IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

Author: Mr. Gabriel Pont
Centre National d'Etudes Spatiales (CNES), France

Mr. Sébastien de Raucourt
Institut de Physique du Globe de Paris, France
Prof. Philippe Lognonné
Université Paris Diderot (Paris 7), France
Dr. Mark Panning
Jet Propulsion Laboratory - California Institute of Technology, United States
Dr. Sharon Kedar
National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory, United States
Mr. Edward Miller
National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory, United States

A VERY BROAD BAND SEISMOMETER ON THE MOON IN 2024

Abstract

In the frame of the NASA's CLPS (Commercial Lunar Payload Services) initiative, the FSS (Farside Seismic Suite) instrument, proposed by JPL (Jet Propulsion Laboratory), has been selected to fly to the Moon in 2024.

It will address three main scientific objectives:

1. Investigate deep lunar structure and the difference between near and far sides activity.
2. Understand how the lunar crust is affected by the development of an impact melt basin.
3. Evaluate the current micrometeorite impact rate and local tectonic activity

The FSS will be an autonomous instrument able to withstand the lunar night (which is not the case of the commercial lander it will be launched with): it will have its own power, thermal control, command and data handling, and communication devices. In particular, FSS requires an innovative thermal design in order to allow operate efficiently through the cold night and hot day. It is based around a cube within a cube design, with spacerless multi-layer insulation separating the two cubes, to permit the dissipation of the heat from the seismometer systems to maintain overnight temperatures, while daytime temperatures are controlled by an efficient thermal switch and mini-loop heat pipe (mini-LHP) system connected to an upward-facing radiator.

The FSS will accommodate two different seismometers types successfully used on the SEIS instrument (INSIGHT mission) on Mars. A single axis, vertical, VBB (Very Broad Band) seismometer, will be associated to a three-axes SP (Short period) seismometer. The VBB, provided by CNES (Centre National d'Etudes Spatiales) has been extracted from the SEIS spare model and will be tuned to lunar gravity, while the SP is a new build based on the SEIS SP design.

An envelope, called the SeismoBox, is being developed in order to accommodate the VBB, with 3 main functions:

- Protect the VBB from the dust (whether on Earth or on the Moon) as the VBB is a mechanical pendulum with very small gaps.
- Take benefit of the vacuum level on the Moon in order to keep the VBB under vacuum (and then increase its performances).
- Protect the VBB from the magnetic field (in particular when the Moon is located in the Earth's magnetic tail).

After introducing the mission and its objectives, the paper will present the FSS architecture. Then, a focus on the VBB and the SeismoBox will be made.