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BIOLOGICAL REQUIREMENTS FOR A SUSTAINABLE SETTLEMENT ON EARTH'S MOON

Abstract

There are a range of challenges associated with long-term human activity and presence beyond Earth – and beyond low Earth orbit (LEO), where humanity has gained some experience over the past four decades and created various space station programs. These include largely physical parameters – such as gravity and/or artificial gravity, radiation protection, human factors, etc. – as well as the diverse biological aspects of any long-duration human habitation. A paper at IAC 2017, the International Astronautical Congress in Adelaide, Australia (“Biological Requirements for Truly Sustainable Space Settlements”, J. Mankins, et al) examined generic requirements for future sustainable human settlements in space – i.e., what would be the minimum biological requirements for a permanent miniature biosphere beyond Earth – but without focusing in on any particular location. The planetary body closest (in time and distance) to Earth is the Moon – where both energy and material resources are available that could make possible permanent settlement in the foreseeable future. This paper will consider the requirements of a truly sustainable space settlement, focusing on the Moon as a candidate location for a biosphere independent of Earth. It will address primarily the biological requirements for such a habitat, but will also examine critical physical requirements, predominantly gravity, radiation and energy. The paper will conclude with recommendations for research and development in the context of an integrated roadmap for future space settlement.