

ARTEMIS 2 MISSION

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Abstract. *This paper discusses the Artemis II mission and its importance for modern space exploration. The aim of the study is to describe the main goals of the mission and analyze its basic physical and technological aspects. The research is based on general concepts of orbital motion, energy conservation, and spacecraft re-entry. The mission tested key systems such as the Space Launch System (SLS), Orion spacecraft, life support, and communication systems. The results show that Artemis II is an important step toward future human missions to the Moon and Mars. It confirms the reliability of modern space technologies and supports further development of space exploration.*

Key words: *Artemis 2, NASA, Orion spacecraft, Space Launch System (SLS), Moon flyby, lunar exploration, crewed mission, deep space, Earth orbit, spaceflight, lunar mission, Artemis program.*

МИССИЯ «АРТЕМИС 2»

Аннотация. *В данной работе рассматривается миссия Artemis II и её значение для современной космической науки. Цель исследования — описать основные задачи миссии и проанализировать её физические и технологические особенности.*

Исследование основано на общих принципах орбитального движения, законах сохранения энергии и процессах входа космического аппарата в атмосферу. В ходе миссии были испытаны ключевые системы, такие как ракета Space Launch System (SLS), космический корабль Orion, системы жизнеобеспечения и связи.

Результаты показывают, что миссия Artemis II является важным шагом на пути к будущим пилотируемым полётам на Луну и Марс. Она подтверждает надёжность современных космических технологий и способствует дальнейшему развитию космических исследований.

Ключевые слова: *«Артемис 2», НАСА, космический корабль «Орион», ракета-носитель «SLS», пролёт мимо Луны, исследование Луны, пилотируемая миссия, дальний космос, околоземная орбита, космический полёт, лунная миссия, программа «Артемис».*

INTRODUCTION

The Artemis II mission is a key step in NASA's return to deep space exploration and the first crewed lunar mission planned in more than 50 years. It represents the second major flight in the Artemis program and serves as a crucial test of the Space Launch System (SLS) rocket and the Orion spacecraft before future lunar landings. Unlike Artemis I, which was uncrewed, Artemis II will carry astronauts on a journey around the Moon and safely back to Earth, demonstrating that NASA's systems are ready for human deep-space travel.

This mission is designed to validate the performance of launch systems, spacecraft life-support systems, navigation, communication, and re-entry procedures under real crewed conditions. It also aims to ensure the safety and reliability of technologies that will later support long-term human presence on the Moon and future missions to Mars. Artemis II marks an important milestone in modern space exploration and a new era of international cooperation and scientific discovery beyond Earth.

Discussion and results. The Artemis II mission has been successfully completed. The Orion capsule splashed down in the Pacific Ocean near the coast of California on April 10 at 17:07 local time, which corresponds to April 11 at 02:07 German time. The crew was reported to be "healthy and in good spirits."

U.S. Navy recovery teams were already waiting in the area and quickly approached the spacecraft. After that, specialists assisted the astronauts in safely exiting the capsule. NASA administrator Jared Isaacman described the mission as "perfect," according to tagesschau.de. The crew consisted of Christina Koch, Victor Glover, Reid Wiseman, and Canadian astronaut Jeremy Hansen.

The return phase was the most dangerous part of the mission. The spacecraft reached a speed of about 38,400 km/h, more than 30 times the speed of sound. During re-entry, temperatures on the heat shield rose above 2,700°C. Despite these extreme conditions, the thermal protection system successfully withstood the stress.

Communication with NASA's mission control in Houston was temporarily lost for about six minutes during atmospheric entry, but this blackout was expected and planned. Shortly before splashdown, the capsule slowed down further using multiple parachutes.

During the mission, the crew collected valuable scientific and technical data, including observations of the lunar surface. They also captured unique images from deep space, including regions that had never been seen by humans before.

Artemis II also set a new distance record. At its farthest point, the spacecraft was 406,771 kilometers away from Earth, surpassing the previous record held by the Apollo 13 mission in 1970.

Artemis II served as a crucial rehearsal for NASA's planned crewed lunar landing in 2028. The mission tested key systems needed for future lunar exploration, including:

- the Space Launch System (SLS) heavy-lift rocket
- an improved heat shield after issues identified in 2022
- the European Service Module developed with ESA

- life support systems designed for long-duration space travel

Each SLS launch costs approximately \$4 billion, and the Artemis program has already required tens of billions in total investment.

