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SPORT COMMERTIAL PILOTED EXPEDITION TO MARS WITH A HUGE SCIENTIFIC EFFECT

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Abstract

The report will focus on new approaches to space exploration, without the use of budgetary funds. How to pay for such a mission as a manned expedition to Mars? Of course, having reduced the cost of such an expedition dozens of times, no more than 250 million dollars. To do this, it is necessary to reduce the price for the construction of a manned complex and reduce the number of launches of carrier rockets. In addition, you need to find an area of commerce that will be interested in planetary missions. Marketing research shows that tourism is a fairly stable area with interest in space tourism. Clients are ready to pay $50 million for the ISS and $150-200 million for a lunar flyby. Also, some studies clearly show that many are ready to fly to Mars and pay money. [3] The only thing left is to reduce the cost of expeditions to Mars from hundreds of billions to hundreds of millions or less. To do this, I developed an advanced project for an ultra-cheap expedition with a very comfortable architecture, this will allow sending astronauts not only on a scientific flight, but also on a sports and tourist flight. I propose to consider several options within the framework of this report to potential investors and sports tourists who have long dreamed of visiting the red planet not in a dream but in reality!

Keywords: Mars, Expedition, Solar Tug, Martian Rover.

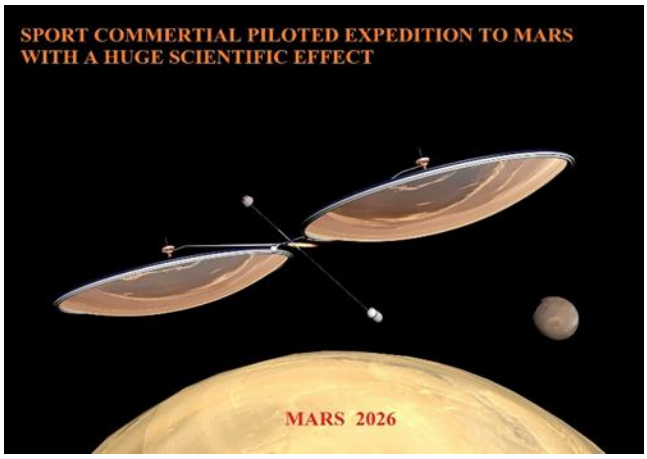


Fig.1. One of the options for an interplanetary manned complex for flying to Mars and other celestial bodies.

1. Introduction

The successful commercialization of astronautics over the past 20 years shows how much private projects turn out to be orders of magnitude cheaper, simpler and safer than projects that are formed at the state level. Space manned projects, which yesterday seemed like a fantasy, are now becoming a reality. This also applies to a manned expedition to Mars.

I often heard this catchphrase! - "No country in the world is able to make a manned expedition to Mars alone, this requires a billion and billions of dollars" (!) [1] No country in the world can do this, because such an expedition can only be implemented by private individuals and for a sum not exceeding $250 million. It may seem like a paradox, but it really works! It was by private individuals, as did Magellan, Joshua Slocum, Amundsen and Scott, [2] the conquerors of Everest and the ocean depths, and many other private individuals who used their own money or sponsors' money.

Private fierce competition between extremals is not as extreme as fierce competition between countries and large corporations.

To imagine how all the countries of the world fly together holding hands, for trillions of budget money and at the same time synchronously put their feet on Mars so as not to consider anyone as their competitor, it looks at least funny. Always let someone's foot touch the first Mars. While it's not a bad idea for a group trip to the red planet, take a single step on Mars together! When all the tourists from the ship take the first step on another planet and no one is offended! Yes, and I would like to note that in my opinion that humanity has already made its main records, a person circled the globe by sea and by air, circled the globe through space, and truly made a breakthrough for mankind by stepping on another celestial body - the Moon. Now, no matter what celestial body a human footstep on, Mars, Venus, Mercury, etc. it will be just another moon, only a little further in distance, more or less beautiful, bigger or smaller, but it will be just a new moon. The next breakthrough of mankind can only be a flight to another planetary system, to another star.

