14th HUMAN EXPLORATION OF THE MOON AND MARS SYMPOSIUM (A5)
Long Term Scenarios for Human Moon/Mars Presence (2)

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DEVELOPMENT AND DEMONSTRATION OF SUSTAINABLE SURFACE INFRASTRUCTURE FOR MOON/MARS EXPLORATION

Abstract

For long-term human exploration of the Moon and Mars to be practical, affordable, and sustainable, missions must be able to identify and utilize resources at the site of exploration. The ability to characterize, extract, processes, and separate products from local material, known as In-Situ Resource Utilization (ISRU), can provide significant reductions in launch mass, logistics, and development costs while reducing risk through increased mission flexibility and protection as well as increase mission capabilities in the area of power and transportation. Making mission critical consumables like propellants, fuel cell reagents and life support gases, as well as in-situ crew/hardware protection and energy storage capabilities can significantly enhance robotic and human science and exploration missions, however other mission systems need to be designed to interface with and utilize these in-situ developed products and services from the start or the benefits will be minimized or eliminated. This requires a level of surface and transportation system development coordination not typically utilized during early technology and system development activities. An approach being utilized by the US National Aeronautics and Space Administration and the Canadian Space Agency has been to utilize joint analogue field demonstrations to focus technology development activities to demonstrate and integrate new and potentially 'game changing' mission critical capabilities that would enable an affordable and sustainable surface infrastructure for lunar and Mars robotic and human exploration. Two analogue field tests performed in November 2008 and February 2010 demonstrated first generation capabilities for lunar resource prospecting, exploration site preparation, and oxygen extraction from regolith while initiating integration with science, fuel cell power, and propulsion disciplines. A third analogue field test currently planned for June 2012 will continue and expand the fidelity and integration of these surface exploration and infrastructure capabilities while adding Mars exploration technologies, improving remote operations and control of hardware, and promoting the use of common software, interfaces, standards for control and operation for surface exploration and science. The next field test will also attempt to include greater involvement by industry, academia, and other countries/space agencies. This paper will provide an overview of the development and demonstration approach utilized to date, the results of the previous two ISRU-focused field analogue tests in Hawaii, and the current objectives and plans for the 3rd international Hawaii analogue field test.