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## Non-rocket launch from Mars

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Time, when the expedition to Mars and back will start, is near. To go back to Mars will need to use a missile capable to overcome the exhaust velocity of 5 km/s. Delivery of such a missile from Earth to Mars is a difficult technical challenge. As an alternative, we propose to consider the use of local resources to launch from Mars without missiles. Martian natural Moon Phobos has one side constantly turned to Mars. If one end of the rope is attached to it, and the lower end is close to the surface of Mars, the spacecraft on the rope can be lifted straight from Mars into space. The length of the tether between Phobos and Mars should be about 9500 kilometers. You can start with the rocket taking off from Mars to dock with rope end, which has a speed of about 2 km/s, which is much less than the required speed to escape from Mars. One can calculate the trajectory of the sub-satellite point and place on its trajectory the launch site of a spacecraft, and use the elastic rope with a hook at the end of the rope to ensure the capture of a loop attached to the device. If the lower end of the cable will be added glider controlled, it can be targeted to virtually anywhere on Mars, and it will allow for the launch of the spacecraft from any region of Mars eight times a day. Solution non-rocket start from Mars is similar to creating a space elevator between the Earth and the Moon. The material for the required strength of the cable has already been developed; long-length cable manufacturing technology can be developed in the coming decades. Lifting gear lunat space elevator can be used on Mars. In order to secure the cable in the body of Phobos a penetrator may be used.

## Biography

Vladislav A Leonov is a Research Scientist in Solar System Investigations department at Institute of Astronomy Russian Academy of Sciences. He has his expertise in Meteor Astronomy. He studies meteor masses distributions in main meteor showers and sporadic flow to estimate real risks for space activity. He is the author of the patent "Earth-Moon elevator".

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