

# **Technology Needs for future Human Space Missions**

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## **ABSTRACT**

A discussion of the need for technology development for the human exploration and development of space will be presented. Human exploration and development of space is aimed at opening the space frontier by exploring, using, and enabling the development of space and expanding the human experience into the far reaches of space. This includes increasing human knowledge of nature's processes using the space environment, exploring and settling the solar system, achieving routine space travel, and enriching life on Earth through people living and working in space. NASA, ISRO, and Chinese space missions and the International Space Station provide extensive experience, research and technology (R&T), and infrastructure for future envisioned programs in support of human exploration and development of space.

In the past decades, several lunar missions have provided valuable remotely sensed and surface data of the Moon. In addition, NASA has studied the development of a lunar habitat and human mission to Mars as possible missions. These missions face common challenges of travel to these planets and for survival of humans on the surface of planets. With the human Mars mission being the first to such a distant planet, advanced technologies will be required to enable the mission and to provide cost effective and safer approaches.

The R&T areas considered important for a human mission to Mars include advanced human support, renewable resources and utilization of planetary resources, space transportation, automation and robotics, space power, information processing and communications systems, sensors, and instruments. NASA is actively providing the technology developed for the space applications to industry, universities, and other organizations for research, education and commercialization purposes. Strategies for this technology transfer will also be presented.