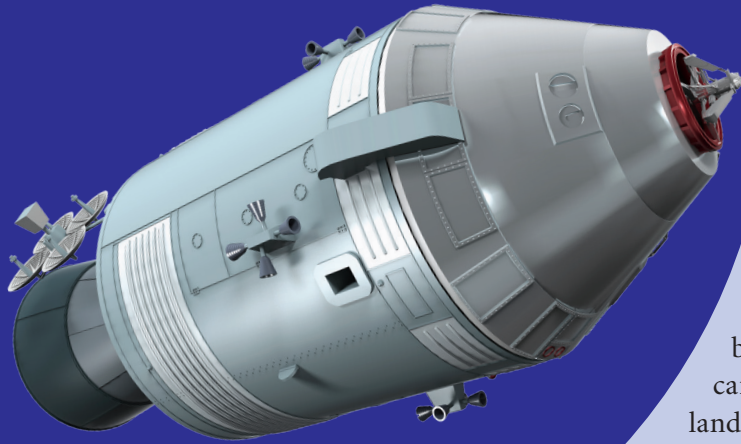
Command and Service Module."

The LM's four specially designed legs folded against its body to allow it to fit inside the Saturn V rocket during launch. Just getting into the LM was tricky. The CSM had to be turned and allowed to dock with the empty LM. The astronauts entered the LM through a series of hatches.

When the two astronauts were in the LM, they worked in a space not much bigger than a walk-in closet. "There are no seats," Stoff pointed out. The astronauts stood. Small,

**The Lunar Module (LM) was full of gear with which to communicate, navigate, and rendezvous. This photograph shows the LM on the Moon.**





Artist's rendering of  
*Apollo* Command and  
Service Module

**Seismic** means  
of or related to  
an earthquake or  
vibration.

triangular windows of thick glass allowed them to look out.

Getting the LM to the Moon's surface presented the greatest challenge of all. "Although the craft was thoroughly tested and the astronauts highly trained," Stoff said, "no one had ever actually landed an LM before." *Apollo 5*, *Apollo 9*, and *Apollo 10* had carried LMs into space, but those LMs did not land on the Moon.

As the *Apollo 11* LM approached the Moon, the astronauts saw that the landing spot looked too dangerous. They used the manual controls to safely land the craft elsewhere.

On the Moon, the LM served as a shelter to protect the astronauts. It also functioned as a laboratory and a communications center. After exploring the Moon, the astronauts used the LM to return to the CSM for the journey home.

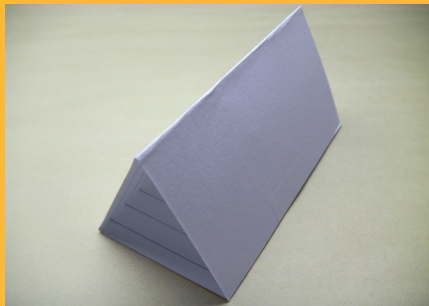
# Make a Lunar Module

by Nick D'Alto

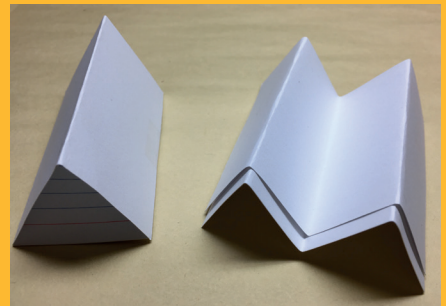
## You Need

- 3 index cards
- tape
- 4 large paper clips
- 4 coins

Designing the Lunar Module (LM) for the *Apollo* program presented a complex engineering challenge. The designers began by doing something simple. They constructed small models. They used ordinary household items, such as wood and wire. They wanted to understand how the different parts of a real LM might work and fit together. Engineers call this approach to building "a conceptual model." Here's how you can build a conceptual model of an LM.



1. To make the ascent stage (in which the astronauts ride to and from the Moon), fold an index card into three equal sections. Tape its ends together to form a triangle.