Open the era of sports tourism to other planets! Invest in my project!

2. Material and methods

This project provides for sending one or two persons of space tourists, geologists, scientists who will be trained and who may be representatives of the investor. The expedition formula is:

One launch of a carrier rocket with a carrying capacity of 22 tons - two travelers!

One launch of a carrier rocket with a carrying capacity of 17 tons - one traveler!

Thus, the number of crew is determined by the number of launches of the same type of interplanetary complexes that can fly to Mars in a group at a short distance, while tourists and pilots can visit each other, and in the event of an emergency, any of the backup ships is able to take on board other tourists or provide support, both technical and moral. The original design of the know-how of the artificial gravity system allows, at the same time, to ensure the docking of residential modules into a common rotational system!

Speaking about the methodology of the sports component of this report, the expedition can be organized in a sports mode. For example, like a regatta. The investor finances at least two rocket launches or more, with a payload capacity of 17 tons for one pilot or 22 tons for two. And in the competitive mode, the sportsmen-explorer demonstrate the marvels of navigation, control and fuel economy in order to be the first to arrive at their destination and take their small step and leap for humanity on Mars.

The key technical solution of the project is a space tug with a solar thermal rocket engine, which has a specific impulse varying within 550-1200 seconds. This is no new idea [4], [5]. But my new technical construction and new design.

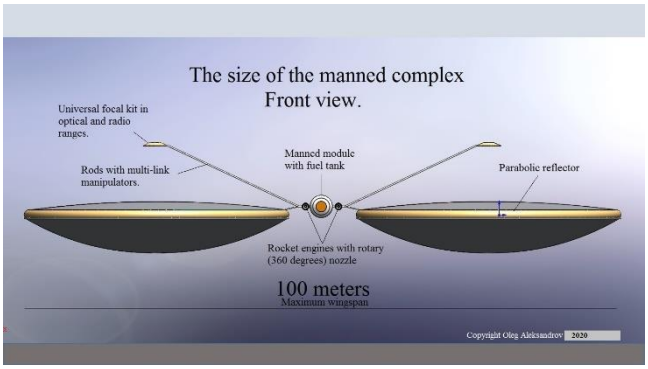


Fig.2. The layout of a manned interplanetary complex with elements of a solar thermal engine operating both on hydrogen and on other substances, for example, on water extracted from asteroids.

I designed this engine in the new options and patent it**. Fig.1. Fig.2.** The engine is capable of running on both hydrogen and other gases. For example, when exploring Phobos and Deimos or on asteroids, I plan to use water extracted directly from them. This will allow for an almost unlimited number of movements on their surface and between them. The drilling rig allows not only to collect soil samples in a sterile manner, but also to extract water, without violating the principles of sterilization. The propulsion system is capable of operating both with one parabolic concentrator and

with two. At the same time, the heat exchanger support rods in their focus can be used as multi-hot manipulators for moving people and goods.

Depending on the selected mode of efficiency of such an engine, the acceleration of the interplanetary expeditionary manned complex (IEC) will be from 100 mm/s2 to 5 mm/s2. The use of this device in the project will allow the use of only one launch vehicle with a carrying capacity of 22 tons and the internal dimensions of the fairing 5 meters in diameter and 15 meters in length, while the cone of the fairing is also a useful space for placing an emergency rescue system (LES) of the crew at launch. **Fig.3.**

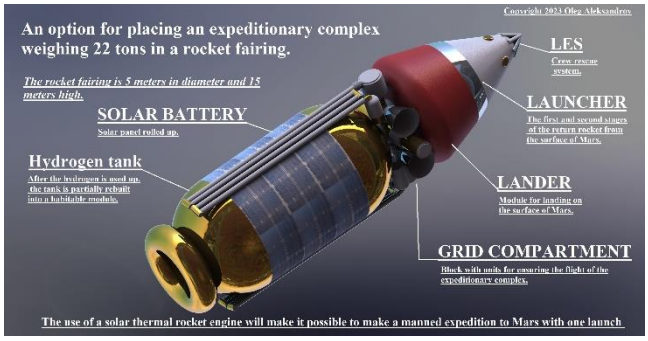


Fig.3. Placement of a manned interplanetary complex for 2 travellers in a standard fairing with a diameter of 5 meters by 15 meters, a standard rocket with a carrying capacity of 17- 22 tons.

