National Aeronautics and Space Administration

MOON TO MARS BINGO

www.nasa.gov/sls

Moon to Mars

With NASA's Artemis campaign, we are exploring the Moon for scientific discovery, technology advancement, and to learn how to live and work on another world as we prepare for human missions to Mars. We will collaborate with commercial and international partners and establish the first long-term presence on the Moon.

Exploration of the Moon and Mars is intertwined. The Moon provides an opportunity to test new tools, instruments, and equipment that could be used on Mars to help us build self-sustaining outposts away from Earth. Living and working in lunar orbit for months at a time will also allow researchers to understand how the human body responds in a true deep space environment before committing to the years-long journey to Mars.

With the work underway, NASA will move deeper into the solar system to achieve ambitious exploration goals and to develop a permanent presence at the Moon and prepare humanity for future exploration to Mars.

America's Rocket for Deep Space Exploration

NASA's SLS (Space Launch System) is a super heavy-lift rocket that provides the foundation for human exploration beyond Earth orbit. With its unprecedented capabilities, SLS is the only rocket that can send NASA's Orion spacecraft, four astronauts, and large cargo directly to the Moon on a single mission.

Offering more payload mass, volume, and departure energy than any other single rocket, SLS can support a range of mission objectives, while reducing mission complexity. The SLS rocket is designed to be evolvable, which makes it possible to increase its capability to fly more types of missions, including human missions to the Moon and Mars and robotic scientific missions to the Moon, Mars, and the outer planets.

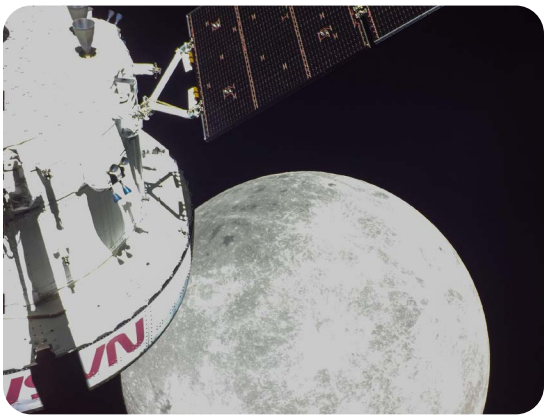
SLS is designed for deep space missions and will send Orion or other cargo to the Moon, which is nearly 1,000 times farther than where NASA's International Space Station resides in low Earth orbit. The high-performance rocket provides the power to help Orion reach a speed of 24,500 mph—the speed needed to send it to the Moon.

NASA's SLS rocket carrying the Orion spacecraft launches on the Artemis I mission Nov. 16, 2022, from Launch Complex 39B at NASA's Kennedy Space Center in Florida.

Orion Spacecraft

The Orion spacecraft, which launches on NASA's SLS heavy-lift rocket, is built by NASA and prime contractor Lockheed Martin. It is currently the only spacecraft capable of crewed deep space flight and highspeed return to Earth from the vicinity of the Moon.

Orion is specifically designed to carry astronauts on deep space missions farther than ever before. It will provide protection from solar radiation and high-speed entry into Earth's atmosphere, as well as advanced and reliable technologies for communication and life support. Orion's missions will span multiple phases, as part of NASA's framework to build a flexible, reusable, and long-duration infrastructure that will last multiple decades and support missions of increasing complexity.



A portion of the far side of the Moon looms large just beyond the Orion spacecraft in this image taken during the Artemis I mission.

