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WATER ICE AS A BUILDING MATERIAL TO CREATE EXTERNAL INHABITED MODULES

Abstract

Numerous data obtained from space probes and rovers allow stating with a high degree of certainty that significant reserves of water ice are under the surface of the Moon and Mars, and their thickness can reach several meters. This fact is undoubtedly crucial for answering a number of key questions regarding the fundamental possibility of exploring the Moon and Mars. One of these issues is the creation of habitable modules, which should provide the required level of comfort and safety for astronauts. The starting point in this problem formulation is the thesis about the complexity of the delivery from the Earth of fully equipped habitable modules or all materials and structures for their creation. The thesis that inhabited modules should be created with the maximum use of local materials leaves the use of water ice practically without any alternative. The most important advantage of water ice over other materials is its ability to screen particles of solar and galactic cosmic rays, which penetrate to the surfaces of the Moon and Mars with almost no attenuation. As is known, hydrogen-rich materials are preferable to shield heavy charged particles, and water and polyethylene have the best specific characteristics among them. Obtaining the required thickness of the ice dome, we can solve the radiation safety problem providing under the ice dome the space radiation background close to the Earth conditions. The unique advantage of water ice as a building material for extraterrestrial inhabited modules is the extreme simplicity of technology and equipment for the ice dome building. There is every reason to raise the question of minimizing or completely excluding the participation of astronauts in ice structures building process. This significantly expands the field of decisions regarding the choice of the strategy of manned missions, opening up the possibility of starting them with sending robots that will prepare acceptable conditions for astronauts to live. The paper presents the concept of building ice structures in extraterrestrial conditions, as well as the results of calculating the wall thickness of the ice dome, which provides the required radiation safety conditions for astronauts