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MARS SAMPLE RETURN—A PROPOSED MISSION CAMPAIGN WHOSE TIME IS NOW

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Introduction: The analysis in Earth laboratories of samples that could be returned from Mars is of extremely high interest to the international Mars exploration community. IMEWG (the International Mars Exploration Working Group) has been evaluating options, by means of a working group referred to as iMOST, to refine the scientific objectives of MSR. The Mars 2020 sample-caching rover mission is the first component of the Mars Sample Return campaign, so its existence constitutes a critical opportunity. Finally, on April 26, 2018, NASA and ESA signed a Statement of Intent to work together to formulate, by the end of 2019, a joint plan for the retrieval missions that are essential to the completion of the MSR Campaign. All of these converged April 25-27, 2018 in Berlin, Germany, at the 2nd International Mars Sample Return Conference.

Science: The iMOST study team has constructed a framework of 7 primary objectives related to the analysis of martian samples. The first objective relates to understanding as many as possible of five specific geologic environments (which ones end up being possible will depend on the landing site): hydrothermal, sedimentary, sub-aerial, rock-hosted, and igneous. Separate planning for these is necessary, because the strategies and kinds of samples are very different. Then there are six discipline-related sample-related objectives, which relate to the following areas: 2). Life, 3). Geochronology, 4). Volatiles, 5). Planetary Evolution, 6). Understand/reduce the risks for humans to Mars, and 7). ISRU. For each objective, a logical set of sub-objectives and/or investigation strategies has been derived. For all objectives, the iMOST team has mapped out the kinds of samples desired/required to achieve the stated objective/sub-objective, as well as the essential measurements to be made on the samples. Interim results were presented for discussion/feedback, to be followed after the conference by a full report.

Engineering: NASA and ESA are currently exploring concepts for the subsequent missions that would result in the return of the samples collected by Mars 2020. The first of these mission concepts, the Sample Return Lander (SRL), would deploy a landed platform at the Mars 2020 landing site, from which a small Sample Fetch Rover would egress and retrieve the cached samples. (Engineering is also examining an option where M2020 itself could deliver samples to the SRL). After returning to the lander, the samples would be transferred to an Orbiting Sample (OS) canister and loaded into a Mars Ascent Vehicle (MAV), which would launch the OS into low Mars orbit. There, an Earth Return Orbiter (ERO) would rendezvous with the OS and capture it. After secure biocontainment, the contained OS would be transferred to an Earth Entry Vehicle (EEV), and the ERO would leave Mars orbit and return toward Earth, where the EEV would be released on a trajectory to land at a designated Earth landing site. After landing, the returned samples would be transferred to a secure Sample Receiving Facility (SRF) for evaluation and, ultimately, extensive science investigation.

Planning for post-return analysis: Following the above two flight missions, the final leg of the campaign would be an entity that we have refered to as Mars Returned Sample Handling (MRSH), which includes the activities between the landing of samples on Earth and sample analysis/curation. MRSH notionally has three components of functionality. Intially Ground Recovery Operations (GRO) would be responsible for safing the entry capsule with the samples, and safely transferring the capsule to a SRF while protecting the samples. Samples would undergo preliminary examination and biohazard analysis to determine next steps with regards to full scientific analysis, curation in one or more Sample Curation Facilities (SCF), and/or controlled distribution to other facilities.

Summary: At the conclusion of the Berlin conference, the participants reached agreement on the following position statement: "The scientific exploration of Mars and the search for extra-terrestrial life have advanced to the point that the return of samples from Mars is more important than ever to enable the next big discoveries in Mars exploration. Capitalising on major engineering progress in recent years by the world's space agencies and industries, we are technically ready to start the development of the flight missions associated with retrieving the samples. In parallel, planning for the potential receipt and evaluation of the samples has started, and should accelerate, as well as for the processes associated with making the samples available to the world's science community. Given the nature and scope of the Mars Sample Return campaign, we expect that engaging the public early and keeping them involved throughout will be a particularly important component of this effort. We have the opportunity and the motivation to make the Mars Sample Return campaign an international endeavour and a reality for all humankind."

References: All information about the iMSR-2 conference is archived at this website: https://atpi.eventsair.com/QuickEventWebsitePortal/2nd-international-conference-on-mars-sample-return/home