THE MOON SHOULD BECOME THE MAIN TESTING GROUND FOR THE DEVELOPMENT AND TESTING OF THERMAL AND GRAVITATIONAL ADAPTATION SYSTEMS FOR TERRAFORMING OF PLANETS AND PLANETOIDS. A. P. Vidmachenko[1,2], A. F. Steklov[2,3], D. N. Miniaylo[3] and N. N. Kolotilov[4], [1]National University of Life and Environmental Sciences of Ukraine, Str. Heroyiv Oborony, 12, Kyiv, 03041, vida@mao.kiev.ua, [2]Main Astronomical Observatory of National Academy of Sciences of Ukraine, Ak. Zabolotnogo Str., 27, Kyiv, 03143, Ukraine, [3]Interregional Academy of Personnel Management, Frometivska Str., 2, Kyiv, 03039, Ukraine, [4]Institute Nuclear Medicine and Diagnostic Radiology of National Academy of Medical Sciences of Ukraine, Platona Maiborody Str., 32, Kyiv, 04050, Ukraine.

Humanity seeks to explore not only near-earth space. In November 2021, an unmanned probe was launched, which will have to collide with one of the near-Earth asteroids for a possible correction of its orbit; space experiments on capturing and transferring small asteroids to a circumlunar orbit have been proposed; the dates of the beginning of the settlement of Mars have already been announced. But before humanity begins to master more and more distant worlds, it is necessary to carefully work out the method of their gradual resettlement outside of Earth.

There are three main types of space bases (stations) for the long-term life of people on planets, on planetoids and in space in general. These stations should be located below the surface, or in massive dome structures on planets and planetoids [1, 6, 11, 13]. It is also possible to place them in prefabricated multi-element settlements flying above the clouds (for example, in the atmosphere of Venus), created on the basis of a stabilizing assembly of many airships. These assemblies must resist hurricane winds and be equipped with special wind generators to extract and store the energy of these winds there [23].

The third type of station should be located in open space. They can be long-term rotary orbital stations. Their main structural parts can rotate around a central asteroid body or comet nucleus. These facilities will be able to provide such stations with the necessary supplies of production materials, water [14, 15, 17], raw materials for rocket fuel, etc. [16, 19, 24]. It is this third type of bases that the authors called “asteroid-comet taxis” [22, 25]. They can become the main type of bases, without which it will be simply impossible to master the volumes of our solar system and terraform planetoids.

Based on the above, we conclude that it is necessary for humanity to create on the surface and in the depths of located relatively close our natural satellite – Moon – special test sites for the development and manufacture of all types of long-term endoplanetary stations. We suggest that placing a person just under the lunar surface in a zone of constant temperatures is the most suitable option in order to protect astronauts from extreme temperatures and radiation [9, 10].

To do this, we need to develop a special technology for the very rapid construction of premises right below the surface for housing and production purposes. It is also necessary to announce competitions for the creation of special systems for the thermal adaptation of such premises and individual space suits [8, 12]. In addition, on the same competitive basis, it is necessary to develop special systems of gravitational adaptation with a list of permanent necessary elements in spacesuits for long-term life.

The Main Astronomical Observatory of the National Academy of Sciences of Ukraine has been conducting research on the Moon, planets and planetoids for many decades. It deals with the problems of selenodesy, physics and dynamics of planetary atmospheres, detailed studies of large and especially interesting planetoids [4, 20, 21]. Also, the development of thermal engineering systems for terraforming planets and planetoids is underway [3]. It was our observatory that was one of the first in the world to start developing practical methods for creating astronomical observatories on the lunar surface. Here, the methods of astronomical observations from the surface and from the orbit of our natural satellite were also worked out [2, 5, 7]. This has now become one of the most important tasks in the field of planetary security and protection.

The authors have developed an effective technology for heating closed spaces under the surface of the Moon using special light "wells", by transferring solar heat under the surface [8, 11]. Such lens-mirror integral systems have been used on Earth for a long time. Such systems will be able to operate throughout the lunar day, tracking the movement of the Sun across the sky, and redirecting light rays to special heat storage systems located below the surface. This will make it possible to create special "heat accumulators" around the settlements under the surface and to heat the settlement bases throughout the moonlit night. Such systems will be able to provide comfortable temperatures for a biological life form of about +20°C and in a moonlit night.

In the very near future, it is necessary to announce international competitions for projects to turn the Moon into a specialized testing ground for the deployment and testing of especially important symbiotechnical systems for terraforming planets and planetoids of different scales. Such systems are required to provide reliable thermal and gravitational adaptation for long-term residence of people there. After that, in case of successful adaptation to the Moon, terraforming Mars, Mercury, and other planetoids will be a much easier task. After all, the basic principles of thermal adaptation there are the same as on the Moon, and the coefficients of gravitational adaptation are significantly lower. But without working out these systems on the Moon, it will be much more difficult for humanity to master other objects and volumes in the solar system.

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