

What should we do with these Martian rocks? A tale of MSR Sample Science and Curation

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The Mars Sample Return (MSR) campaign is the most complex and ambitious sample return mission to date. The first leg of the campaign, Mars 2020, has successfully landed in the Jezero crater, and the rover Perseverance is already sampling Mars. ESA and NASA have allocated substantial budgets to support the development of a partnership formalised through the signature in October 2020 of a NASA-ESA Memorandum of Understanding (MOU) concerning the flight elements of the MSR Campaign. A fundamental aspect of the partnership as stated in the Joint Statement of Intent between NASA and ESA on MSR campaign science benefits signed on 2 July 2019, is that samples would be treated as one collection and jointly managed. This has been a leading principle for all subsequent actions.

To clarify the activities to be done on the collection, the MSR Science Planning Group (MSPG) in 2018, followed by a second MSPG2 in 2020 were jointly chartered by NASA and ESA to develop key technical inputs for the curation and science activities to be done in the first years after sample return. These inputs have been translated into proposed design requirements for the short- to medium-term needed infrastructure [1]. One of the MSPG2 working groups has delivered a framework for the science management of the collection [2]. Final reports and requirements from MSPG2 were delivered in July 2021. In parallel, a Sample Safety Assessment Protocol working group under the umbrella of COSPAR is currently finishing their deliberations and report [3]. This sample safety assessment overlaps with the time critical and sterilisation sensitive science identified by MSPG2 for execution in the above referenced infrastructure. All these community-defined requirements, recommendations and findings are going to feed into the next steps to prepare the ground-segment activities and infrastructure. As a minimum, there is a need for a Sample Receiving Facility (SRF) for the first years after landing. This primary SRF should be jointly-managed between ESA and NASA, and allow for all needed curation, sample handling and sample analysis (pre-Basic Characterization, Basic-Characterization and Preliminary Examination as well as sterilization-sensitive, time-sensitive science and sample safety assessment) to be done in containment. NASA and ESA are planning independent but coordinated studies to clarify the design trade space and cost associated with handling Mars samples. A formalisation of the NASA/ESA partnership for MSR ground-segment is also underway, with an upcoming Science MOU (2021) and a potential agreement on ground infrastructure (planned 2022).

The upcoming decade will be busy with preparing the infrastructure, the science, and the overall management of the samples. There will be ample opportunities for the worldwide community to participate in the preparation activities, with a joint ESA/NASA Announcement of Opportunity expected soon, followed by more AOs later in the 2020's.

References

[1] Carrier B.L. et al. 2021, *Astrobiology* [2] Haltigin T. et al. 2021, *Astrobiology* [3] Kminek G et al. 2021, SSAP