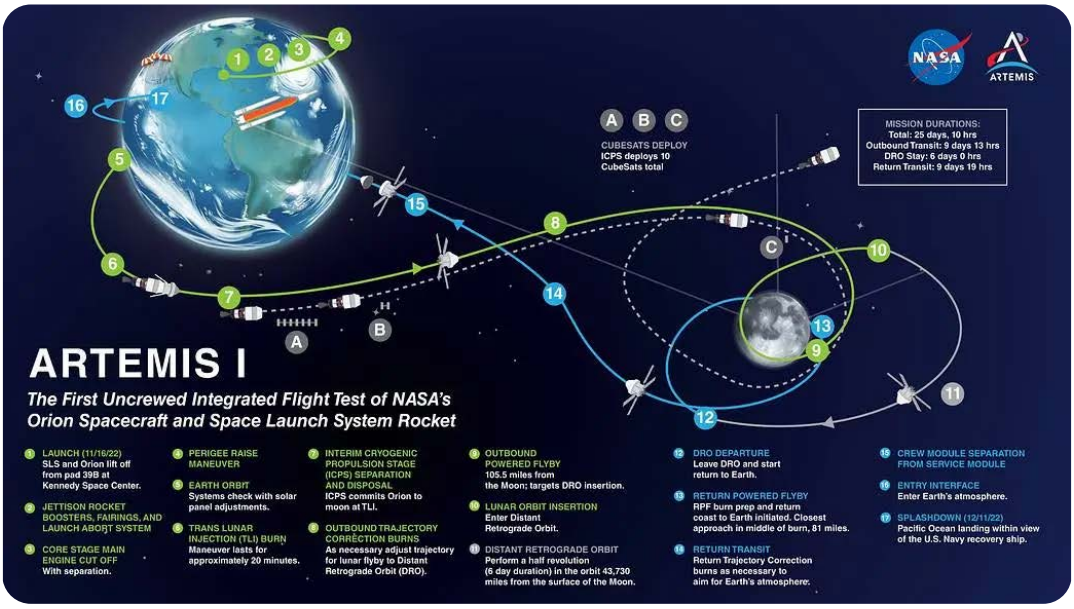
Artemis I

Artemis I was the first integrated test flight of NASA's Deep Space Exploration Systems: the Orion spacecraft, SLS (Space Launch System rocket), and upgraded Exploration Ground Systems at NASA's Kennedy Space Center in Florida.

This was the first in a series of increasingly complex missions to build a long-term human presence at the Moon that will enable future crewed missions to Mars. Artemis I launched Nov. 16, 2022, from Launch Complex 39B at NASA Kennedy. The Orion spacecraft splashed down off the coast of California Dec. 11, 2022.

The primary goals for Artemis I were to demonstrate Orion's systems in a spaceflight environment and ensure a safe re-entry, descent, splashdown, and recovery prior to the first flight with crew.

The Artemis I test flight was a success and proved that SLS and Orion were ready for crewed flight.



Trajectory for Artemis I, the first integrated test flight of NASA's Orion spacecraft, SLS (Space Launch System) rocket, and the ground systems at NASA's Kennedy Space Center in Florida.

Future Artemis Missions

Artemis II builds on the success of the uncrewed Artemis I mission and will demonstrate a broad range of capabilities needed for deep space missions. The Artemis II test flight is NASA's first mission with crew aboard the SLS (Space Launch System) rocket and Orion spacecraft.

Four astronauts will venture around the Moon on Artemis II on NASA's path to establishing a long-term presence at the Moon for science and exploration through the Artemis program. The 10-day flight will help confirm systems and hardware needed for early human lunar exploration missions.

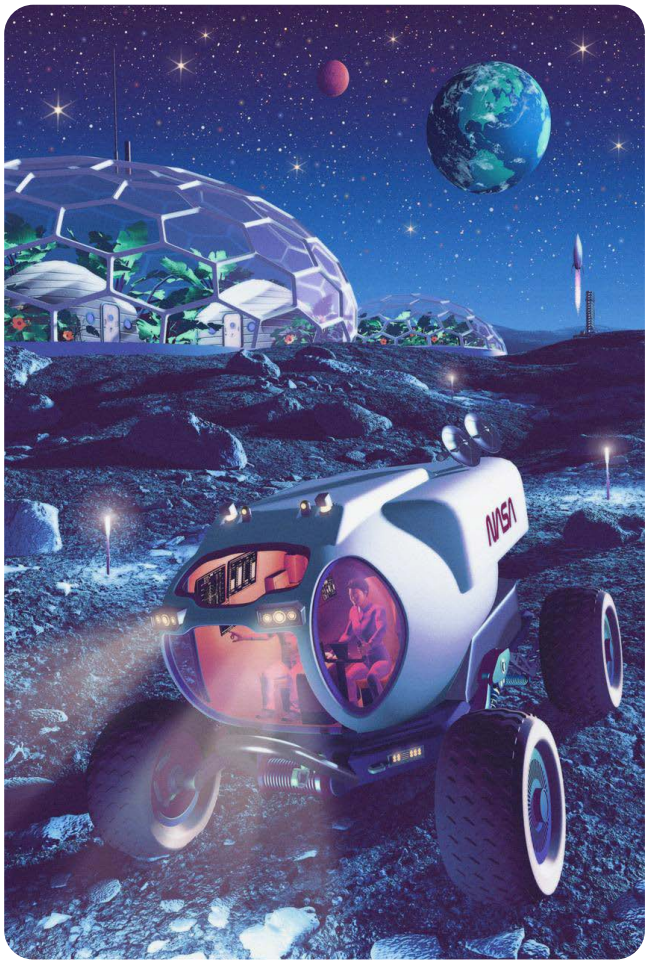
Artemis III will be one of the most complex undertakings of engineering and human ingenuity in the history of deep space exploration, exploring the lunar South Pole region. Over the course of about 30 days, the Artemis III astronauts will travel to lunar orbit, where two crew members will descend to the surface and spend approximately a week near the South Pole of the Moon conducting new science before returning to lunar orbit to join their crew for the journey back to Earth.

