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THE UNSOLVED CHALLENGES OF SPACE BIOSPHERES: A RESEARCH AGENDA

Abstract

An epochal turning point would see the realization of a lunar human settlement, which would require a high degree of autonomy from earthbound services and supplies. In this, a crucial role will be played by the exploitation of local resources and environmental features, as well as by the development and maintenance of bioregenerative ecosystems. The Biosphere Team has been established by the SGAC Space Exploration Project Group, in partnership with the MVA Architecture Working Group, to explore the opportunities presented by the combination of biospherics with the peculiarities of the lunar south pole. This includes the usage of regolith as living soil, customized selection of crops and in situ production and utilization of resources, with the ultimate goal of achieving a maximum degree of biosphere autonomy. This shall also go towards re-creating an environment most similar to Earth and guaranteeing an ideal habitat for the plants, by regulating nutrients, water and daylight supplies. On the other side, the study is designed to explore the disturbance factors deriving from such a strategy, like the presence of metal elements in the soil and the irregular morphology of regolith particles, as both aspects could affect the development of the crops selected. Therefore, delving into these specific aspects would aim in creating and maintaining a well-established ecosystem. The outcome of the work is a multidisciplinary research agenda highlighting the major gaps and needs in research and development required to further advance biosphere technologies towards wider integration with human needs and lunar environments. Please note that this abstract is submitted under the auspices of SGAC, as part of the activities of its Space Exploration Project Group.