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The SEIS Experiment for the Insight Mission: Development and management plan

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Abstract

SEIS is a Mars seismometer, provided by CNES to JPL to be the threshold instrument of the next Mars mission, InSight, to be launched by NASA in March 2016.

Discovery missions leads to a very strict frame of development, where schedule is driving development and qualification plans.

We will explain how this constraint has been taken into account during development phases, until delivery of flight model, with a context of international cooperation without exchange of founds between partners.

1. Introduction

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 an hybrid 3-axes instrument, which joins 3 very broadband oblique sensors with 3 short period sensors. The sensor assembly and its wind and thermal shield will by deployed on the Mars surface from a Phoenix-like lander 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, which manages a wide consortium including IPGP of Paris, Imperial College of London, Oxford University, MPS of Göttingen, ETH of Zürich, ISAE from Toulouse and the Jet Propulsion Laboratory of Pasadena.

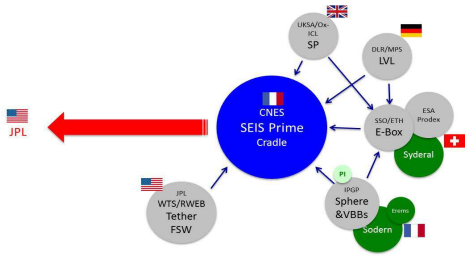
In addition to the seismometer, the Insight payload will also include a suite of instruments complementary to the seismometer, such as a precision temperature sensor, a micro-barometer, a magnetometer and a wind sensor, making it the first broadband seismic broadband station on another planet. A heat 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 self-noise of about 10^{-9} m/s^2/sqrt(Hz) in its seismic bandwidth for the very broadband component. These challenges implied a very complex hardware, both from a mechanical point of view and from an electronic point of view. Due to programmatic context of this NASA mission, deadlines were very short, and the development plan had to be driven by schedule. Qualification phases of the instrument and its sub-systems had to be shortened and parallelized.

Also, specific attention has been paid to the organization of the consortium that was in charge to deliver the SEIS instrument, and to the consequences of such a wide collaboration schema on the development plan.

3. Figures

Below, is a symbolic picture of the consortium, and interfaces between partners.



6. Development and qualification plan driven by schedule

We will present all type of concerns that have been met due to schedule driven activities, consortium organization, associated risks, and how we have mitigated them.

This can be taken as lesson learns for scientific instruments developed in a similar context.