The astronauts' observations, samples, and data collected will expand our understanding of our solar system and home planet, while inspiring the Artemis Generation.

To the Moon

From lighting up our skies to preserving evidence of our solar system's history, Earth's closest neighbor plays a pivotal role in the study of our planet and beyond. The Moon is a fundamental part of Earth's past and future – an off-world continent that may hold valuable resources to support space activity and scientific treasures that can tell us more about our own planet.

Although Americans first walked on its surface in 1969, our explorers left footprints at only six sites, during a total of 16 days on the surface. The next wave of lunar exploration will be fundamentally different. The lunar surface will serve as a crucial training ground and technology demonstration test site where we will prepare for future human missions to Mars and other destinations.



This illustration of Moon to Mars transportation and habitation shows astronauts driving a pressurized rover away from the dome of a translucent lunar habitat.

This illustration of Moon to Mars multidisciplinary science shows astronauts collecting and analyzing lunar regolith.

Moon to Mars Bingo

Preparation:

1. A week or so prior to playing Moon to Mars Bingo, provide each student with a copy of the Vocabulary Study Sheet (p. 6) to study.
2. Make copies of the BINGO card (p. 11). Fill in the boxes using the words and numbers from the Vocabulary Study Sheet. You may wish to laminate the cards to make them last longer. Four completed sample cards are provided (pp. 9-10)
3. For covering the spaces on the card, a sheet of NASA logos has been provided (p. 12) for you to copy, laminate if you wish, and cut for use by players. You may already have markers from another Bingo game or you may choose to use beans, pennies, or some other object.
4. Using the Vocabulary Clue Sheet (pp. 7-8), cut the clues into strips. Fold the strips and place them in a container (bowl, bag, hat, etc.). Another option is to laminate the sheet prior to cutting into strips. Obviously, you would not be able to fold them afterward but they will last longer.

Instructions:

1. Prior to beginning the game, select what constitutes a BINGO – a vertical row, a horizontal row, a diagonal row, any row, postage stamp (on the outer lines), etc. Make certain all players know what is considered a BINGO.
2. Draw a strip from the container and read the definition aloud. You can opt to have players call out the answer and then cover the word if it is on their card or simply have them cover the word on their card without calling out the answer for all to hear.
3. ALTERNATIVE – When the Vocabulary Study Sheet has not been provided prior to playing: Draw a strip from the container and read the definition. Have students call out possible answers. If no one gets the correct answer, the clue reader should state the answer and have players cover the answer if it is on their card.
4. Using the Master Answer Sheet provided (p. 13), place a marker on each answer as the clues are read.