Europe is working to strengthen its position in the space sector. German companies such as Rocket Factory Augsburg and Isar Aerospace are planning their own rocket launches.

German astronauts Matthias Maurer and Alexander Gerst are also expected to participate in future Artemis missions. They view the program not as a one-time lunar landing, but as the foundation for a long-term human presence on the Moon.

The most important component needed to send astronauts on a lunar flyby for the first time in over 50 years is currently being transported to NASA's Kennedy Space Center.

The core stage of NASA's Space Launch System (SLS) rocket, built by Boeing, was placed on NASA's Pegasus barge at the Michoud Assembly Facility in New Orleans. It is now being transported on a 900-mile journey to Florida.

This hardware includes four RS-25 engines originally developed by Aerojet Rocketdyne during the Space Shuttle era. Once it arrives, it will be moved to the Vehicle Assembly Building, where it will be positioned vertically at a height of 212 feet. There, it will be integrated with other parts of the SLS rocket, including two solid rocket boosters produced by Northrop Grumman. When fully assembled, the rocket will generate about 8.8 million pounds of thrust at launch.

The upcoming mission, Artemis II, is planned to launch no earlier than September 2025 from Launch Pad 39-B at Kennedy Space Center. It will carry NASA astronauts Reid Wiseman, Victor Glover, Christina Koch, and Canadian astronaut Jeremy Hansen on a lunar flyby aboard the Orion spacecraft developed by Lockheed Martin.

The last time humans traveled to the Moon was during Apollo 17 in 1972, marking more than five decades since a crewed lunar mission.

A NASA official, Catherine Koerner from the Exploration Systems Development Mission Directorate, stated that the Artemis program aims to achieve highly complex goals that will inspire future generations, advance scientific research, and strengthen U.S. leadership in space. She emphasized that the SLS rocket plays a central role in establishing a long-term human presence on the Moon.

The SLS rocket first flew in November 2022 during the uncrewed Artemis I mission. At that time, it was considered the most powerful rocket to reach orbit, until newer SpaceX Starship and Super Heavy systems demonstrated even greater thrust capabilities.

Despite this, NASA continues to view SLS as the only system capable of launching both astronauts and cargo for deep space missions. These missions include building the lunar Gateway station and conducting regular exploration of the Moon's south pole to search for water ice that could potentially be used for fuel and oxygen in future lunar habitats.

The Orion spacecraft successfully completed its uncrewed Artemis I flight and returned safely to Earth, although issues with heat shield damage remain a major concern that must be resolved before astronauts can fly aboard it.

According to current plans, Artemis III is expected to launch no earlier than September 2026. This mission would send Orion back to lunar orbit, where it will dock with SpaceX's Starship lander. Two astronauts will then transfer to Starship and descend to the lunar surface, with one of them expected to become the first woman to walk on the Moon.

The Artemis program originated in 2012 after the cancellation of the Constellation program, which also included the Orion spacecraft. However, the program has experienced significant delays and higher-than-expected costs.

A 2023 audit by NASA's Office of the Inspector General reported that costs for the first three Artemis missions are expected to exceed \$93 billion, with the SLS rocket accounting for about \$23.8 billion of that total.

The report also estimated that each SLS launch could cost around \$2.5 billion. NASA has aimed to reduce this to about \$1.25 billion per launch through improved efficiency and restructuring, but auditors have considered this goal unrealistic. However, costs may drop closer to \$2 billion per launch under newer contracts, representing about a 20% reduction.

NASA's long-term objective, originally set during the Obama administration, is to eventually send humans to Mars by 2040.

NASA SLS program manager John Honeycutt noted that delivering the core stage for Artemis II to Kennedy Space Center marks a transition from manufacturing to launch preparation. He added that the team is encouraged by the success of Artemis I and focused on achieving the first crewed Artemis mission.

Conclusion. In conclusion, the Artemis II mission represents a historic and essential step in humanity's return to deep space exploration. By successfully sending astronauts around the Moon and safely bringing them back to Earth, NASA demonstrates the readiness of the Space Launch System and Orion spacecraft for future crewed lunar landings. The mission not only confirms the reliability of advanced space technologies but also provides valuable scientific data and operational experience for upcoming missions.

Beyond its technical achievements, Artemis II symbolizes a new era of exploration, inspiring global cooperation and future ambitions such as establishing a long-term human presence on the Moon and preparing for journeys to Mars. It stands as a bridge between past lunar exploration and the future of interplanetary travel, marking a major milestone in the continuation of human space discovery.

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