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REFLECTION SEISMOLOGY SYSTEMS FOR PLANETARY GEOLOGY; A FEASIBILITY STUDY

Abstract

Reflection seismology is a well known and common method for mapping the Earth's subsurface and is, among other applications, used for 3D mapping of oil fields in the ocean floors. By measuring the incoming vibrations along a line or network of sensors, one can determine depths and compositions of underground layers. This paper presents the results of a feasibility study to determine if this method is applicable for planetary geology with special emphasis on Lunar or Martian geology. Reflection seismology would be able to provide more detailed information on subsurface structures and layering than previous instruments have been able to.

The feasibility study started with a study into current planetary geology questions. Several scenarios for geological research have been indicated where reflection seismology could provide answers or new insights. This was done in cooperation with several geologists from Dutch institutes. In cooperation with the geophysics department of the TU Delft, each scenario was classified whether reflection seismology was indeed suitable and the instrument's requirements were derived from the scientific goals.

The scenarios worth investigating were modelled and analyzed to determine whether a seismic network could measure the desired features and details. Special attention was paid to the influence of lower gravity, the strong damping of sound waves by regolith and loose ground coupling.

Once it was determined whether a seismic system could measure the desired features, a technical analysis of the entire system followed. Critical design parameters for a seismic network proved to be power supply of each measurement unit and the data transfer between the units and back to Earth. The next step will be to find solutions for these problems. For the analysis certain deployed configurations were used based on previous and future missions.