Vocabulary Study Sheet

- **1/3** – amount of Earth's gravity at the surface of Mars
- **1/6** – amount of Earth's gravity at the surface of the Moon
- **12** – number of people, all American men, to walk on the Moon
- **18** – after modifications, number of pounds, in millions, one crawler-transporter can lift; two would be able to move the St. Louis Gateway Arch
- **1972** – the last time anyone walked on the Moon
- **212** – height, in feet, of the SLS core stage
- **40** – number of minutes that the Martian day is longer than an Earth day
- **45** – number of minutes it takes to completely open or close the Vertical Assembly Building's doors
- **456** – height, in feet, of the Vertical Assembly Building's high bay doors, the largest doors in the world
- **5** – tons of propellant an SLS solid rocket booster burns each second
- **8** – number of 747 jet aircraft that the 4 RS-25 engines could keep in the air
- **Apollo 11** – first NASA mission to land on the Moon
- **Artemis I** – first integrated SLS and Orion test flight
- **Booster** – produces 3.6 million pounds of thrust for SLS
- **Core Stage** – SLS fuel tank
- **Curiosity** – NASA rover that has been on Mars since 2012
- **Deep Space** – space beyond the Earth's atmosphere, especially that part lying beyond the Earth-Moon system
- **Differentiated** – composed of different layers with different compositions
- **Johnson Space Center (JSC)** – home base for NASA astronauts
- **Kennedy Space Center (KSC)** – NASA Center where rockets are launched
- **Launch Abort System (LAS)** – protects astronauts if a problem arises during launch by pulling the spacecraft away from the launch pad
- **Luna 2** – first spacecraft to land on the Moon; it was a Soviet craft
- **Mars** – the fourth planet from the Sun
- **Michoud Assembly Facility (MAF)** – location where the core stage is built
- **Moon** – only celestial body beyond Earth visited by humans
- **Neil Armstrong** – American astronaut and first person to walk on the Moon
- **New Moon** – when the Sun and Moon are aligned, with the Sun and Earth on opposite sides of the Moon
- **Orion** – NASA's new spacecraft for carrying astronauts into deep space
- **Payload** – the cargo carried by a rocket
- **Pegasus** – name of the NASA barge used to ferry hardware
- **Red Planet** – nickname of Mars; given because of the red "rusty" dust that covers the planet
- **RS-25 Engine** – weighs 7,775 pounds and used to power the core stage of SLS
- **SLS (Space Launch System)** – NASA's new rocket for launching humans and large payloads to deep space
- **Thomas Harriot** – first person to make a drawing of the Moon in 1609
- **Vehicle Assembly Building (VAB)** – one of the largest buildings in the world, covering 8 acres

Vocabulary Clue Sheet

Use the cut lines to cut the clues into strips.

1/3 – amount of Earth's gravity at the surface of Mars

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Pegasus – name of the NASA barge used to ferry hardware

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SLS (Space Launch System) – NASA's new rocket for launching humans and large payloads to deep space

Thomas Harriot – first person to make a drawing of the Moon in 1609

Vehicle Assembly Building (VAB) – one of the largest buildings in the world, covering 8 acres

B	I	N	G	O
VAB	Artemis I	Neil Armstrong	1/6	RS-25 Engine
1/3	Orion	Luna 2	Core Stage	Pegasus
Red Planet	Mars	FREE	5	Moon
Deep Space	MAF	Payload	JSC	18
SLS	12	Booster	Apollo 11	Thomas Harriot

B	I	N	G	O
Differentiated	Apollo 11	JSC	Red Planet	45
New Moon	Curiosity	212	SLS	Moon
KSC	MAF	FREE	Deep Space	Core Stage
1972	Mars	Orion	Artemis I	VAB
Payload	Neil Armstrong	LAS	Pegasus	12

