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PREPARING FOR THE HUMAN EXPLORATION OF MARS: HEALTH CARE AND PLANETARY  
PROTECTION REQUIREMENTS AND PRACTICES**Abstract**

At this time there is an emerging emphasis within NASA on support for human exploration missions beyond low-Earth orbit, with the current pathway to the exploration of Mars making use of the International Space Station (ISS) as a stepping stone to a mission to a Near-Earth Object (most likely an Earth-crossing asteroid). The continuation of the ISS program to 2020 and the eventual goals of asteroid and Mars exploration highlight questions regarding astronaut health and planetary protection that have not been addressed since the Apollo program. While the short duration of the Apollo missions limited health concerns about deconditioning and bone demineralization, they provided telling lessons learned about the challenges of placing humans in contact with alien planetary surfaces. Apollo taught numerous lessons about preventing (human commensal) biological contamination of spaceflight hardware, planetary surfaces, and the samples collected by the astronauts, while at the same time providing an improved understanding of the effects of exposure to extraterrestrial planetary materials and environments on astronaut health. While some aspects of practice (e.g., the health stabilization program prior to spaceflight) are still ongoing, many of the lessons of Apollo were not learned by the current generation of space support professionals, but exist only as dusty (and only occasionally digital) records of lunar exploration. For the missions currently envisioned, it will be essential to recast and relearn the lessons of Apollo to ensure the safe return of astronauts to Earth, and indeed, the safety of the Earth biosphere, itself. This paper will explore the practices and technologies that must be developed to ensure effective monitoring astronaut health during a mission, the state of microbial populations within the closed environment of the spacecraft, as well as any detrimental health effects due either to the conditions within habitats during the mission, or from exposure to planetary (asteroidal, lunar, martian) materials. The Committee on Space Research has recently [1] cited high-level requirements for planetary protection provisions on human missions to Mars, and those will form the backdrop for discussions of the requirements for medical monitoring, microbial inventory, and contamination control required for these missions. With Mars as a potential site for extraterrestrial life and possible astronaut exposure to that life, it will be important to establish sound requirements and mission practices for that eventuality during development of the expanded human exploration portfolio.

Ref. [1] COSPAR: Planetary Protection Policy (revised 24 March 2011). COSPAR, Paris, France, 2011.