THE MARS SEIS EXPERIMENT: FIRST TESTS. P. Schibler[1], D. Mimoun[1], P. Lognonne[1], D. Giardini[2], W. T. Pike[3], and the Mars SEIS team.
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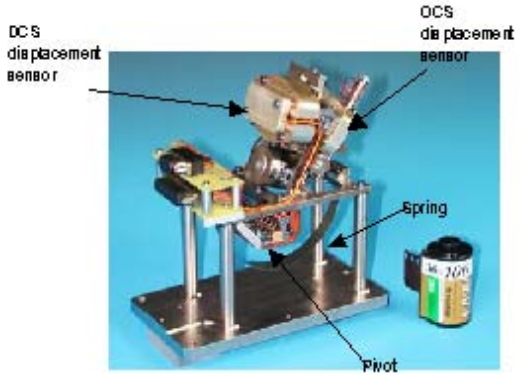
Scientific objective: the objective of the Mars SEIS experiment is the determination of the deep internal structure of Mars. In particular, geophysical parameters of first importance, such as the state (liquid/solid) and size of the core, as far as structure of the mantle and shape of discontinuities will be determined by the experience. It was proposed by a large team of scientists, mostly involved in Earth seismology and Earth tides. The seismic data analysis will determine the mean values of the shear and bulk elastic moduli and seismic attenuation as a function of depth, mainly from the transmitted phases. The reflected phases will mainly constrain the position of the interfaces between the mantle and core, the state of the core, the position and characteristics of mantle discontinuities and crustal thickness.

Instrument description: the instrument integrates a Very Broad Band two axis seismometer, completed by a third axis short period seismometer, and environmental sensors for pressure, infrasounds and temperature. The sensors measure signals in an ultra-broad band, from the tidal frequencies (0.05 mHz) up to the short period frequencies (50 Hz). Long term VBB bias will be actively decorrelated from temperature and pressure variations, allowing the sensor to operate in a thermal environment with daily variations of about 40 °K. Infrasounds, which might be associated to dust devils and atmospheric discharge, will be also monitored. The overall mass of the SEIS instrument is 2.3 kg, including all sensors, data control processors and installation devices. Acquisition will be performed by a series of 24 bits A/D converters, while the thermal and drift control will be performed by a feedback generated by a 24 bits D/A converter.

SEIS development status: we are currently at the end of the B phase, with a breadboard of the VBB axis already delivered by industry (EADS-Sodern) in July 2004. Most critical parts have been tested, including shock tests (200g, 20 ms) for pivot, electronics components and displacement sensors. The electronics breadboard has also been delivered and was under extensive performance tests at ETH facilities. The Sphere (phase B Breadboard), including the two VBB axis, has been delivered by industry (EADS-Sodern) at summer 2005. Structural and Thermal Model (STM) of Sphere has been delivered at the end of 2005. Full seismic calibration and environmental tests are planned in 2006.

Preliminary results: functional results are satisfying and noise optimization is under process. Preliminary noise results are encouraging. We expect to demonstrate that we have reached the STS2 noise level in the incoming months.

Missions planned: the SEIS is one of the core instruments of the Geophysical and Environment Package (GEP) included in the baseline of ExoMars mission which has been approved by ESA (Berlin ministerial council) last December, with a launching planned in 2011. The idea for the GEP and SEIS is also to built progressively a network on Mars, for several martian years of operation by participating to other NASA missions (2011 and later).



VBB axis
R&T development by CNES-IPGP-SODERN

Sphere Breadboard including 2 axes