# Now You Have It, What Do You Do With It?
# A Mission to a Returned Mars Sample

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NASA has long been committed to following the recommendations of the Space Studies Board (SSB) in its reports on sample handling and testing [1, 2], many of which are now reflected in the COSPAR Planetary Protection Policy [3]. In particular, the 1997 SSB study *Mars Sample Return: Issues and Recommendations* [1], recommended that:
1) "samples returned from Mars by spacecraft should be contained and treated as potentially hazardous until proven otherwise," and
2) "rigorous physical, chemical, and biological analyses confirm that there is no indication of the presence of any exogenous biological entity."

## *Timing is Critical*

- Given the planned launch by NASA of a sample-caching rover in 2020, and with serious discussion by an international consortium of completing the Mars sample-return in subsequent launch opportunities, it is time to begin serious definition and development focused on the analysis, containment, and protection of that sample.
- Given the long lead times involved in providing for such a "mission," it is imperative that preparations for handling a Mars sample begin soon.

## *Testing is Required*

- In the late 1990s the development of a protocol to support the analysis of samples in a containment facility was begun by NASA and CNES, together.
  - The result was a "Draft Test Protocol" (DTP) that outlined requirements "for the safe receiving, handling, testing, distributing, and archiving of martian materials here on Earth" [4].
- The DTP addressed, in a comprehensive fashion, aspects of sample handling and testing, as well as physical-chemical analyses and curation considerations for untested portions of the samples, to ensure that controlled distribution of the samples outside of containment could be accomplished after the requirements of the DTP are met.
- After a blue-ribbon review (Chaired by Joshua Lederberg of Rockefeller U. and Lynn Goldman of Johns Hopkins U.), the "Final" version of the DTP published in October 2002, represented a consensus understanding of what is required to meet planetary protection requirements for a Mars sample return mission.

## *What Has Changed?*

There have been numerous improvements and updates to the study of biology and extraterrestrial samples in the 15 years since it was published [e.g., 5], supported by several focused activities and studies that have occurred since the DTP was published [e.g., 6]. In particular, there has been an increased realization that a broad commonality exists between the physical and chemical analyses required to complete a biohazard and life-detection protocol and those necessary for an "early" characterization of returned martian samples. This has the potential to conserve a larger proportion of Mars material than would be possible if the two activities were not linked.

- **A selected science team for early sample analysis would provide an effective voice for science, and a better biohazard test protocol, overall**.

[5]

## *Now is the Time (we hope….)*

The current notional timeline discussed for a Mars sample return mission could return a sample to Earth as early as 2029 [7]. Based on the recommendations of the DTP [4], and the SSB [1, 2] the planning for a Mars sample receiving facility (SRF) should be started in 2018, or as stated by the SSB [2], "in the earliest phases of the Mars sample return mission." Such planning can refresh and broaden the participant base, make specific improvements to the existing DTP, and update it to reflect current analytical and biological research, while including early science and opportunities, such as advanced robotics, for a more effective and less contaminating protocol execution.

References: [1] SSB (1997) Mars Sample Return: Issues and Recommendations. National Academy Press. [2] SSB (2009) Assessment of Planetary Protection Requirements for Mars Sample Return Missions. National Academies Press. [3] Kminek, G. et al. (2017) Space Research Today 200:12-25. [4] Rummel, J.D., et al., eds. (2002) NASA/CP-2002-211842. [5] Allwood, A. et al. (2013) Astrobiology 13:203-216. [6] Haltigin, T. and Smith, C.L. (2014) International Mars Architecture for the Return of Samples (iMARS) Phase II Science Subteam Report in AGU Fall Meeting Abstracts, 2014. [7] Zurbuchen, T. (2017) Presentation and oral comments to the SSB Committee on Review of Progress Toward Implementing the Planetary Decadal Survey, 28 August 2017.