

**Planetary Protection: Updating the Draft Test Protocol in the light of almost two decades of research.** M. M. Grady<sup>1</sup> and the COSPAR SSAP WG<sup>2</sup>, <sup>1</sup>School of Physical Sciences, The Open University Milton Keynes MK7 6AA, UK (monica.grady@open.ac.uk), <sup>2</sup>Sample Safety Assessment Protocol Working Group.

**Introduction:** The return of samples from Mars has been an international scientific priority for several decades – and it now seems that it actually might take place in the next decade (or so). But, we need to be prepared for materials to come back to Earth. There are top-level technical and governance issues that must be solved, including: where will the samples be received? How will they be curated? Where and how will they be studied? How will they be distributed? etc. Before any of these questions, though, must come consideration of planetary protection.

To date, all missions that have landed on Mars have been subject to planetary protection requirements that ensure that forward contamination is kept to a minimum, i.e., the microbial burden carried by spacecraft is reduced as far as possible by implementing bioburden control measures. Now that we are considering bringing material back to Earth, it is essential to consider the problem of backward contamination, the possible contamination of Earth by martian organisms. A Draft Test Protocol, drawn up in 2002, lays out the requirements for “sample materials to be assessed for biological hazards and examined for evidence of life (extinct or extant), while safeguarding the samples from possible terrestrial contamination” [1]. Since this protocol was produced, there has been a growth in our understanding of Mars through results from successful lander and rover missions, as well as from a greater variety of martian meteorites. Understanding of microbiology, the conditions under which microorganisms survive and the techniques for identifying and sequencing them has also increased.

It has been recognized by iMars II [2] and COSPAR that it is now time to update the Draft Test Protocol, enabling the community to prepare for Mars Sample Return (MSR) using the most recent and relevant information. To this end, COSPAR established in September 2018 a Sample Safety Assessment Protocol Working Group (SSAP WG) to provide a mechanism by which the international community could meet to discuss and update the Draft Test Protocol [1]. It is not intended that the SSAP Working Group would cover aspects of a MSR programme that deals with implementation of the protocol (e.g., sterilisation of material from Mars, environmental and health monitoring, containment elements, contingency planning, management elements, etc.).

**SSAP WG tasks:** Following review and assessment of all relevant documentation, in particular the Draft

Test Protocol [1], the Life Detection Workshop Report [3] and various MEPAG-sponsored reports [3–6], the WG will undertake the following tasks concerning the biohazard determination of the returned samples:

- Define type of sample preparation, measurements and associated instrumentation
- Define the sequence of measurements
- Define what constitutes a representative sample for this assessment in terms of type and mass
- Define the statistical approach for sample selection and data analysis
- Define a decision tree to evaluate the safety status of the material from Mars
- Define success/no-success criteria to determine the safety status of the material from Mars, taking into account the sensitivity of this determination on terrestrial contamination in the analysed material
- Estimate the time necessary to execute the protocol
- Ensure throughout the process the highest degree of harmonisation feasible with the scientific analysis of the material from Mars (safety assessment benefitting from science analysis and vice versa).

The tasks will be undertaken through a series of workshops taking place through 2019; the final report will be presented to the 2020 COSPAR Scientific Assembly. The WG is working in parallel, but in contact with, the MSR Science Planning Group (MSPG). The MSPG is a joint NASA-ESA panel established to consider issues around scientific analysis of the returned material. The SSAP WG and the MSPG have several members in common, and at least one of the workshops will be held jointly.

**References:** [1] Rummel J. et al. (2002). [2] Haltigin T. et al. (2018). *Astrobiology* 18 S-1-S-131; [3] Kmínek G. et al. (2014). *Life Sciences in Space Research* 2, 1–5; [4] McLennan S. M. et al. (2012). *Astrobiology* 12, 175–230; [5] Beaty D. W. et al. (2008). Retrieved from [https://mepag.jpl.nasa.gov/reports/iMARS\\_FinalReport.pdf](https://mepag.jpl.nasa.gov/reports/iMARS_FinalReport.pdf); [6] Beaty D. W. et al. (2018). Retrieved from [https://mepag.jpl.nasa.gov/reports/iMOST\\_Final\\_Report\\_180814.pdf](https://mepag.jpl.nasa.gov/reports/iMOST_Final_Report_180814.pdf)