PLANETARY PROTECTION FOR MARS SAMPLE RETURN

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A Mars sample return (MSR) mission must deal with two new categories of planetary protection requirements: (1) assuring a very low probability of inadvertent release of the sample in order to provide extra protection against the extremely unlikely possibility of biological hazards in the returned material and (2) keeping the samples free of round-trip Earth organisms to facilitate confirmation of safety after return to Earth. This presentation describes the planetary-protection-related technical challenges awaiting an MSR mission as well as the range of capabilities being developed to meet these challenges. Containment assurance requires breaking the chain of contact with Mars: the exterior of the sample container must not be contaminated with Mars material. The sample container and its seals must be designed to survive Earth impacts corresponding to the candidate mission profiles and the Earth return vehicle must be designed to withstand the thermal and structural rigors of Earth atmosphere entry (all with an unprecedented degree of confidence). Sample contamination must be avoided by sterilizing the entire spacecraft, a challenge with modern avionics, or by sterilizing the sample collection and containment gear and then isolating it from other parts of the spacecraft.