

HUMAN EXPLORATION OF THE MOON AND MARS SYMPOSIUM (A5)
Strategies to Establish Lunar and Mars Colonies (1)

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THE ROLE OF CAVES AND OTHER SUBSURFACE HABITATS IN THE FUTURE EXPLORATION
OF MARS

Abstract

Landing on another planet would arguably be the most important achievement of human kind. Within the next three decades, there will likely be a human mission to Mars that may involve an extended stay (2-3 years). The success of this mission is highly dependent on the safety and health of the crew, since the surface of Mars is a harsh environment where humans cannot survive without supporting technology like life support systems. For these reasons the strategy to establish a safe and sustainable human base on Mars must be carefully designed and executed. This places great economic and technological burdens on current mission designs that are based on surface habitats, and which need to mitigate important hazards such as radiation, impacts, or extreme temperature fluctuations.

While the surface of Mars is harsh to humans, the subsurface provides natural shelters, such as caves, that can be transformed into habitats with a relatively low technological and engineering investment. If the issues of crew safety, health risk and economic burden are mitigated, a human mission to Mars may appear more amenable to the public and private sectors alike. The use of caves as outposts during the first and following human missions to Mars also has a strong cultural connotation, given the important role that caves and similar shelters played as social, ritual and artistic sites during the evolution of human kind.

In 2009, an international team of students and professionals assembled during the International Space University's Space Studies Program to examine how caves on Mars can serve as habitable/storage facilities for a human mission; the technology to make these caves usable for these purposes; the cost/benefit analysis of using caves as habitats, compared to the fully man-made alternative; the issues related to international cooperation, space law and policy, philosophy and culture; as well as the applicability of cave/natural structures utilization to other bodies such as the Moon. The paper will present the results of the interdisciplinary study.