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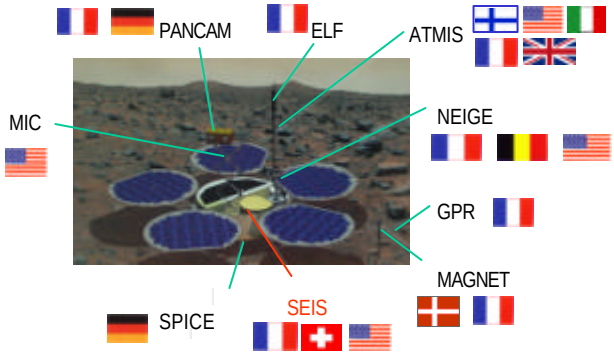
The NetLander SEIS experiment : a multiparameter station on Mars

NetLander 2007 : The NetLander mission will deploy in 2007/2009 a network of 4 stations on Mars for one Martian year of operation.



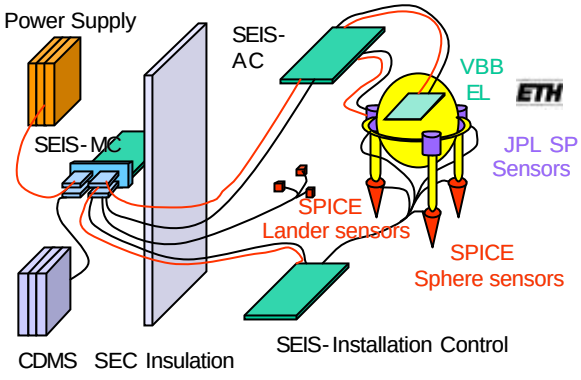
Nine Instruments selected by an AO in 1999, grouped in 4 Packages :
Geophysics, Atmospherics, Ionospherics, Mineralogy/Geology

Geophysical package : The geophysical package will sound the deep interior (D) and the subsurface (S) with the following multi-parameters approach
- Seismometer (SEIS, seismic velocities and attenuation, D, S)
- Seismometer and infra-sounds (SEIS, compliance and shear modulus, S)
- Magnetometer (MAGNET, electrical conductivity, D, S)
- Ground Penetrating Radar GPR (permitivity, S)
- SPICE (Thermal conductivity, S)
- Geodesy experiment, NEIGE (density, D)

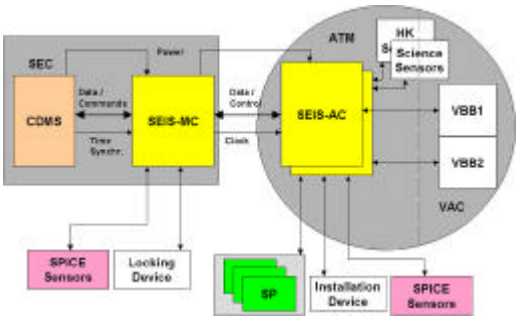
SEIS-NL experiment : This experiment will integrate a VBB (Very Broad Band) 2 axis seismometer, a 3 axis Short Period seismometer and a series of environmental sensors for pressure, infra-sounds and temperature. IPGP (France) has the overall responsibility of the experiment and is responsible for the VBB and environmental sensors. ETHZ (Switzerland) is responsible for the electronics of the experiment and JPL (USA) for the SP (Short Period) sensors. SEIS-NL instrument is also in charge of data acquisition for SPICE experiment.

Scientific objective : The SEIS-NL instrument will perform both the seismic and tidal measurements. It was proposed onboard the NetLander 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.

SEIS sub-systems

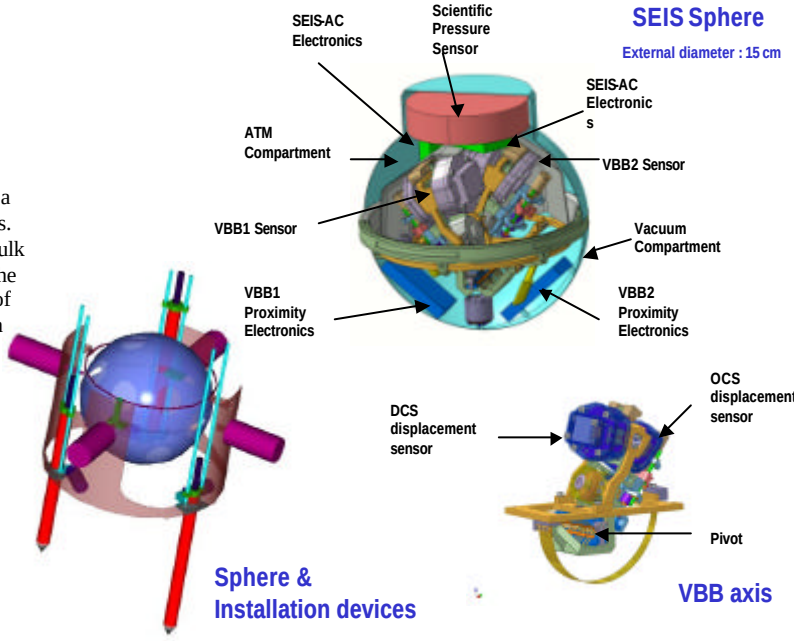


Technologies and collaboration : The experiment is done by a consortium between France (white), Switzerland (yellow) and USA (green). Funding by PRODEX for Switzerland, NASA for USA and CNES/INSU for France.



Technical description : The overall mass of the SEIS experiment is 2,3 kg, including all sensors and the data control processor. Acquisition will be performed by a series of 24 bits A/D, while the thermal and drift control will be performed by a feedback generated by a 24 bits D/A.
The package of sensors will allow :
- to measure signals in an ultra-broad band, from the tidal frequencies (0.05 mHz) up to the short period frequencies (50 Hz)
- to perform environmental decorrelations of the temperature and pressure variation on Mars, allowing the sensor to operate in a thermal environment with daily variations of about 40°K
- to search for infra-sounds which might be associated to dust devils and atmospheric discharge.

Seismometer is protected against direct wind by housing and is uncoupled from lander. Petals produce shadow around the sensor. Direct contact with ground is obtained by 3 spikes.



Data transmission : We expect a daily transmission of LP data (1 sps) for a volume of 2.5 Mbits/day. The seismometer team, in at least two geographical locations, will perform the quick-look on the Earth of these data, in order to maximise the turn-around time during regular shift hours (Paris and Pasadena, UT+1 and UT-8). From these data, a set of time will be identified, and a table of parameters will be up-linked to each of the 4 landers in order to flag and to save the interesting data in the main memory of the CDMS (e.g. when quakes are tentatively identified). The corresponding VBB (20 sps) and SP data (100 sps) will then be progressively sent at a rate of about 5 Mbits/day.

Reference : Lognonné P. & B. Mosser, Planetary Seismology, 14, 239-302 *Survey in Geophysic*, 1993. P. Lognonné et al. The NetLander Very Broad band seismometer, Planet. Space Sc., 48,1289-1302, 2000.
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