A key technical solution for the tug itself is a method of long-term storage of hydrogen to power its rocket engines and the ability of its engines to run on both hydrogen and water or volatiles that can be mined from the soil on the Martian moons Phobos and Deimos. In addition, the key solution will also be the simplest method of creating artificial gravity in the 0-1 G range for travellers. This system of artificial gravity will also work on the surface of the satellites of Mars.

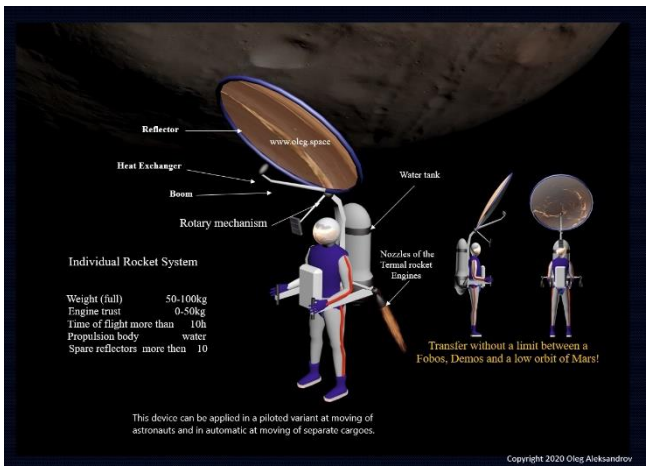


Fig.4. One of the options for an individual system of moving a traveler, explorer, geologist on Phobos and Deimos, the system works on water extracted from Phobos and Deimos. The system is also based on a solar thermal rocket engine.

For a full-scale study of the satellites of Mars, the project can use the method of research using individual means of movement. Such devices will allow you to travel on Phobos and Deimos with an unlimited supply of fuel if water or volatile substances are easily obtained on the satellites of Mars. **Fig.4. Fig 10.**

How about a round the world flight around Phobos and Deimos?

For investors who love flying in the atmosphere of Mars, I can offer an exclusive methodology for exploring the Surface of Mars, using manned helicopter or motor gliders with vertical take-off and landing. Such gliders will allow you to travel indefinitely, because they run on atmospheric carbon dioxide.

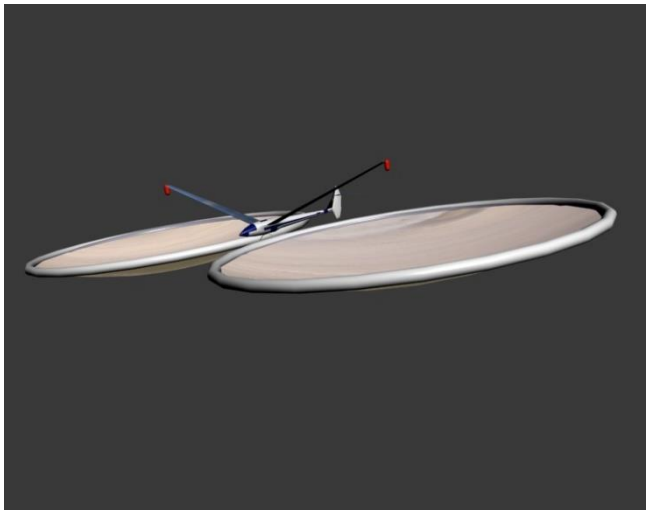


Fig.5. One of the variants of the expeditionary complex, which includes a descent vehicle made in the form of a multifunctional aircraft.