B	I	N	G	O
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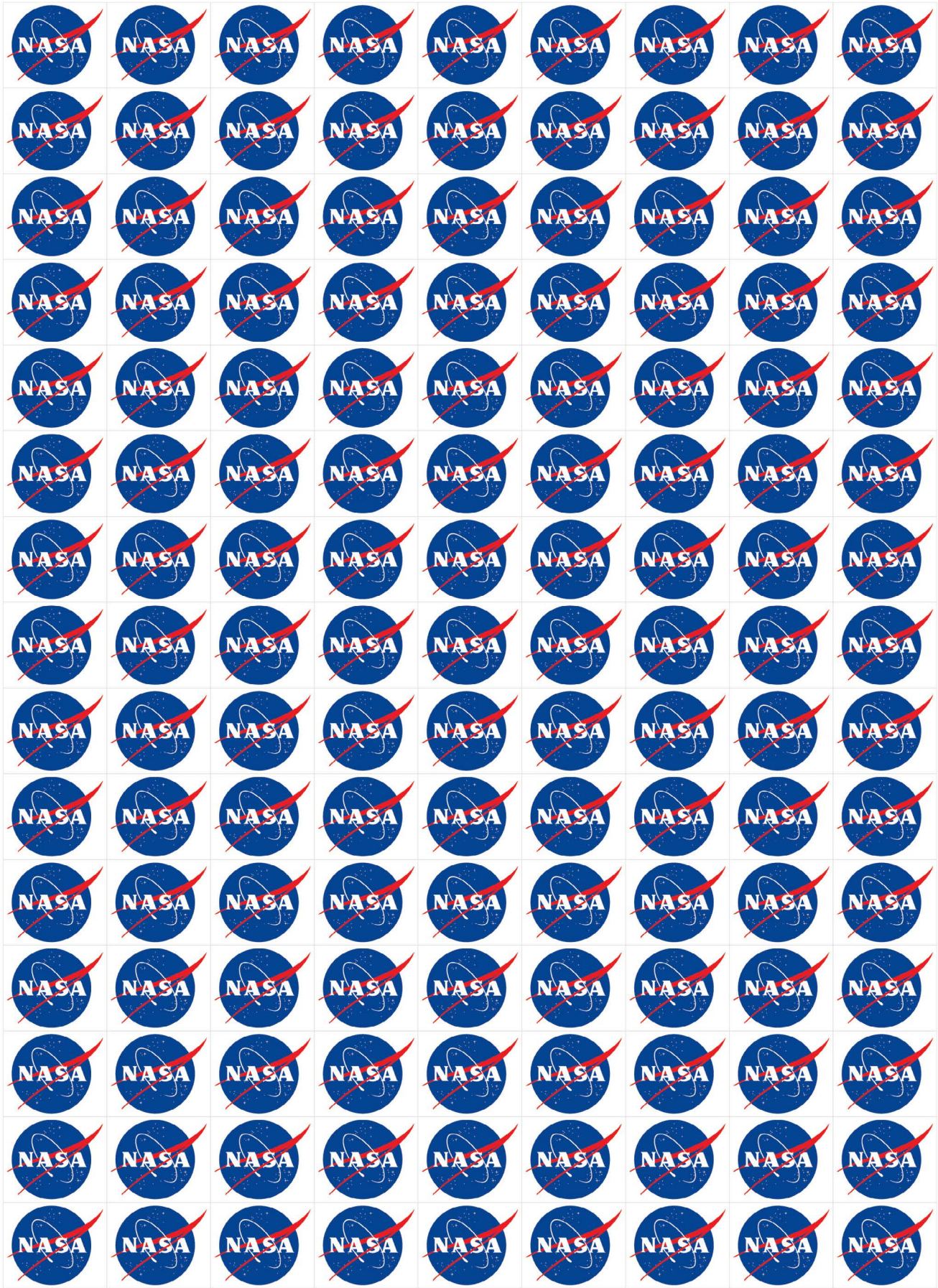
12	Booster	New Moon	Core Stage	LAS
1972	Deep Space	ARTEMIS	VAB	Curiosity
456	JSC	Pegasus	Mars	Orion
8	Luna 2	SLS	KSC	40

B	I	N	G	O
Thomas Harriot	Core Stage	212	Differentiated	8
Payload	Curiosity	Red Planet	JSC	456
RS-25 Engine	Mars	ARTEMIS	Payload	LAS
Moon	SLS	45	Luna 2	Pegasus
1/6	KSC	Neil Armstrong	New Moon	Orion

B	I	N	G	O
				

B	I	N	G	O
				

Card Markers



Master Answer Key

1/3	1/6	12	18	1972
212	40	45	456	5
8	Apollo 11	Artemis I	Booster	Core Stage
Curiosity	Deep Space	Differentiated	JSC	KSC
LAS	Luna 2	Mars	MAF	Moon
Neil Armstrong	New Moon	Orion	Payload	Pegasus
Red Planet	RS-25 Engine	SLS	Thomas Harriot	VAB

National Aeronautics and Space Administration

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For more information about SLS, visit:

https://www.nasa.gov/Artemis
https://www.nasa.gov/SLS
https://www.facebook.com/NASAArtemis/
https://www.x.com/NASAArtemis
https://www.instagram.com/NASAArtemis