

Apollo's Lunar Module Bridged Technological Leap to the Moon



President John F. Kennedy, speaks in front of an early design for the Apollo lunar module. The large windows were later replaced with smaller, down-facing windows. Seats also were removed resulting in a design in which the astronauts stand. NASA Administrator James Webb, Vice President Lyndon Johnson, Dr. Robert Gilruth, director of NASA's Manned Spacecraft Center (now Johnson Space Center) in Houston, and others participate in the activity on Sept. 12, 1962.

Credits: White House/Cecil Stoughton



On July 24, 1962, Dr. John Houbolt explains his lunar orbit rendezvous concept for landing on the Moon. His approach called for a separate lander which saved weight from the "direct ascent" design in which the entire spacecraft landed on the lunar surface.

Credits: NASA

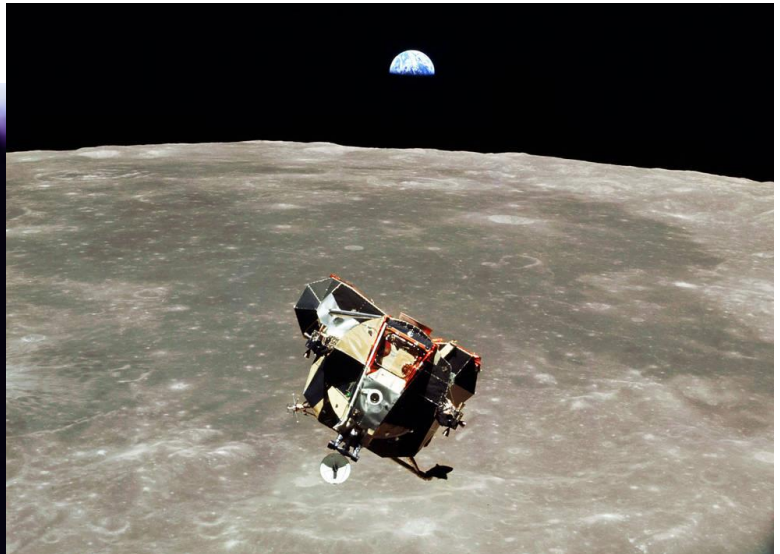


(upper left) In the Manned Spacecraft Operations (now the Neil Armstrong Operations and Checkout) Building at NASA's Kennedy Space Center in Florida, the lunar module for Apollo 10 is being moved for mating with the spacecraft lunar module adapter. Apollo 10 orbited the Moon in May 1969 and served as a "rehearsal" for the first lunar landing.

Credits: NASA

(upper right) Apollo 11 commander Neil Armstrong participates in training on June 19, 1969, in the Apollo lunar module (LM) mission simulator. Simulators for both the LM and command module were located in the Flight Crew Training Building at NASA's Kennedy Space Center.

Credits: NASA



(upper left) On July 20, 1969, the Sun's glare helps illuminate the Apollo 11 lunar module (LM) with Neil Armstrong and Buzz Aldrin aboard. The LM has just undocked from the command module to prepare for the first landing on the Moon a few hours later.

Credits: NASA/Mike Collins

(upper right) Apollo 11 - As the Earth rises above the Moon's horizon, the Apollo 11 lunar module's (LM's) ascent stage is seen from the command module. Moon walkers Neil Armstrong and Buzz Aldrin rendezvous with Mike Collins in lunar orbit on July 21, 1969. Eight years earlier, a small group of Langley Research Center engineers, including Dr. John Houbolt, proposed the "Lunar Orbit Rendezvous" approach. On six Apollo landings the concept proved successful.

On May 25, 1961, President John F. Kennedy challenged America to meet the goal of "landing a man on the Moon and returning him safely to the Earth." A first step in that technological leap for NASA was deciding how. At the time, many NASA managers and engineers believed the most feasible method was "[direct ascent](#)," -- a spacecraft launched by an enormous rocket traveling directly to the Moon and landing as one unit. After exploration of the surface,

a portion of the lander blasts off, returning to Earth. Another approach, called "Earth Orbit Rendezvous," involved launch of several Saturn 1 rockets. A spacecraft, similar to the direct method, would be assembled in space for the lunar mission.