The glider fits well with the architecture of the solar tug. Moreover, to enter the atmosphere of Mars, you do not need a screen and a parachute for landing. My piloted glider or piloted helicopter will do everything. This glider and helicopter are my favourite option and it is well developed! **Fig.5**
Speaking about the method of reducing the proportion of galactic radiation per crew during a very long journey (950 days), then the stay on Mars, Phobos and Deimos can be reduced to 99.9 using 50 percent surface plus 40-49 percent bulk soil.
And finally, I would like to mention another well-known method, the implementation of which I worked on in the period 2001-2005. It's about a solar sail! I managed to develop a technique for its manufacture and deployment, which will allow the formation of frameless film structures larger than 2x2

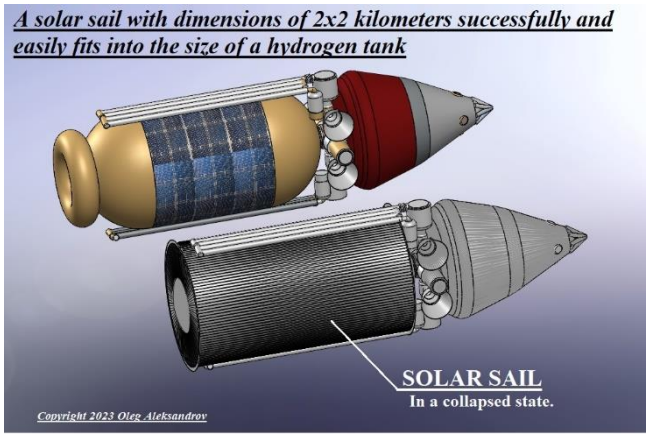


Fig.6. A solar sail with dimensions of 2x2 kilometers successfully and easily fits into the size of a hydrogen tank. At the same time, the manned complex does not change constructively.

kilometers and manage them! I have returned to the idea of a sail many times on a manned expedition to Mars, and I still seriously consider this possibility. This is environmental friendliness, this is absolute reliability, and most importantly, this is an unlimited number of maneuvers in space! For an investor, I can offer this method for a manned

flight to Mars with two launch schemes. The technique is the launch of a manned complex with a sail into the earth's orbit at an altitude of at least 500 km. Next after deployment of the sail and its automatic spiral acceleration in 80 days to the moon with access to its orbit waiting for the crew.
The crew starts on the second passenger rocket and after 80 days and 2-4 days gets to the Moon, where it docks with a sailing spacecraft. Then, with an acceleration of 1mm/s2, the sailing ship makes a 1.5-year exciting expedition to Mars, landing on its surface and back! If necessary, preliminary training of the crew with a landing on the lunar surface is possible. At the same time, no matter how paradoxical it may sound, but even with an additional rocket launch, I will meet the declared 250 million dollars! **Fig.6.**

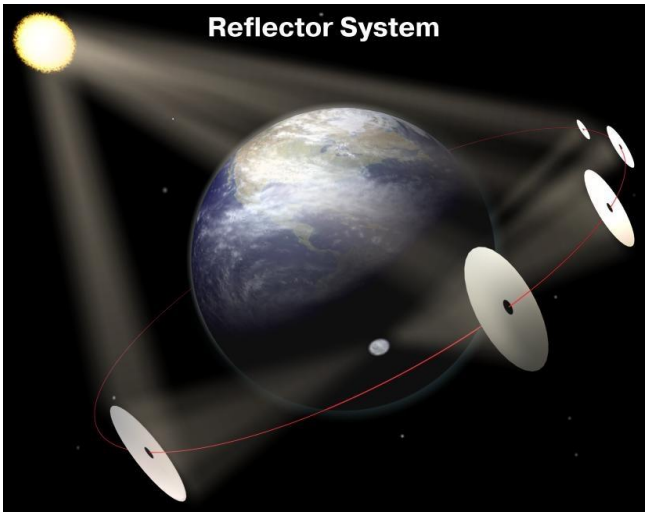


Fig.7. The Reflector Sail is a real business!

