Development of a Martian Water Resource Project Management System

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ABSTRACT

In-situ resource utilisation (ISRU) refers to operational practices to extract natural resources locally on a non-terrestrial body (i.e. the Moon, Mars, or asteroids) and transform them into useable products to support in-space activities. Viewed as a means to dramatically reduce overall mission cost and reliance on Earth for the supply of critical resources, ISRU forms an integral part of both the National Aeronautics and Space Administration's (NASA) and SpaceX's current plans to accomplish human missions to Mars. Locating a source of water has been identified as a near term priority, in particular interest is growing in the potential use of Mars's mid-latitude (~30-60º) buried ice deposits. However, at present, there are significant knowledge gaps in our understanding of the nature and present-day distribution of these ice deposits, particularly at the spatial scales required to inform the decision-making process for an in-field robotic exploration campaign. Incorporating the use of locally acquired water into the design of a human exploration mission to Mars will require a high degree of confidence in the capability to locate, access, extract, and produce required quantities. This work presents a new project management system to guide resource exploration and evaluation of Martian water ice resources. Recommendations for activities, workflows and decision criteria to progress a project from early concept design through to operation are provided. The proposed approach draws on project lifecycle management strategies used by the extractive industries on Earth adapted to suit the unique requirements of undertaking such endeavours on Mars. The developed guidelines and processes will assist mission planners, operators, scientists, and other stakeholders planning to conduct water production projects on Mars enabling better decision-making and communication of information. This presentation will also provide a discussion on the potential cross-over benefits of collaborative work between the resource industries on Earth and the emerging space resource sector.