SPACE TOURISM AS REALITY OF THE 21ST CENTURY

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ABSTRACT

The author reviews and assesses the prospects for development of space tourism in the near future, analyzes the activities of both public and private companies and their cooperation. The advantages and disadvantages of the travels of «amateur cosmonauts», their place in the system of classification of the types of tourism are revealed. Based on the review, the conclusion was made about the reality of the emergence of a new tourism industry, the feasibility of investing additional financial resources in the development of space tourism in Russia and the outlooks of Russian private space companies are justified.

Keywords: space tourism, new-generation missiles, extraterrestrial routes, private space companies, moon colonization, colonization of Mars.

Background. *For most people, space tourism is associated with a distant future, where people make flights to the Moon, Mars, Jupiter's moons, asteroids and so on. This is not surprising, since the interpretation of the definition of space tourism in many sources is not complete, and therefore does not include suborbital flights[1], visits to the international space station, space museums, cosmodromes and other places related to the space industry. Meanwhile, it is interesting to trace the history of emergence of space tourism, to assess its features in the context of recent years, to identify trends in development of the United States, Europe, Asia and Russia.*

Objective. *The objective of the author is to consider space tourism as a reality of 21st century.*

Methods. *The author uses general scientific methods, comparative analysis, scientific description, evaluation approach.*

Results.

ISS – the first tourist destination

The history of space tourism begins with flights to the ISS, which were created by Soviet designers, and then their business was continued by a new Russia. The first space tourist is Dennis Tito – an American of Italian descent. His six-day flight, he committed in 2001, which cost him 20 million US dollars. In total, the ISS was visited by seven space tourists (one of them did this even twice).

These flights are of great importance not only for space tourism, but also for the space industry as a whole, because they showed that space is not open to one highly qualified specialists with excellent health, months of grueling training, but also ready to accept ordinary people (Dennis Tito boarded the ship at the age of 61). Let's not forget the other: during organization of tourist flights cooperation was established between the company «Space Adventures» and the state corporation Roskosmos, which marked the beginning of a new stage in space exploration – the entry of private space companies onto the scene.

However, the first flights showed also the vulnerable aspects of space tourism –the high cost and complexity of transportation.

These two problems are interrelated, because at the moment, one-time rockets are used to bring an object into orbit. The fact that complicates the development of space tourism, since, on the one hand, flights to the ISS and just flights into orbit become accessible only to millionaires, which turns this type of tourism into an elite one, and on the other hand makes it economically impossible for private companies to conduct independent flights. As a confirmation, it is enough to indicate that only a small part of non-state companies have a spacecraft that is ready or is under development. As a result, they have to lease ships from state corporations, and this, in turn, does not allow to develop a unique product to the full.

Reusable technology

The key to solving these two problems lies in the possibility of reusable use of rockets and spacecraft. Noteworthy is the fact that active in this direction are not states, but just private space companies that are trying to make the most of their funds from a generally limited budget.

The initiator of the reusable approach was Elon Musk, a Canadian-American businessman, founder of SpaceX. At one of the conferences in the USA, he cited an analogy regarding the situation with the colonization of America. According to him, the Europeans would never have settled the whole continent if the ships were disposable. That is why the founder of SpaceX set up the creation of a reusable rocket to reduce the cost of bringing cargoes into space tens of times.

It should be noted that every year private space companies play an increasing role in the US and European countries: SpaceX with Musk created a reusable rocket Falcon 9, a spaceship Dragon; Blue Origin is developing its suborbital spacecraft and reusable heavy carrier rocket: Virgin Galactic is making the latest preparations for suborbital flights on its spacecraft: Interorbital Systems has developed its own Neptune cargo dispatch system. In addition, Orbital ATK designed the spacecraft Cygnus, Thales Alenia Space produces satellites, as well as modules for the ISS and much more.

The company Blue Origin was founded by Jeff Bezos, an American entrepreneur who is the head of Amazon. The purpose of his arrival in the space industry is to make space flights routine, and for the task in hand he focuses on their safety and price reduction. In the future, Bezos dreams of building space hotels that will soar in space like the ISS, the first colonies on the Moon and Mars, and then whole cities, but now he has priority in organizing permanent suborbital flights and putting into operation a reusable heavy orbital carrier rocket New Glenn, which will compete with the rockets of the company SpaceX. Since 2012, Blue Origin conducts various tests of its suborbital spaceship New Shepard. After successful tests in 2016, Jeff Bezos plans to conduct a manned flight in 2018.

Virgin Galactic, a member of Virgin Group, founded by Richard Branson, specializes in suborbital flights.

