Press Release

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World first
French SEIS seismometer up and running on Mars

The InSight mission's SEIS seismometer, deployed on the surface of Mars by a robotic arm on 19 December 2018, was successfully tested out on 1st January.

For the first time in the history of space exploration, a seismometer is now operating on Mars. SEIS (Seismic Experiment for Interior Structure), for which France has engineering responsibility and is the instrument principal investigator, was deployed on the surface of the red planet by the InSight lander on 19 December 2018. It was tested out on 1 January and is working well.

This is a historic moment and a great hope for geophysics. The two U.S. Viking 1 and Viking 2 missions launched by NASA in 1975 were each carrying a seismometer. One failed to function, while the other—fixed to the deck of the lander—was unable to measure Mars' seismic activity as it was too sensitive to the background noise generated by winds. SEIS is thus the first instrument of its kind to be placed on the surface of the red planet.

The last time a similar instrument was set down on the surface of a celestial body other than Earth was 46 years ago in December 1972, when U.S. astronaut and geophysicist Harrison Schmitt deployed ALSEP (Apollo Lunar Surface Experiments Package) on the Moon for the Apollo 17 mission.

The aim of planetary seismology is to learn more about the interior structure and composition of planets—the size and nature of their core, mantle and crust. SEIS will therefore be listening out for 'marsquakes' and meteorite impacts to obtain a clearer picture of the planet's interior and determine the source of its seismic waves. Such data will yield crucial information to understand how Mars and other rocky planets formed and evolved.

After SEIS was set down on the ground by InSight's robotic arm, the first operations consisted in releasing the grapple holding it, taking photos from all angles to make sure that everything was nominal and then switching on its heaters to prevent it from getting cold, as SEIS is not yet protected by its Wind and Thermal Shield (WTS). Its electric tether was unrolled two days later and then extended on 6 January to reduce transmission of vibrations from the lander.

The three very-broad-band (VBB) seismic sensors built by IPGP[1], Sodern and CNES, which make up the core of SEIS housed inside their titanium sphere in strict vacuum conditions, have now been recentred and are beginning to record minute ground displacements. All three are operative, as are the UK-built short-period sensors, and have already shown that Mars' surface is—when there is little wind—more stable than in the best seismic cellars on Earth.

SEIS's deployment isn't quite over yet, as its protective WTS still has to be lowered into place. The WTS is a large white dome with a tripod and a protective skirt that tightly 'hugs' the ground to stop wind blowing in, thus enabling SEIS to operate within a less constraining range of temperatures than it if had been exposed to the harsh Martian climate. This last operation is currently scheduled for the second half of January, after which the instrument will be in its final configuration to 'take the pulse' of Mars and probe its deep interior.

CNES is lead contractor for SEIS and IPGP is the instrument principal investigator. IPGP designed the VBB sensors built by Sodern and tested them before delivery to CNES. Research scientists and

engineers from IPGP, Paris Diderot University, the ISAE-Supaero aeronautics and space institute and CNRS (the LPGN planetology and geodynamics laboratory in Nantes and the LMD dynamic meteorology research laboratory) make up the rest of the French team at JPL that will be analysing the first data from SEIS. CNES is funding French contributions to the mission, coordinating the international mission consortium[2] and was responsible for integrating, testing and supplying the complete instrument to NASA. .

1 Institut de Physique du Globe de Paris
2 In collaboration with JPL, the Swiss Federal Institute of Technology (ETH Zurich) and the Max Planck Institute for Solar System Research (MPS, Göttingen, Germany), and Imperial College London and Oxford University, which supplied subsystems for SEIS.

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