

MARS SAMPLE RETURN: PLANNING FOR RETURNED SAMPLE SCIENCE.

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Introduction: As the Mars 2020 Perseverance rover continues to augment its current suite of martian samples in Jezero Crater [1-4] and prepares to create the first sample depot, the Mars Sample Return (MSR) Program flight missions prepare to retrieve the samples and deliver them to Earth as early as 2033. There is much planning to do in preparation for the terrestrial “ground-based” portion of the MSR Campaign, currently described as the Sample Receiving Project (SRP) which would begin with arrival of the samples on Earth. The SRP will be a partnership between NASA and ESA, working together to deliver the samples from Mars, and is also intrinsically a partnership between science and curation to characterize and protect the samples and to maximize their scientific value. The SRP is currently in the planning/pre-project phase and has the following draft objectives:

- Recover the returned spacecraft (including contained samples) at the Earth landing site, establish secondary containment, and transport to the Sample Receiving Facility (SRF).
- Design, build, equip, and operate the SRF, such that it would protect the integrity of the samples and assure biological containment until the samples are deemed safe for release.
- Extract samples, complete basic characterization/preliminary examination, and develop a sample catalog for sample allocation.
- Support execution of the science for the sample safety assessment.
- Conduct worldwide science investigations sufficient to achieve the MSR Campaign’s primary scientific objectives (TBD), including both within and external to biological containment.
- Provide curation services and enable long term curation.

Guiding Principles for Scientific Participation: The Science Management Plan for MSR has several guiding principles (derived from [5]) that are meant to optimize sample science return and to ensure that the international science community remains engaged throughout the planning and analysis phase of MSR, including:

- Transparency: Access to samples must be fair and processes must be as transparent as possible
- Science Maximization: Management and sample-related processes must optimize the scientific productivity of the samples
- Accessibility: International scientists must have multiple opportunities to participate throughout the MSR process
- One Collection: The returned samples should be managed as a single collection even if housed in separate facilities
- Return on Investment: Agencies providing the investments required to execute the MSR campaign should receive demonstrable benefits for enabling the samples’ return

MSR Campaign Science Group (MCSG): As of the time of writing, ESA and NASA are in the process of selecting the initial membership (i.e., Phase 1) of the MSR Campaign Science Group. This group will be comprised of applicants from the international science community, who will provide input on the scientific aspects of the SRP, including the scientific objectives of SRP, the R&D/R&A roadmap needed to optimize sample analyses, the science traceability matrix, and science-related requirements, among other topics. This group will be recomputed every two years and will eventually evolve to the MCSG Phase 2, which will consist of PIs who have been selected to perform the initial analyses on the samples when they arrive. The MCSG 1 and 2 will function similarly to a Project Science Group (PSG) for a flight mission.

Science Community Workshops: In order to keep the sample science community engaged in ongoing planning for returned sample science, several community workshops are planned over the coming years. In the near-term we are planning for a science community workshop related to optimizing the initial depot of M2020 samples to be placed on the martian surface. This workshop is expected to take place in late September. Further details will be released shortly via the usual planetary science mailing lists.

Proposal Opportunities: The desire of ESA and NASA science leadership for the MSR Campaign is that as many opportunities for engagement with the samples and sample planning are competed as is feasible. This could include opportunities to participate in an R&A analogue program, as well as other opportunities in the near future. Current planning also includes an initial Announcement of Opportunity (AO) to propose instrumentation and investigations to take place inside the SRF as early as 2026.

References: [1] Cohen B. et al. (2022) *Metsoc 2022 (this meeting)*. [2] Herd C. D. K. et al. (2022) *Metsoc 2022 (this meeting)*. [3] Treiman A. (2022) *Metsoc 2022 (this meeting)*. [4] Udry A. et al. (2022) *Metsoc 2022 (this meeting)*.