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DEMONSTRATING CAPABILITIES FOR MARS EXPLORATION ON THE MOON

Abstract

The U.S. Space Policy Directive of 2017 calls for the United States to lead the return of humans to the Moon for long-term exploration and utilization, followed by human missions to Mars. To achieve these goals, NASA is working with commercial and international partners to develop systems and operational approaches that could be tested on the Moon to prepare for Mars missions. To achieve these goals, NASA's Exploration Campaign Strategy involves the International Space Station (ISS) to investigate the effects of long-duration spaceflight on human health and performance, a crew-tended Gateway in lunar orbit to demonstrate deep space operations, initial robotic missions to the Moon followed by human missions, and robotic precursor missions to Mars to characterize environments and resources. A huge jump in current capabilities is required to land humans on Mars. These include landing large payloads, surface habitation, extra-vehicular activity and crew mobility systems, in-situ resource utilization, and ascent from Mars to return the crew to Earth. Many of these needed capabilities can be tested on the Moon to reduce the risk for Mars missions. There are a few challenges, however, in extrapolating from capability demonstrations on the Moon to enabling Mars missions such as greater remoteness, the Mars atmosphere, different gravity levels, and planetary protection. Key technology development activities, concepts for early demonstration of the required capabilities on the Moon, and potential areas for commercial and international partnerships will be discussed.