But most importantly, the construction of universal reflector sailing tugs will make it possible to carry out, in addition to an expedition to Mars and other bodies of the solar system, a number of commercial projects, such as space mirrors for illuminating the night regions of the earth from space, **Fig.7**. the fight against global warming, the fight against space debris, advertising light show. And what about the first steps in terraforming Mars as early as 2027? Yes, experiments on lighting the night regions of Mars while the crew is working on the surface. And experiments on additional insolation of the illuminated regions of Mars. **The Reflector Sail is a real business!**

3. Results

Thus, analyzing marketing statistics on the formation of interest and prices for exclusive space tourism, one can come to the conclusion that private financing of the expedition can be provided if its price does not exceed 250 million dollars. The author of this report solved the problem of a cheap expedition by using a single launch scheme and a special solar tug.
The project has been developed up to the level of TRL-2 and is at the stage of transition of development to the level of TRL-3 for the manufacture of the technical part. Separate key elements of the project, such as, for example, a universal space tug with a thermal rocket engine with a specific impulse of more than 750-1000 seconds, were partially and successfully worked out and tested by the author of the project back in 2005 **Fig.8.** and are at the TRL-3 level.
Several versions of the concept of the Martian expeditionary complex have been developed, using a descent vehicle in the form of a multifunctional manned rover, which is also in the process of transition to the TRL-3 level of preparation for the construction of the demonstrator and its testing.
Tests of parabolic concentrators with a diameter of more than 10 meters were successful. The expected results of the behavior of this pneumatic design and quite satisfactory ability of the reflector to form a focal spot were obtained.
Devices for automatic extraction and formation of this design, as well as automatic replacement of used film concentrators during various maneuvers and emergency breakdown by micrometeorites were also tested. Weight characteristics and energy have been confirmed.
A technique has been developed to ensure and maintain high temperatures and heat exchange in the heat exchanger using salt water and various gases to ensure high specific impulse of more than 350-9000 seconds.

Fig.8. In 2005, I successfully experimented with the manufacture of light symmetrical parabolic concentrators over 10 in diameter.

The cost of the project consists of three main options:

1. Conducting an examination of the project by specialists of the leading space agency (country of your choice) and obtaining the necessary licenses for this expedition. (The author of the project already has this experience in obtaining a positive examination and licensing for a pilot project of a manned expedition to Mars **Fig.9,**

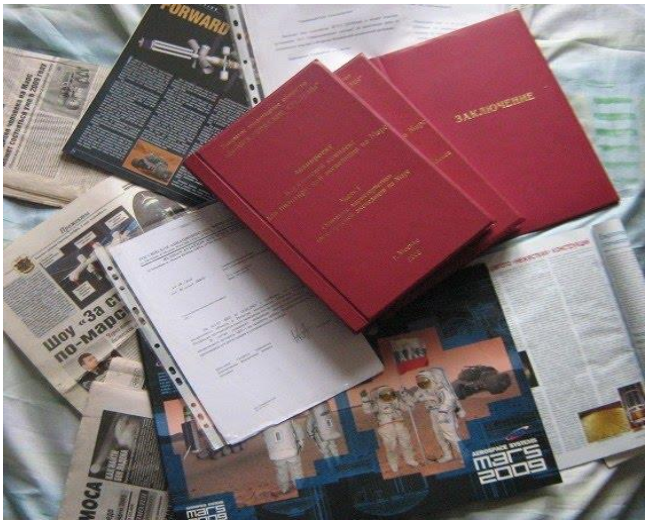


Fig.9. In February 2002, I opened a space company, developed the concept of a commercial expedition to Mars, where for the first time I suggested using ready-made certified modules, components and assemblies. The project passed a positive examination in a major space agency and my company even received a license in 2004 to continue work.

which is incomparably more complex and much more ambitious in terms of technical solutions and cost). My new project is much cheaper, more reliable, easier and absolutely environmentally friendly and does not use hazardous toxic high-boiling fuel components either for basic maneuvers or for orientation of the complex.

