Geophysical Research Abstracts
Vol. 17, EGU2015-9665-1, 2015
EGU General Assembly 2015

The SEIS Experiment for the InSight mission: status and performance expectations

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The Insight NASA Discovery mission, led by the Jet Propulsion Laboratory, will deploy in September 2016 a very broadband seismometer on the Mars surface, SEIS (Seismic Experiment for Interior Structure). It is a hybrid 3-axes instrument, which encloses 3 very broadband oblique sensors and 3 short period sensors. The sensor assembly and its wind and thermal shield will by deployed on the Mars surface from the Phoenix-like spacecraft by a robotic arm (IDS). The acquisition system will be hosted in the spacecraft warm electronics box, and connected to the deployed sensor assembly by a tether. The SEIS experiment is provided by CNES, the French Space Agency that makes the coordination of a wide consortium including IPGP of Paris (SEIS PI Institution), Imperial College of London, Oxford University, MPS of Göttingen, ETH of Zürich, ISAE from Toulouse and the Jet Propulsion Laboratory of Pasadena.

In addition to the seismometer, the Insight payload will also include a suite of instruments complementary to the seismometer, such as a precision temperature sensor, a micro-barometer, a magnetometer and a wind sensor, making it the first geophysical multi-parameter station on another planet. A heat flow sensor and geodetic measurements will provide additional science measurements, in order to constrain the internal structure of Mars.

Several challenges have been overcome to design and realize the planetary seismometer, which will exhibit a noise of about 10-9 m/s2/sqrt(Hz) in its seismic bandwidth bandwidth (0.01-1 Hz) for the very broadband component. These challenges include a very efficient insulation from the external temperature variations, and a finely crafted mechanical design to keep the extreme sensitivity of the seismometer, while allowing enough robustness for the harsh mechanical environment encountered during the launch and landing sequences.

Also, specific attention has been paid to understanding the various environment contributions to the noise figure. A discussion will be presented, on how to understand the seismometer performance figure in a changing environment, and how to secure the mission science goals in the challenging environment of the Mars surface.