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HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
Human Lunar Exploration (1)

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ESTABLISHMENT OF A LUNAR BASE BY COUPLING LUNAR IN SITU RESOURCES UTILIZATION AND BIOREGENERATIVE LIFE SUPPORT SYSTEMS WITHIN THE OASIS NETWORK OF SPACEPORTS

Abstract

The creation of a network of spaceports combining In Situ Resource Utilization (ISRU) and bioregenerative life-support systems would provide an easier and more affordable access to orbital and deep space destinations. In the longer term it would enable the development of extraterrestrial human habitats in the inner solar system. Following the Operations And Service Infrastructure for Space (OASIS) project, this paper describes in greater details the establishment and development of the second node of the network, on the Moon. Node 2 is based in the Lunar South Pole, where trapped water in craters, almost constant illumination on the craters' rim, and small temperature gradients offer the best environment. Initially unmanned, the lunar outpost is composed of a spaceport to land and launch vehicles safely, a power plant, and an in-situ resources processing plant. Water is extracted and sent to node 1 in Low Earth Orbit and is also separated on site into hydrogen and oxygen, which can be used as propellant for various spacecraft and to support habitation and human operations. Other lunar volatiles trapped in the near sub surface include N2, usable for habitat atmosphere generation and for plant growth medium, H2, and other carbon compounds. Additionally ilmenite, a common lunar mineral, can be used to produce titanium, oxygen and manufacture semiconducting devices such as photovoltaic cells. Critical technologies, such as regolith excavators and the Moon shuttle, with their concepts of operations, requirements, functions, and design are detailed. The business model and rationale for node 2 in the frame of the network of spaceports, as well as the law and policy framework are described comprehensively. The OASIS infrastructure with a lunar node 2 will reduce space exploration and development costs by providing in situ derived propellants on demand, and ultimately will fundamentally revolutionize how we travel in the solar system.