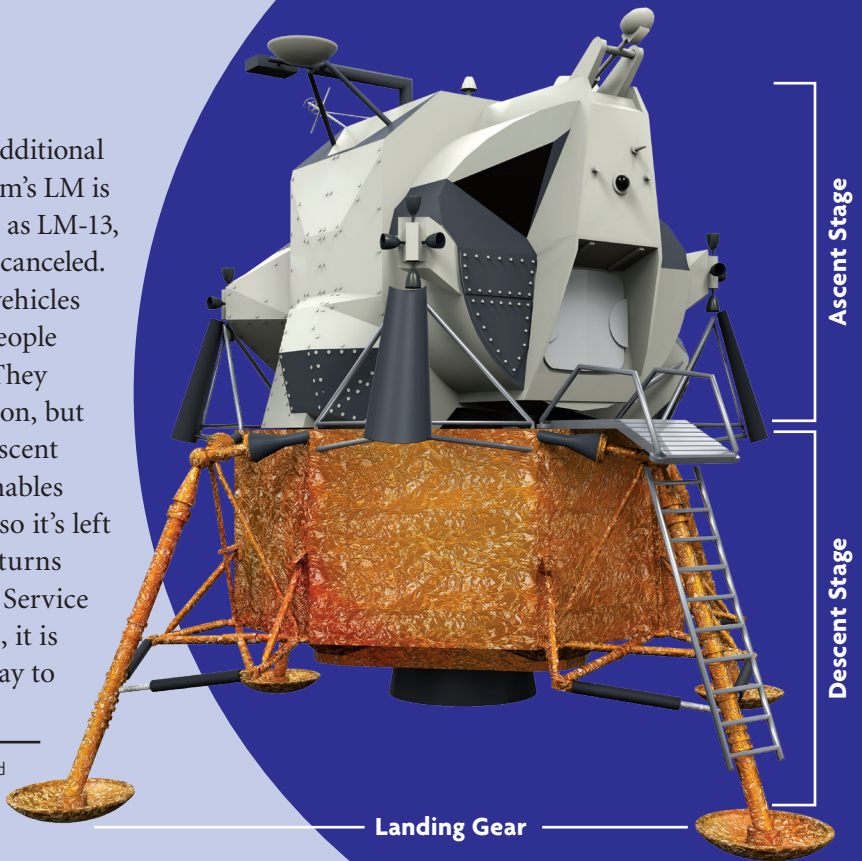


2. To make the descent stage (which holds the landing gear and rocket), fold two index cards into four equal sections. You should end up with the letter "M." Nest the two cards together.

After the success of *Apollo 11*, five additional LMs landed on the Moon. The museum's LM is one of just three left on Earth. Known as LM-13, it was intended for a mission that was canceled.

"LMs are rare. They are the only vehicles ever designed to operate and carry people entirely in space," Stoff explained. "They carry astronauts to and from the Moon, but they don't return themselves. The descent stage becomes the launch pad that enables the ascent stage to leave the Moon—so it's left behind. And once the ascent stage returns the astronauts to the Command and Service Module, it's cut loose." In most cases, it is meant to crash into the Moon as a way to gather *seismic* lunar data. 🌙

As a boy, future aerospace engineer **Nick D'Alto** watched the Moon landing on television. He still remembers seeing a delayed recording of the LM touchdown.



Artist's rendering of Apollo Lunar Module



3. Attach paper clips to each corner of the descent stage to make the landing gear.



4. Set each landing gear leg (paper clip) on top of a coin. The coins

represent the round landing gear pads used on the LM when it landed on the Moon. Place the ascent stage on top of the descent stage.

5. Test your module model by flexing the landing gear in and out. The LM's legs folded up to fit in the Saturn V rocket and then unfolded for landing on the Moon.
6. Lift off the ascent stage. This demonstrates how the astronauts used its rockets to leave the Moon and to return to the Command and Service Module. Both the descent stage and the landing gear remained on the Moon.

## A Model Model

Add accuracy to your model by drawing these extra details:

- Both stages carried rockets on the underside to propel them.
- The ascent stage had two hatches. One hatch was on top for the astronauts to get in from the Command and Service Module. Another hatch was on the side for the astronauts to use when they reached the Moon.
- The ascent stage had many displays and controls, which the astronauts used to manage the craft.