German Aerospace Center


# Philae on 67P – MUPUS experiment hammers probe into a comet 500 million kilometres from Earth

*18 November 2014*

**Probe discovers hard ice and measures temperature of minus 170 degrees Celsius on Comet 67P/Churyumov-Gerasimenko**

The MUPUS instrument, one of 10 experiments on the Philae lander that touched down on comet 67P/Churyumov-Gerasimenko encountered very hard material with a temperature of about minus 170 degrees Celsius – probably rich in ice. "This is a surprise! We did not expect to find such hard ice below the surface," explained Tilman Spohn from the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR), the Principal Investigator for MUPUS.

**Ice under loose dust layer**

During the night of 13 to 14 November 2014, the MUPUS instrument was deployed from the 'balcony' of the lander – that is, from the open instrument bay on the rear wall of Philae – and was hammered about 40 centimetres into the comet's surface. This was unsuccessful, although the hammer power was gradually increased to the highest available level. "Using comparative measurements performed in the laboratory, we estimate that the probe must have likely encountered a layer with the same strength as ice under a 10 to 20 centimetre thick layer of dust," says Spohn. The infrared sensor incorporated into the instrument found that the covering layer of dust exhibited a low thermal inertia. "The team believes that under the very porous dust layer, ice is present." This ice contains dust and might even be quite porous, but, having been thermally sintered over the course of centuries to millions of years, its ingredients have been baked together by repeated temperature changes.

**Measurements on approach and after landing**

The instrument's infrared sensor, which was developed by the Institute of Planetology at the University of Münster, together with the Space Research Centre in Warsaw and other international partners, is now managed by the DLR Institute of Planetary Research. Data was recorded during the approach and bounces across the comet surface. However, the MUPUS thermal sensors and accelerometers in the anchors could not be used because the anchor harpoons did not fire into the comet surface beneath the lander. "Philae was not anchored to the surface of the comet and possibly came to rest in a tilted position; one of the three legs of the landing gear was not in contact with the surface. After landing, it was not clear whether the MUPUS experiment would be able to perform as intended."

Philae's ultimate landing site is probably at least one kilometre away from the targeted position – likely in front of a wall composed of ice. The team at the DLR Lander Control Center (LCC) was, however, able to operate all 10 instruments on board the lander and obtain data. "We are very happy that many measurements were possible and are currently in the process of analysing the data," says Spohn. "MUPUS could be used again, if we can collect sufficient energy to charge the lander's battery. Then we can examine the layer on which the probe is situated, and observe how the comet develops as it moves closer to the Sun."

**The mission**

Rosetta is an ESA mission with contributions from its member states and NASA. Rosetta's Philae lander is funded by a consortium led by DLR, the Max Planck Institute for Solar System Research (Max-Planck-Institut für Sonnensystemforschung; MPS), the French Space Agency

(Centre National d'Etudes Spatiales; CNES) and the Italian Space Agency (Agenzia Spaziale Italiana; ASI).

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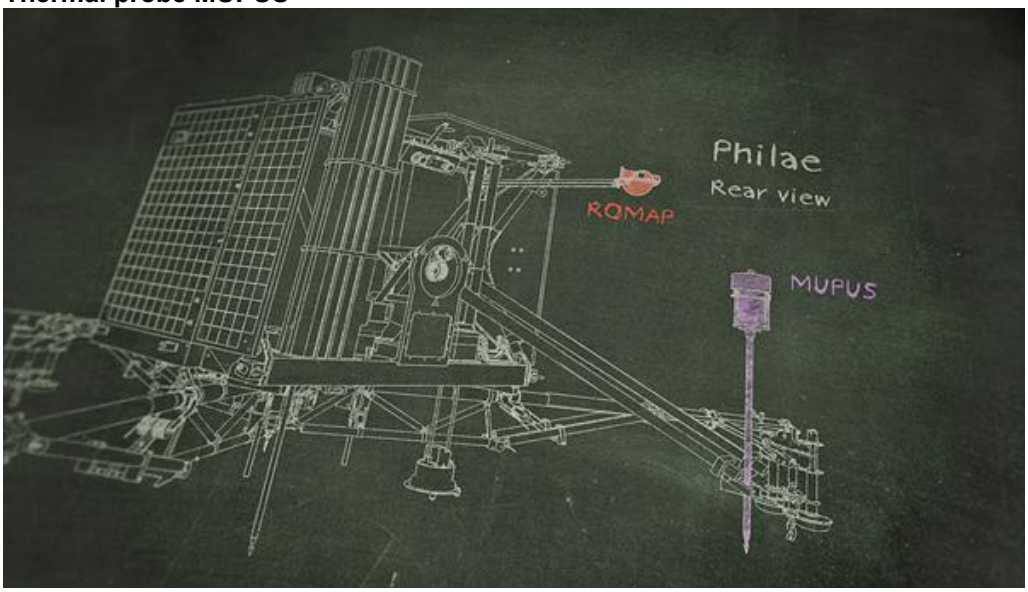
**Thermal probe MUPUS**




The thermal probe MUPUS measures the temperature on and beneath the comet's surface, as well as the thermal conductivity of the surface material.

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