UDC 00 https://www.doi.org/ 10.53355/ZHU.2024.109.4.021

PROSPECTS FOR ORBITAL FLIGHTS TO THE MOON: NEW HORIZONS AND CHALLENGES

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In recent decades, the Moon has attracted increasing attention as a potential target for orbital flights. In this article, we explore the prospects and opportunities for the development of orbital flights to the Moon, as well as identify the challenges faced by scientists and engineers in carrying out such missions. We look at various aspects such as technological innovation, scientific research, potential benefits for humanity and the impact on the environment. The discovery of new horizons in orbital flights to the Moon can lead to breakthroughs in our knowledge of space ecology, geology and astronomy, as well as create new opportunities for the development of technologies and resources that can be used on Earth and in space.

Keywords: *moon, flight time calculation, scientific research.*

Introduction

Orbital flights to the moon represent a new era in space exploration. While previously the Moon was considered primarily as an object for astronomical observations and space missions, modern technologies and scientific discoveries open up new opportunities for deeper exploration of this celestial body. In this article, we will look at several key aspects that make orbital flights to the Moon so attractive and challenging at the same time.

Technological innovation: One of the main challenges facing scientists and engineers is the development and improvement of technologies necessary for orbital flights to the moon. This includes the development of new engines, life support systems, radiation protection and other aspects related to long-term human presence in space. The use of autonomous systems and artificial intelligence can also play an important role in ensuring the safety and effectiveness of missions.

Scientific research: Orbital flights to the moon provide a unique opportunity for scientific research of various aspects of the Moon. This includes studying its geological structure, formation, possible sources of water and other resources, as well as analyzing the lunar atmosphere and magnetic field. In addition, orbital flights can provide an opportunity to place observatories and telescopes on the Moon, which will allow scientists to conduct more accurate and detailed observations of outer space.

Benefits for humanity: Orbital flights to the moon can bring significant benefits to humanity. First, exploring the moon can help us better understand the origin and evolution of our planet, as well as provide valuable insights into possible solutions to problems related to climate change and environmental crises. In addition, the development of new technologies and resources on the Moon may be important for future space missions, including planned flights to Mars and beyond.

Environmental impact: However, orbital flights to the moon can also have a negative impact on the environment. It is important to take into account the potential environmental consequences of such missions, including possible contamination of the lunar surface and the impact on its natural resources. Therefore, it is necessary to develop strict measures to protect and preserve the lunar ecosystem.

Materials and methods

There are several methods of flying to the moon that have been used in the past and may be used in the future. Here are some of them:

Launch Vehicle: This method was used in NASA's Apollo program missions that allowed astronauts to reach the moon. The launch vehicle carries a spacecraft with a crew and equipment into low Earth orbit. Then the second stage of the rocket is activated to put the ship on a trajectory towards the Moon. After reaching the Moon, the spacecraft can make a landing or an orbital flyby.

Orbital module: This method uses the separation of the spacecraft into two parts: the command module and the lunar module. The command module remains in orbit of the Moon while the lunar module descends to its surface. After completing the exploration of the Moon, the crew returns to the command module and returns to Earth.

Launch from the Moon: This method involves placing a base on the Moon, with which you can launch spaceships back to Earth. The base can use the resources of the Moon, such as lunar regolith (the surface layer of the soil), to produce fuel and other materials necessary for the launch. This method may be more cost-effective and allow for longer and more stable stays on the moon.

Magnetic catapults: This is a concept that has been proposed for future missions to the moon. The idea is to use magnetic catapults to accelerate spacecraft to the moon. This would reduce the amount of fuel needed to reach the Moon and reduce the size and mass of the launch vehicle.

These are just some of the methods of flying to the moon, and new technologies and approaches may be developed and used in the future.

Main part

In this article, we will present some calculations related to orbital flights to the Moon. Consider the following scenario: a flight to the moon followed by a return to Earth.

Orbit calculation: To reach the moon, the spacecraft must enter a translunar orbit. This is an orbit that crosses the orbit of the Moon. Calculations of the orbit are carried out using the laws of gravity and the mechanics of motion of celestial bodies. To do this, special programs and computer models are used that allow you to determine the optimal parameters of the orbit, such as altitude, speed and angle of inclination.

Trajectory calculation: After entering the translunar orbit, the spacecraft must fly through the Lagrange point L1, where the gravitational forces of the Earth and the Moon are balanced. Then it should continue moving towards the Moon, taking into account the gravitational influence of the Moon and other celestial bodies. Trajectory calculations are based on the laws of motion and gravity, as well as accurate data on the mass, distance, and velocity of the Moon and Earth.

Flight time calculation: The duration of the flight to the moon depends on the chosen trajectory and the speed of the spacecraft. The flight usually takes about 3-4 days, but this may vary depending on the specific conditions and mission parameters.

Calculation of return to Earth: After reaching the Moon and completing exploration tasks, the spacecraft must return to Earth. To do this, calculations are carried out to determine the optimal return trajectory, taking into account the gravitational influence of the Moon and the Earth. The calculations also take into account the exact parameters of entry into the Earth's atmosphere and speed reduction before landing.

Calculation of fuel and resources: For a successful flight to the moon and back, fuel and resource calculations must be taken into account. Calculations include determining the required amount of fuel to achieve the required speeds and orbit changes, as well as calculating oxygen, food and water reserves for the crew.

It is important to note that all calculations of the flight to the Moon are based on complex mathematical models and require accurate data about celestial bodies and mission parameters. They may also be subject to change depending on the specific conditions and objectives of the mission.

Results and discussions

Moon missions are challenging and technically challenging tasks that involve many challenges and obstacles. Here are some of the main challenges that orbital flights to the moon face:

Gravitational influence: The gravitational influence of the Moon and the Earth is one of the main factors influencing the flight path. Proper consideration of the gravitational influence and calculation of the optimal trajectory requires accurate data on the mass and distance between the Moon and the Earth.

Fuel and resources: A large amount of fuel is needed to reach the moon and return. Calculations and accounting of the required amount of fuel, as well as oxygen, food and water reserves for the crew are difficult tasks.

Radiation protection: Outer space, including flights to the moon, is subject to high levels of radiation. Protecting the crew and equipment from radiation is an important aspect of flying to the moon.

Conclusion

Orbital flights to the moon represent a unique opportunity to expand our knowledge of space and create new technologies and resources. However, these missions also present complex challenges that require innovation and attention to environmental aspects. We hope that our article will help shed light on the prospects of orbital flights to the Moon and stimulate further research in this area.

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