[1] Suborbital flight is a flight in which a spacecraft moves along a ballistic trajectory at a speed less than the first space flight, after which it will not receive an orbit. The height that a suborbital ship can reach is 100 km, while passenger aircraft fly at an altitude of 9–12 km.

The company's website already offers a 2,5-hour such flight on its own spacecraft SpaceShipTwo, in which at the same time 8 people: two pilots and six passengers will be in a state of weightlessness for 5–6 minutes. The ticket price will be 250 thousand US dollars. According to the latest data, the company accepted applications from more than 450 people, of which more than 150 in advance made a deposit. However, the exact date of the commencement of the flights has not yet been announced, this is due to the failed test in 2014 and the constant transfer of test flights.

With regard to the previously mentioned company SpaceX of Elon Musk, its owner sets himself a more ambitious goal – to make humanity a multi-planetary species. Elon Musk believes that to preserve our species, we are obliged to begin the colonization of other planets, because there are already problems on the Earth related to climate change. In addition, overpopulation is growing, in some countries there is a problem of lack of water and food, and there is no guarantee that any country will not start a total war using weapons of mass destruction. It is also necessary to take into account the danger coming from asteroids, the course of which can run through our planet. However, if humanity possessed colonies on other planets, then the loss of the Earth would certainly be a tragedy, but as a species we would not have disappeared [1]. The space rockets created by SpaceX are quite competitive. The cost of delivering cargo weighing not more than 10,5 tons to a geotransport orbit on the Ariane-5 ESA rocket developed by the European aerospace industry corporation is 140–150 million US dollars, while the Falcon 9 is capable of delivering a cargo weighing up to 8,3 tons for 62 million dollars, and Falcon Heavy – cargo up to 22,2 tons for 90 million dollars.

Moreover, in 2018 the company intends to carry out a commercial flight around the moon on the ship Dragon 2. The trip is planned for two passengers and will last for a week. While there is no information from the company regarding the cost of such a flight, according to experts' estimates, the price may amount to more than 300 million US dollars.

But the main task of Elon Musk is the conquest of the Red Planet, because here he is in accord with the ideas of our Tsiolkovsky is going to create a new house for humanity.

Mars is a new destination?

However, Musk is not the first who is ready to send people there. Bas Lansdorp, a Dutch entrepreneur, founded the project «Mars One». Its goal is the colonization of Mars. According to Lansdorp, the technologies needed to conquer the Red Planet already exist or will soon appear. At the initial stage of the project, a very ambitious timeframe for sending people to another planet was declared, but soon they were transferred: the first manned flight with a crew of four is expected in 2026, and the arrival of the colonists on Mars in 2027. The first manned flight, next year, it is planned to send the second same crew. However, many specialists, including scientists from ESA and NASA, criticize the project for its technical and financial inconsistency. And some people call Bas Landsdorp just a fraudster [2].

In 2030, a manned flight to Mars is planned to be carried out by NASA. US President Donald Trump supports this mission, believing that NASA should shift its focus from Earth exploration programs to manned spaceflight missions.

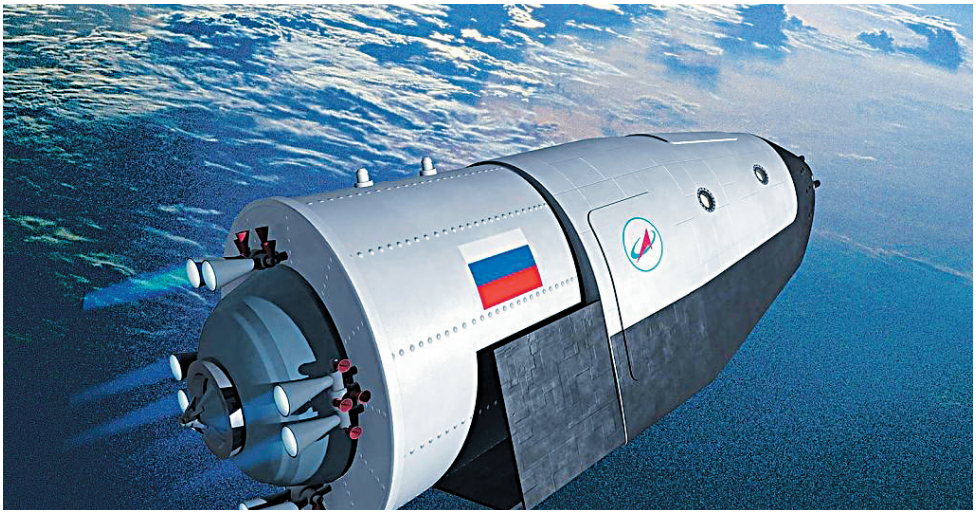
Roskosmos and ESA do not plan to land on Mars, nevertheless they carry out a lot of joint research. In 2010, a very significant experiment began from a psychological point of view. Most people believe that the progress of mankind in the study and conquest of the cosmos depends on our technical level of development: engines, spaceships, robotics and so on. Of course, this is an indispensable component, without which we will not be able to move forward. But we must not forget that man is a social and biological being, therefore life under other conditions can have a negative impact on him. Many scientists, including private companies, are trying to find out what effect the weightlessness on the human body will have, how the colonists will feel with the other physical parameters of the planet (gravity, pressure, temperature, etc.). Moreover, no one can predict how people will behave in a confined space for many days (flight to Mars can take more than 80 days). The Mars-500 experiment was conducted to find out how the psychological state of people will change in conditions of close living, whether they will be able to remain calm and continue to do their work, whether they will suffer stress from longing for normal life.

