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GENERAL PRINCIPLES OF CONSTRUCTING SPACE GREENHOUSES FOR HABITABLE BASES

Abstract

In the second decade of the 21st century, the idea to colonize the Solar System in order to satisfy human needs for resources is sufficiently supported by both the public and the leading space companies. The Moon as a celestial body closest to the Earth is considered a part of its space infrastructure. Colonization of the Moon will allow testing of main technologies needed for long-term human presence in the future space settlements. The international community and Yuzhnoye SDO at the same time are working on the concept of creating the Lunar industrial research base. This concept is based on the serious analysis of different aspects of lunar exploration and subsequent usage of its resources as well as modern developments and large reserve of different technologies of the company used for solving various tasks concerning the subject matter of the Moon. One of the tasks solved during the creation of habitable bases is provision of life activity for the future space settlers. For many years different organizations work to create closed ecosystems capable of simulating natural environment. Such states as the USA, Russia and China have experience in creating closed ecosystem prototypes. This work analyses the existing projects of closed ecosystems and set up the most promising technologies for constructing closed ecosystems as a part of the conception of Lunar industrial research base developed by Yuzhnoye SDO. The most admissible procedures to grow agricultural crops under artificial conditions were examined and established. Basic structure of a closed ecosystem consisting of one horizontal and three vertical greenhouse modules was designed for the Lunar industrial research base. Prototypes of a photobio-reactor and conveyer greenhouse were developed as the target hardware for the greenhouse module and the phases of their introduction to the Lunar base life-support system were predicted. The closed ecosystems of Yuzhnoye SDO shall provide partially closed biochemical processes that reduce the amount of provisions and oxygen delivered to the Lunar base, cut the Lunar base maintenance costs and increase safety for humans on the Moon.