Planetary Protection is Good for You! – An International and Individual Consensus

John D. Rummel
SETI Institute, *Mountain View, California*
< *jrummel@seti.org*>

Fig 1. Is it really? Is it a hitchhiker? Concerns about science quality are especially important when claims about extraterrestrial life are being made.

The Knowledge Dilemma

- *How do we compensate for what we don't know about life when setting requirements?*
- *How do we compensate for what Mars and other worlds are showing us?*

The Role of COSPAR

- Maintains an international consensus standard for planetary protection policy for the use of spacefaring nations
- Consultative with the UN Commission on the Peaceful Uses of Outer Space (UNCOPUOS) with respect to 1967 Treaty provisions
- Provides a forum for discussion of new mission concepts, requirements, and future contamination concerns, as well as generating communications regarding these issues.

References: [1] Wells, H. G. (1898) The War of the Worlds, London: William Heinemann. [2] "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies," Article IX, U.N. Doc. A/RES/2222(XXI) January 227, 1967. [3] Kminek, G., and Rummel, J. D. (2015) COSPAR's Planetary Protection Policy, Space Research Today 193, 7-17. [4] NASA (1999) Biological contamination control for outbound and inbound planetary spacecraft, NPD 8020.7G, Washington, D.C. [5] Rummel, J. D., Allton, J. H., and Morrison, D. (2011) A microbe on the Moon? Surveyor III and lessons learned for future sample return missions, LPSC Abstract 5023.

Long before space travel was a reality, the implications of biological contamination control (i.e., planetary quarantine/protection) were appreciated and illustrated—most notably in H. G. Wells's (1898) War of the Worlds [1]. The triumph of Earth microbes over the invading martians saved the day for the earthlings, but provides a timely and instructive comment on one potential concern that might cause the human invasion of Mars to have a negative outcome.

By 1967, general agreement among spacefaring nations had been reached that interplanetary contamination should be avoided. Article IX of the United Nations Outer Space Treaty of 1967 reflected this agreement, placing obligations on spacefaring nations:

> …parties to the Treaty shall pursue studies of outer space including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter…[2]

Both COSPAR and the International Astronautical Federation consult with the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) on Space Treaty matters, and COSPAR has developed and maintains its own planetary protection policy [3]. Current COSPAR planetary protection policy provisions are fitted to the nature of the target body to be studied, as well as the type of mission to be flown. The provisions depend on current scientific knowledge, which for NASA is based on internal and external recommendations, "but most notably from the Space Studies Board of the National Academy of Sciences" [4].

The spectre of detecting life from Earth when looking for life from (name your favorite extraterrestrial habitat) is a major concern for the field of astrobiology. We are bathed in Earth life, which makes it difficult to differentiate it from extraterrestrial life unless strict measures are taken to avoid and/or remove the biological and organic contamination on spacecraft carrying life-detection instrumentation. Given the challenge of reaching your favorite extraterrestrial habitat with proper (working) instruments, it is particularly problematic that critical measurements could be affected by contamination carried by the same spacecraft. False- positive results about life can have the unfortunate result of drowning out the actual detections of extraterrestrial life that are the goal that taxpayers are funding, and might lead to unnecessary protection of environments that do not, in fact, have life (Fig 1).

Technology Options: The Viking missions of the mid-1970s benefitted from a major investment in technology solutions by NASA, as well as from strict adherence to parts qualification and thermal engineering. Currently, NASA has chartered a Planetary Protection Technology Definition Team to report on technologies allowing for first class planetary science—including the astrobiological search for extant or extinct life—to be accomplished without being confounded by spacecraft-borne contamination.

Sample-Return Specifics: There are special challenges when considering a sample return mission to name your favorite extraterrestrial habitat. There is a danger both in false positive detections of life that is really Earth life, as well as the lack of a detection of extraterrestrial life, if it is present in the sample. Critical questions asked by the biohazard detection protocol, designed to safeguard the Earth against an unknown life-form, will depend on the virtual elimination of Earth-sourced organisms that may hitchhike on the round-trip mission or be introduced in the process of handling the returned sample (see [5]).