As a result, a crew of six successfully passed the test, which simulated a 520-day flight to Mars, including landing on the Red Planet and extracting the necessary samples on it. Of course, the experiment cannot convey with a 100-percent accuracy the psychological state that will be in people flying to Mars, but the information obtained is of great value and relevance. It also has great significance, because already in 2022 Elon Musk and SpaceX plan to send a manned mission to Mars. Moreover, the crew will be not of six people, but of one hundred. At first, these flights will be only one way, that is, 100 volunteers will probably never see the Earth again. And yet, as the first colony on the Red Planet expands (Musk plans to carry out 10000 flights there and create a wholly self-supporting colony within 40–100 years), stable transit between Earth and Mars will be established, which will make it possible to make tourist trips.

It is worth noting that unlike the «Mars One» project, Elon Musk has a clear plan of action for implementation of his mission. By 2022, SpaceX will have rockets for the output of superheavy loads, a system of refueling spacecraft in orbit will be tested. The main advantage of Musk in comparison with others is the fact that the company SpaceX is able to assume most of the mission from a financial point of view, other projects rely only on sponsors. It is also important that Musk makes the flight accessible not only for millionaires. The price of the ticket to Mars is 200 thousand US dollars, this is the average cost of buying a house in North America.

Earth satellite development

At the same time, the European Space Agency is betting on the development of the moon. Johann-Dietrich Werner, Acting Director of ESA, believes that the creation of the Moon Village would be the most reasonable step after the termination of the ISS service in 2024. Moreover, the idea of developing the Moon is also supported by Russia, China, Japan and India. Werner counts on the fact that, in addition to the states, private companies will join the project, which, incidentally, already have considerable interest in the satellite of the Earth. According to the plan, each private company will deal with a certain business on the Moon: one will extract water, another helium, the third will organize space tourism and so on [3].



However, the domestic private space company Lin Industrial has more ambitious plans. It developed the project «Moon Seven» – construction of a Russian base on the Moon using already existing missiles, ships and technologies. This initiative is perfectly combined with the statement of Dmitry Rogozin that Russia will create a permanent base on the Moon until 2030. The only problem for the project is the need to reduce the weight of the spacecraft to 3,6 tons.

The Russian Rocket and Space Corporation Energia is developing its own multipurpose reusable space ship Federation, as well as a commercial space station that can be used for space tourism. In addition, the company has several projects to make tourist flights around the moon on the Soyuz ship.

The Cosmocourse is planning to compete with Western colleagues in the sphere of suborbital flights. According to the statements of Pavel Pushkin, the general director of the company, in 2020 the first flight from the Kapustin Yar cosmodrome is planned, while its own reusable space complex will be used. Suborbital flight will pass at an altitude of 180–220 km, its duration will be 15 minutes, of which 5–6 minutes will be the state of weightlessness. The crew will consist of six tourists and one instructor. The ticket price will not exceed 200–250 thousand US dollars [4].

Conclusion. *In the near future, mankind will once again return active interest in manned spaceflight, which will result in the creation of the first outposts at other objects of the solar system. Of course, space tourism will play an important role in this action and will contribute to the development of the space industry. However, we see that if large players are now appearing in the sphere of suborbital flights, then for the «lunar market» there is no obvious fight yet.*

At the same time, the Russian state corporation Roskosmos has a large budget, technology and space technology, thanks to which the country can start developing the Moon. In addition, domestic private companies already offer a ready-made plan for a tourist flight to Earth's satellite. With sufficient government support, they could form a unique tourist product and help Russia in forcing promising lunar programs.

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