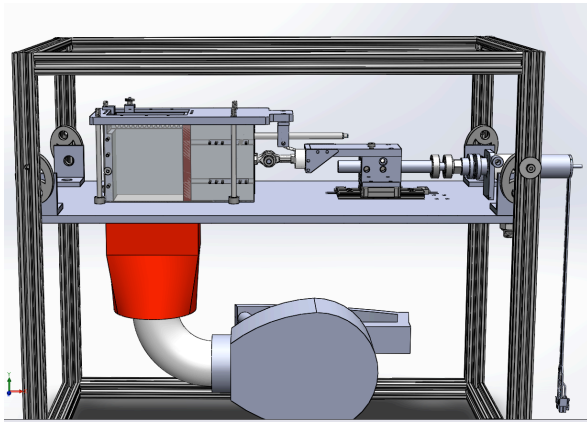
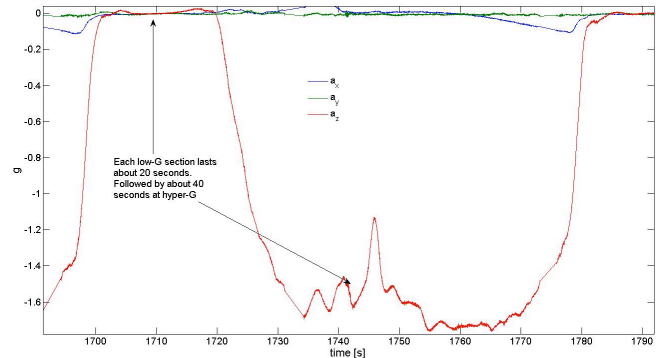


**Fundamental Characterisation of Microgravity Geomechanics.** D. Arthur<sup>1,2</sup>, C. Senatore<sup>3</sup>, I. Vlahinic<sup>1,2</sup>, K. Iagnemma<sup>3</sup>, J. Andrade<sup>1</sup>, R. C. Anderson<sup>2</sup>, M. M. Khan<sup>4</sup>, N. Fine<sup>3</sup>, B. Trease<sup>2</sup>. <sup>1</sup>California Institute of Technology, <sup>2</sup>NASA Jet Propulsion Laboratory, <sup>3</sup>Massachusetts Institute of Technology, <sup>4</sup>Curtin University. ([Daniel.T.Arthur@jpl.nasa.gov](mailto:Daniel.T.Arthur@jpl.nasa.gov))

**Abstract:** A series of workshops were held in the summer of 2011 at Caltech, on the topic of “xTerramechanics”. These workshops were sponsored by the Keck Institute for Space Studies (KISS) with co-leads from JPL, Caltech, and MIT. This paper presents the aspect of xTerramechanics concerned with design of experimental hardware and protocols for characterization of fundamental geomechanics in microgravity environments, and early testing aboard a Zero Gravity Corporation hyperbolic research flight over Cape Canaveral, FL.



The discipline of xTerramechanics entails the study and modeling of interactions between spacecraft (e.g., rovers) and extraterrestrial geomaterials (e.g. Martian soils). The study has focused on the canonical case of surface interactions stemming from mobility issues related to Martian rovers to deepen our understanding of key mission life-cycle processes: formulation trades, design, mission operations, and in-situ science context and integration. The collaborations that led to the xTerramechanics research stream were born from experiences of the Spirit rover’s embedding incident on Mars, with concern for the operations of the MSL and M2020 Mars Rover Missions.



In addition to presentation of the design and construction of specialized testing equipment, we also explain the impact of this work on both operational and fundamental science aspects of the MSL and M2020 rover missions, and also present highlights from our feature on the popular BBC documentary ‘Stargazing Live’.



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