2. Payment for launch services. (The launch services market is becoming more attractive and diverse) According to official information from various companies, the service will amount to no more than 35-63 million USD for the delivery of 17- 22 tons of cargo to low earth orbit.

3. Expenses, including unforeseen expenses, for the construction and development of the technical part of the project in accordance with the standards adopted in the space industry for individuals and companies.

The timing of the project also depends on several options:

1. Start of the 950-day expedition along the Homan trajectory already in November 2026. A very soft, safe and absolutely reliable option from the technical point of view. However, it requires great enthusiasm from the crew so that time flies unnoticed. The expedition will allow you to perform a huge number of tasks to study the surface of the planet Mars, using a self-propelled manned vehicle **Fig.10,**

Fig.10. As with my earlier projects, I am also considering using manned rovers for my missions. This will make the expedition more rewarding and eventful.

as well as slowly explore its satellites Phobos and Deimos**. Fig 10. Fig. 11 Fig 12**. In addition, the study of human capabilities directly in action will provide an indispensable service for the further exploration of deep space by public and private companies. And finally, it will close all questions on the impact on the crew of a long-term space flight. Moreover, the author finally resolved the issue of protecting the crew from hard cosmic radiation (HCR) in such a long flight, since the ship's energy makes it easy to do this.

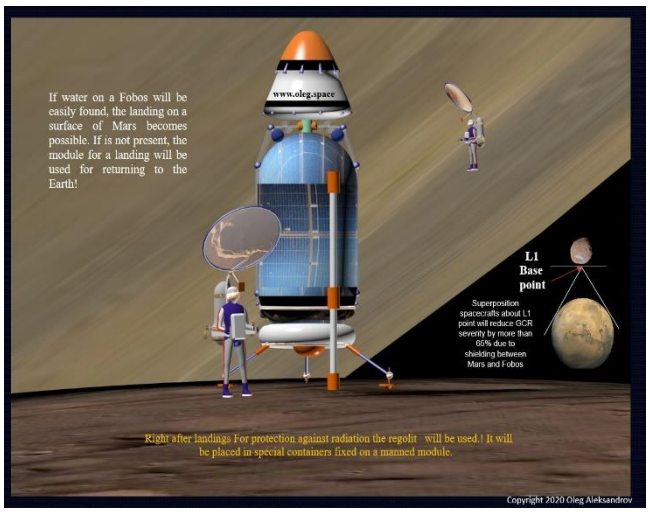


Fig.11. For the study of Phobos and Deimos, I plan to apply radiation protection using double shielding by the satellite of Mars and the planet itself. By placing a habitation module deep in a crater opposite Mars, radiation can be reduced by 85-99,9 percent!!!

Fig.12. And to travel on the moons of Mars, I'm going to use a thermal rocket engine powered by water mined directly on them.

The project according to the first option also does not require the costs of working out the re-entry into the earth's atmosphere with the second cosmic velocity, since the re-entry velocity will be easily extinguished to 8 km per second by jet braking. Despite the unfavourable year in terms of energy, 2026 when flying with a specific impulse of even 750 sec. is not noticeably heavy. This option, however, provides for an emergency reduction in the total time of the expedition to 450 days with no more than 10-15 days of stay in the vicinity of Mars.
2. Start of the 450-day expedition in 2028. The expedition will be quite energetically costly and less valuable for scientific work. The technical side of the project requires careful development of the process of entering the Earth's atmosphere with an extremely high speed of approach to the Earth.
3. Start of the 152-day expedition in 2030. The option is extremely extreme and requires careful study of another type of power propulsion system directly in space to its absolute reliability. However, noticeably short times are very suitable for tourist flights to Mars starting from 2030.

