

A MICROBE ON THE MOON? SURVEYOR III AND LESSONS LEARNED FOR FUTURE SAMPLE RETURN MISSIONS. John D. Rummel¹, Judith H. Allton², and Don Morrison³; ¹Flanagan 250, East Carolina University, Greenville, NC 27858, <rummelj@ecu.edu>, ²Mail Code KT, NASA/Johnson Space Center, 2101 NASA Pkwy, Houston, TX 77058, <judith.h.allton@nasa.gov>, ³2440 Glen Ridge Dr., Highland Village, TX 75077, <donmorrison1@juno.com>.

Introduction: A continuing program of sample return missions can provide an essential link connecting solar-system reconnaissance missions and remotely sensed data to the realities of solar system materials at the molecular and atomic scale. In many cases, the results from such missions can be used to focus future exploration in a dynamic fashion, and the physical and chemical attributes of planetary samples can be established in a stepwise fashion that combines mission results and laboratory analyses on Earth. This can be true for a wide variety of fields that make use of planetary materials, including astrobiology and the search for life. In fact, so promising is the potential for such missions that the NRC in its 2008 strategy for the astrobiological exploration of Mars stated that “the greatest advance in understanding Mars, from both an astrobiology and a more general scientific perspective, will come about from laboratory studies conducted on samples of Mars returned to Earth” [1]. Nonetheless, there are important caveats that must qualify that finding—in particular, a concern about the ability of some astrobiological analyses to be conducted on returned samples free of contamination introduced once the samples are returned to Earth.

One particular example that demonstrates the difficulties of dealing with possible biological contamination, after the fact, was introduced as a result of the 1969 *Apollo 12* mission, where astronauts landed on the Moon near the site of the *Surveyor III* spacecraft and returned portions of it to Earth for analysis.



Fig. Apollo 12 astronaut Pete Conrad and a photographer with the Surveyor III camera prior to bagging and storage (NASA JSC photo S-69-62290).

The Case of the *Surveyor III* Camera: *Surveyor III*, had landed near the eastern shore of Oceanus Procellarum in April 1967. When the *Apollo 12* crew returned to Earth, they also returned the *Surveyor III* TV camera and other selected parts. Subsequently, the camera was partially disassembled, and portions [2, 3] subjected to microbial sampling and analysis. The results of this sampling reported to the Second Lunar Science Conference [3], and in contractor reports [4] were that a live microbe—*Streptococcus mitis*—had been isolated from the foam between circuit boards within the camera body. The authors of those reports hypothesized that a small colony of *S. mitis* had made the round trip to the Moon and back, and survived.

But did that really happen? The result was first reported in the mainstream biological literature by Taylor [5] in the *Annual Review of Microbiology*, but not as a primary result, and it has occasionally been cited by other scientists and by hordes of print and broadcast reporters, as proof that Earth microbes could survive the harsh lunar environment. Thanks to the WWW, that story will likely never disappear entirely, but does that make it true? Not really, but proving the truth in such a situation is difficult, if not impossible.

Nonetheless, recent analysis of the photograph record of the processing and examination of the camera body at the Manned Spacecraft Center suggest that there were multiple opportunities for contamination to be introduced during the handling of the camera, and particularly during the microbial sampling of the camera body [3, 4]. The presentation of this analysis will include specific concerns and lessons learned for future sample return missions.

References: [1] National Research Council Committee on an Astrobiology Strategy for the Exploration of Mars (2008) *An Astrobiology Strategy for the Exploration of Mars*, NAS Press. [2] Knittel, M. D., Favero, M. S., & Green, R. H. (1971) *Proc. of the Second Lunar Science Conference* 3: 2715-2719. [3] Mitchell, F. J., & Ellis, W. L. (1971) *Proc. of the Second Lunar Science Conference* 3: 2721-2733. [4] Mitchell, F. J., & Ellis, W. L. (1972) p. 239-251 in *Analysis of Surveyor 3 material and photographs returned by Apollo 12*. U.S. Gov. Scientific and Technical Information Office, Washington, D.C. (NASA SP-284) [5] Taylor, G. R. (1974) *Ann Rev of Microbiology* 28: 121-37.

Acknowledgements: This work was supported by the NASA Planetary Protection Research Program.