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PLANETARY PROTECTION TRADES AND LESSONS LEARNED FROM DESIGNING MARS SAMPLE RETURN'S CAPTURE, CONTAINMENT & RETURN SYSTEM

Abstract

The Mars Sample Return campaign aims to deliver rock cores, regolith and atmospheric samples to Earth. Inspection and testing of the samples will guide insights about the geologic and climate history of Mars, including the potential for ancient life. The rover Perseverance has started to collect such samples on the surface of Mars and subsequent missions would recover the sealed sample tubes, launch them into Mars orbit, and transport them back to Earth. These elements are currently in the planning and design stages of development, and represent an international effort of NASA, the European Space Agency (ESA), and many industry partners. The work presented here provides an overview of the backward planetary protection trades and lessons learned from designing the NASA-provided Capture, Containment Return System. This payload, located on the ESA-provided Earth Return Orbiter, would detect and capture the container with up to thirty sealed tubes previously put in Martian orbit, contain them in redundant containers to ensure that no potentially hazardous Mars particles are released, and return them to Earth through an entry vehicle. Topics include partial jettison of the capture enclosure, replacement of the aseptic transfer system with an ultraviolet illumination system while giving the orbiting sample container a primary containment function, and leveraging different design options to augment the micrometeoroid protection system improving shielding performance.