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Microgravity Experiments from Sub-Orbital to Orbital Platforms (3)

Author: Dr. ANA PIRES
INESC-TEC, Portugal, ana.c.pires@inesctec.pt

Dr. Rui Moura
University of Porto, Portugal, rmmoura@fc.up.pt

EXPLORATORY EXPERIMENT IN MICROGRAVITY FLIGHTS: HARDNESS TESTER FOR ANALOG PLANETARY ROCKS

Abstract

Lunar exploration is more and more imperative when we talk about space missions. But not limited to the Moon or Mars, it is important to include asteroids, comets, and meteors. Sampling and analysis have posed great challenges in the past and present in such low gravity environments as comets and asteroids (e.g. failure of Philae to land on the 67P/Churyumov-Gerasimenko comet, or more recently missions such as Ryugu and Bennu , demonstrate how microgravity research on Earth is important to the planning and success of geological sampling). This research presents an experiment related with planetary geology and it was performed under the framework of a microgravity campaign in the National Research Council of Canada—NRC (Ottawa) with PoSSUM Project (www.projectpossum.org). The main purpose is assessing rock hardness testing functions of the Equotip3 (Proceq®) and equipment behavior in microgravity and lunar gravity environments, as well as to carry out a preliminary approach for data correlation. This was the first time that this type of research was carried out inside a FALCON20 and the first time ever that this equipment flew in these environments. The data gathered in the experiment enabled us to understand the rock behavior and the hardness values, which are easily related with Uniaxial Compressive Strength values in laboratory. Later, a thorough numerical modeling will be performed to analyze all the measurements (in-situ) and to determine data correlation with the microgravity environment. The experiment was tested in 2 rock samples from Flagstaff (San Francisco Volcanic Field); basalt and limestone. In terms of future outcomes, this experiment will certainly contribute for the development of the robotic geo-system that is currently on-going – forthcoming integration in a lander/rover and space suit miniaturization for integrated human use.