

SPACE EXPLORATION SYMPOSIUM (A3)  
Mars Exploration – Part 2 (3B)

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## FUTURE ROBOTIC MISSIONS TO MARS

**Abstract**

Detailed analyses into mission architectures for manned missions to deep space have been conducted at the Space Station Design Workshop and at the Caltech Space Challenge – two student design competitions. With the objective of safely sending humans to a near-Earth asteroid or a Martian moon and back, these preliminary investigations assess the challenges associated with prolonged astronaut habitation in deep space, such as radiation mitigation, counteraction of microgravity on human physiology and deficiencies in advanced life support technologies. Furthermore, launch vehicle capabilities, spacecraft assembly in LEO and methods of sample retrieval have additionally been explored.

Prior to the manned mission, a robotic precursor mission is frequently designed to reduce uncertainties in regards to global topography, radiation properties and potential hazards at the vicinity of the destined site. Within this framework, the author draws upon knowledge from existing robotic missions such as the Mars Exploration Rovers and the Mars Science Laboratory to design future robotic missions intended for additional exploration of the Martian environment and to reduce the risk of prospective human missions. An inquiry into the required scientific instruments can be taken from an examination of the available scientific instrument on board the Mars Rovers, Mars Odyssey and Mars Express. Initial designs have been proposed by the author at the aforementioned workshops. In a comprehensive study at the Jet Propulsion Laboratory, these concepts are addressed further with the expertise of the Mars Program Office.