Planetary Protection And Implications For Lunar Mission Planning: Science, Technology, And Feed-Forward To Mars

Cassie Conley, NASA HQ, Washington, DC; Margaret Race, SETI Institute

Abstract: In planning future exploration and permanent presence on the Moon, it will be important to consider planetary protection in the discussions from the early stages, even though current policies and regulations do not impose specific planetary protection controls for missions to the Moon. At the very least, integrating controls and monitoring to avoid cross contamination will be critical for science related activities on the Moon. Developing technologies and protocols to monitor human health effects potentially caused by exposure to lunar materials (such as dust) will also be key. Consideration of planetary protection issues using the Moon as a test-bed will be important for developing diverse technologies enabling future long duration planetary missions to protected bodies such as Mars. To reduce overall mission risks and costs it will be important to avoid pursuing multiple distinct and expensive technology pathways—one for the Moon and another for Mars or other bodies.

A number of recent workshops and studies have analyzed in detail the ways that planetary protection controls and concerns are likely to impact long duration missions and exploration activities. Among the important technologies and issues that have been targeted for further work include life support systems, both within habitats and during EVAs; environmental monitoring and control; sample containment and curation; development of protocols to ensure cleanliness during collection and testing; investigations of the nature and amount of cross contamination between inside and outside environments during routine activities and sampling/exploration; waste handling and disposal during and after human presence and mission completion; spacesuit and hardware cleaning and repair during the missions; and human factors that might interfere with implementation of planetary protection protocols or proper science methods.

In addition to considering the design and science implications of these issues, it will also be important to communicate to the public about planetary protection as part of human exploration. Addressing anticipated contamination avoidance questions for both the Moon and Mars will be essential for maintaining public understanding and support for the missions—particularly since they are subject to distinctly different controls based on current planetary protection policy..

Particular workshops and references that provide more information on these planetary protection-related R&D needs include:

Beaty, D.W., et al. (2005). An Analysis of the Precursor Measurements of Mars Needed to Reduce the Risk of the First Human Missions to Mars. Unpublished white paper, 77 p, posted June, 2005 by the Mars Exploration Program Analysis Group (MEPAG) at http://mepag.jpl.nasa.gov/reports/index.html.

Criswell, M.E., et al. 2005. Planetary Protection Issues in the Human Exploration of Mars, Final Report May 9, 2005 (workshop held June 2001), NASA, Ames Research Center, Moffett Field CA , NASA/CP – 2005-213461

Hogan, J.A. et al., 2006. Life Support and Habitation and Planetary Protection Workshop Final Report, NASA, Ames Research Center, Moffett Field CA , NASA/TM- 2006-213485

Hogan, J.A., et al. 2005. Influence of Planetary Protection Guidelines on Waste Management Operations, paper 05ICES266, International Conference on Environmental Systems, Rome Italy, July 2005 (Paper No. 2005-01-3097 in Journal of Aerospace, SAE 2005 Transactions, March 2006)

Hogan J.A. et al., 2007. Results Summary of the LIfe Support and Habitation and PP Workshop, Paper No.2006-01-2007. SAE 2006, Transactions of Journal of Aerospace, March 2007

Race, M.S. et al., 2007. Planetary Protection and Humans on Mars: NASA/ESA Workshop Results, (Report of the 2005 workshop in preparation; also, a summary article currently under review in Advances in Space Research, 2007. For more information contact: mracemom@aol.com)