

Conceptual Study of Small Active Seismic Exploration Package on Moons and Small Bodies

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Seismic exploration is a powerful tool to probe inner structure of planetary bodies. Developing a seismic observation package that is compatible with small to middle size spacecraft will open a new window to investigate deep interior of planetary bodies including asteroids and small satellites such as Phobos. We have been designing and developing a seismic observation package with 3 axes seismometers, active seismic source and anchoring system. This was originally designed for Japanese Martian Moons eXploration (MMX) Mission. We were not selected for the nominal payload but the selection process of optional instruments is still ongoing. Here we will present the basic concept of our seismic observation package and describe each subsystem. The seismic observation package consists of 3 components, a seismometer, an active seismic source, and an anchoring mechanism. The seismometer is based on a short period sensor that was designed for Japanese Lunar A mission. In addition to the previous design, we are developing a new feedback for higher sensitivity at lower frequencies. Current sensitivity of the SP seismometer decrease below 1 Hz but with new feedback, the sensitivity stays high down to 0.1 Hz. The active seismic source is designed so that we can control the generated waveform. This is a well-developed method in terrestrial seismology known as ACROSS (Accurately Controlled Routinely Operated Signal System). By controlling the waveform of the seismic source we can search for the reflected signal through cross correlation method. The anchoring mechanism will be necessary especially on low gravity condition. One of the major problems in planetary seismic observation is the coupling between the instruments and the ground. This will be an important issue especially for active seismic source. We will describe results of our conceptual study of the seismic observation package and discuss the possibilities of future space missions.

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