CAPABILITIES FOR PLANETARY PROTECTION: SAFEGUARDING THE CREW AND ENGINEERING SYSTEMS FOR HUMAN MISSIONS TO MARS. K. Venkateswaran, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA; kjvenkat@jpl.nasa.gov

Planetary protection policies derive from international treaties whose goal is "to preserve our ability to study other worlds as they exist in their natural states; to avoid contamination that would obscure our ability to find life elsewhere—if it exists; and to ensure that we take prudent precautions to protect Earth's biosphere in case it does." Mandates are in place to minimize the likelihood of catastrophic outcomes as a result of human-associated cross-contamination between solar system bodies.

To meet planetary protection obligations, NASA needs:

- Integrated system technologies to protect human life from extraterrestrial microorganisms (should they exist) and to shield engineering systems from bio-corrosion.
- Assurance of compliance with evolving standards for planetary protection (both forward and backward contamination) relating to the human exploration of Mars.
- A sound technical basis to determine whether the inadvertent shedding of bio-contaminants from human explorers can be minimized to such a degree that the search for life could continue in an unobstructed, meaningful manner.

This presentation identifies a body of work to address NASA needs relative to microbial monitoring and controlling the harmful impact of microbial corrosion. One of the present knowledge gaps revolves around developing an integrated microbial monitoring system that is validated in a terrestrial Mars analog environment and ready for deployment on a human mission to Mars. Such a system needs to be developed and is essential for human missions to comply with requirements to avoid harmful contamination and thereby facilitate the search for extraterrestrial life. The integrated microbial monitoring system will bolster confidence in, and lend support to, planetary protection efforts, hardware reliability, and sustained crew health. By forewarning human explorers of any significant fluctuations in microbial burden, the system allows the crew to take immediate action to significantly diminish any threat to crew health, or deterioration of the habitation module resulting from bio-corrosion. This approach will strive to directly integrate the technologies proposed herein with those being developed for robotic Mars sample return missions, thereby providing a cradle-to-grave planetary protection implementation capability for human exploration.