IAF HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Human Spaceflight Global Technical Session (9-GTS.2)

Author: Mr. Abhinav Prakash
University of Houston, United States

Mr. Victor Kitmanyen
University of Houston, United States
Mr. Aidan Corrigan
University of Houston, United States

DEVELOPMENT OF A LUNAR SURFACE ARCHITECTURE AS A "PROVING GROUND" FOR FUTURE MARS MISSIONS

Abstract

The journey to Mars will be unpredictable and one that humans have never experienced before. It will require an unprecedented role for autonomy. Ground control will have to relinquish control due to the communication delay. The mission will have huge scientific and financial value. For such a mission to succeed it is vital that the mission planning take a leading role and, as much experience be gained as possible. To enhance human experience for such a mission it is imperative that we “practice” in a non-terrestrial environment where the conditions are not controlled. The Moon serves as the ideal location for such a task. It offers easy access, possibility of fast rescue and some familiarity due to past human experience. To emphasise the importance of the Moon in a future Mars architecture, this paper proposes a six week mission (which encompasses two weeks of lunar night) to the Moon's south pole to test technologies and practices to be used on this journey. The mission acts as a “proving ground” to test technologies and practices to be used on Mars. The mission was constrained to three landings, four crew members and a total of thirteen metric tons per cargo module. This paper uses an architectural approach to analyze various mission parameters such as mass, volume,power, utilized equipment and tools, mobility hardware, base layout and exploration activities. A redundant transport system is proposed that encompasses use of multiple elements. Diverse trade studies were conducted to select these parameters.The logistics and role of a future Lunar Orbital Platform-Gateway is analysed.Some major functions that can be supported by the Lunar Platform are Communications Contingency Operations Telerobotics Advanced scientific research A major driver for this study was to map the list of activities that could be performed during such a mission. The list of activities applicable to both Moon and Mars were obtained by identifying common goals between NASA's Strategic Knowledge Gaps (SKG's) and Future Technology Roadmaps (TA's). A mission schedule plan which lists weekly activities is produced to demonstrate the types of data, results and practices that can be utilized.