4. Conclusions

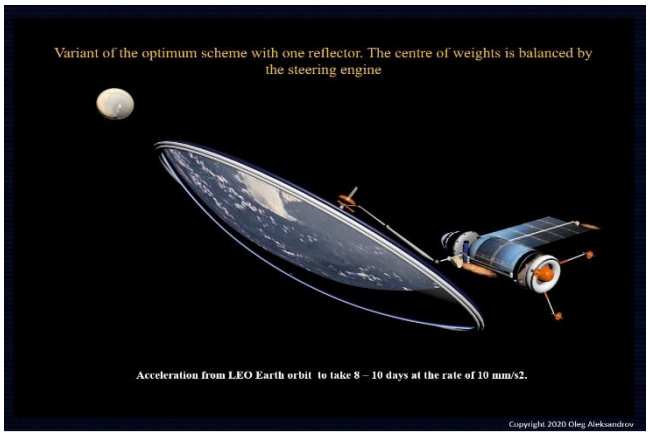
So, a commercial project of a 950 or 450-day manned expedition to Mars and back is offered to the attention of investors. To Mars, which has already been conquered by robots from different countries and is waiting for the first sports tourist, who will finally open the era of commercial interplanetary expeditions by paying no more than 250 million dollars! Everything is already on the market for this: certified launch vehicles from private and public companies from different countries, and my inexpensive project for a safe and very, very reliable expedition to the surface of the sensational red planet and, most importantly, no less reliable return to earth! This will not be a competition to global state projects for the industrialization and colonization of the planet - it will be an ordinary private expedition that can solve a huge number of scientific problems in parallel. The problem of bacteria in the upper soil layer on Mars has already been solved by automatic devices and it is not there, all the dust and upper soil have been mixed by dust storms for hundreds of millions of years, and each grain of sand has been carefully sterilized by ultraviolet light. Therefore, here we can only talk about speculation on the topic of bacteria, but this does not mean that this project does not provide for measures to sterilize equipment and spacesuits, these measures are provided for very seriously! As for deep drilling, where theoretical traces of theoretical organisms can theoretically remain, then deep drilling is not an end in itself of the expedition, in this case the drilling unit will be attachments supplied by a specialized organization.

Brief investment roadmap.

1. May 2023 Signing an agreement of intent and confidentiality with the investor. Full familiarization of the investor with classified information on this project. The investor can choose one of five project options. Variants of devices for the study of the surface of Mars. (Fixed spacecraft and mobile options such as manned rovers, manned motor gliders, manned helicopters.
2. June 2023 Submission of a preliminary design to the space agency chosen by the investor for the examination of the project and receiving instructions for further approval of the project and its support at all stages of implementation up to obtaining a flight license.
3. September 2023 Obtaining a positive decision and instructions for interaction with space agency specialists.
4. September 2023 Signing a contract, the owner of the project with the investor for its investment.

5. September 2023 Start of investment. Payment for the launch service, ordering a launch vehicle for launch in early November 2026.
6. October 2023 - October 2025 Production of tests, modules, components and assemblies for the expedition. Parallel crew training.
7. October 2025- February 2026 the final demonstration before the commission of the space agency of the interaction and performance of all the technical components of the manned complex.
8. February 2026 -May 2026 Registration of a flight license. IEC assembly.
9. May 2026 - October 2026 Transportation of the assembled IEC to the launch site. Mounting IEC in the launch vehicle fairing. Carrier launch into low Earth orbit
10. October - beginning of November 2026 Final testing of the elements of the complex in Earth's orbit. Acceleration to Mars.

In conclusion, we can say the following: You can fly to Mars not only with the help of a solar rocket engine, but also with the help of a sail. And despite the fact that a three-launch launch scheme was used for flying with a sail, the cheapness of the sail and its potential allows you to meet the same 250 million dollars.



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