But a small group of engineers, including Dr. John Houbolt, assistant chief of the Dynamic Loads Division at NASA's Langley Research Center in Virginia, had an idea called, "[Lunar Orbit Rendezvous](#)." In a 1961 letter to Dr. Robert Seamans, NASA's associate administrator, Houbolt proposed separate vehicles, one to land on the surface while another circled the Moon. The risky part was the landing craft must rendezvous with the "mother ship" in lunar orbit so the astronauts can return home. At that time, bringing two spacecraft together in space had never been tried. But the landing could require a much smaller spacecraft. "Rendezvous in lunar orbit is quite simple," Houbolt believed. "I would rather bring down 7,000 pounds to the lunar surface than 150,000 pounds."

While initially a skeptic, Dr. Wernher von Braun, director of NASA's Marshall Spaceflight Center in Huntsville, Alabama, agreed that the lunar orbit rendezvous approach would simplify reaching Kennedy's goal in a timely manner. Studies and debates continued during the following months. Initially dubbed the lunar excursion module, the name was later changed to simply [lunar module](#), or LM.

The LM will be remembered for its role between July 1969 and December 1972 as six of the spacecraft successfully landed 12 American astronauts on the Moon.



Credits: NASA

NASA Marks the Legacy of Apollo

From October 2018 through December 2022, NASA is marking the 50th anniversary of the 11 Apollo missions that included landing a dozen Americans on the Moon between July 1969 and December 1972. Today, NASA is working to return astronauts to the Moon to test technologies and techniques for the next giant leaps – challenging missions to Mars and other destinations in deep space.

For more information about NASA's plan for the future, visit:

[NASA Exploration: Back to the Moon and On to Mars](#)

HOMEWORK



National Aeronautics and Space Administration (NASA)
March 16, 2019

*****This homework is due TODAY, March 16, 2019**

www.clevelandwater.com/ClevelandSTEP

Name _____ Grade _____ Date _____

Instructions:

1. Solve each math equation, circle the correct letter with the correct answer, and write the letter of the correct answer in the blank.
2. After you have solved ALL equations, unscramble all of the letters you filled in the blanks to come up with the correct answer to the question below.

1. $10 + 10 + 10 + 20 + 50 = ?$ Correct Letter _____

P. 100

J. 50

L. 0

K. 70

2. $2 \times 2 \times 3 \times 3 \times 1 \times 0 \times 2 \times 1 \times 1 \times 1 = ?$ Correct Letter _____

P. 145

I. 69

L. 0

B. 45

3. At the age of 6, Chippie was twice as old as his wife Dovie. Now that Chippie is 70 years old, how old is Dovie? Correct Letter _____

M. 35

O. 67

Z. 73

G. 40

4. It takes 40 individual skittles to make one pack. How many skittles do you need to make 3 packs?
Correct Letter _____

- U. 80
- T. 102
- J. 103
- A. 120

5. $1 - 1 + 2 - 2 + 3 - 3 + 4 - 4 = ?$ Correct Letter _____

- L. 0
- H. 10
- O. 20
- Y. 1

6. $0 \times 2 + 1 = ?$ Correct Letter _____

- K. 10
- N. 9
- V. 8
- R. 7
- O. 1
- X. 6

What is the name of the program/missions NASA had with the goal of landing Americans on the moon almost 50 years ago? _____



**Northeast Ohio
Regional Sewer District**

Program Sponsors:

Cleveland Water, 1201 Lakeside Avenue, Cleveland, Ohio 44114

Northeast Ohio Regional Sewer District, 3900 Euclid Avenue, Cleveland, Ohio 44115