Design and Testing of a Sample Container to Preserve Rock Cores for Mars Sample Return

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As outlined by the Science Definition Team for NASA's proposed Mars 2020 rover mission, a long-term Mars Sample Return program would be a multi-step process designed to collect, cache, retrieve, and return Martian rock samples in metal tubes. In order to maintain the samples' scientific value, the seal used in the tubes must maintain cleanliness and seal integrity through events which may include launching off of the Mars surface by a Mars Ascent Vehicle and landing on Earth's surface at high-gravity force. Testing hardware was designed using computer-aided design software to fit the sample tubes for vibration and shock tests to validate a prototype sample tube-sealing method to MSL qual/protoflight level for future sample return missions. Assembly and testing procedures were written to carry out the tests. Helium leak-rate data were collected on four different sealing methods before and after each characterization test. The seals were tested on a vibe table to simulate lift-off and then dropped from a drop tower at 3,500 G to characterize a high-gravity landing on solid earth. The aim of this task is to test which sealing method could best maintain a leak level of below 1×10^{-8} atm·cc/sec He. Details of the project will be used to write requirements on preserving the core samples.