Philae spacecraft lands successfully on comet

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Initial touchdown of the Philae lander module at its designated landing site on Comet 67P/Churyumov-Gerasimenko was confirmed yesterday at 16:03 UTC. The module, part of the Rosetta mission, will be the first spacecraft to perform on site analysis of a comet's composition. Reports from both the lander and the Rosetta orbiter indicate that the scientific instruments on board are functioning properly. They have already begun to send back data.

Jubilation broke out among the science teams at the European Space Operations Centre in Darmstadt, Germany, and other national operation centers of the European Space Agency (ESA) upon radio confirmation of contact with the comet and continuing telemetry from the lander. Rosetta was launched ten years ago and has so far involved 2,000 people and cost 1.4 billion Euros.

Placing Philae on Comet 67P posed unique problems. It is more than 500 million kilometers away, meaning that there is a delay of nearly an hour between when the ESA sends a signal and confirmation that said signal was acknowledged. (The delay between Earth and the Mars Curiosity rover during its landing was a quarter of that time.) The consistency of the landing area was almost wholly unknown in advance, with speculation that ranged from a hard crust to the texture of cotton candy. At the surface of the comet, the lander weighs as much as a sheet of paper does on Earth.

Moreover, comets are active bodies which begin to shed parts of their icy exterior as they orbit closer to the Sun. As such, aggressive measures are required to make sure that a spacecraft on the surface of a comet stays in place.

To facilitate this, Philae has a tripod landing platform equipped with ice screws which actively engage on landing, two harpoons as additional anchors and a cold-gas thruster designed to gently push the lander into the comet while it secures itself so it doesn't bounce off the surface.

However, not everything went as planned. Both the thruster and harpoons did not activate when needed. Measurements from the onboard magnetic field analyzer indicate that the lander sank some four centimeters into the comet's surface and then rebounded twice. Throughout this, science data was returned to Earth so it is suspected that Philae eventually did make a soft landing on the surface using only the tripod and ice screws.

Assuming the lander survives the events of its first day and finds a secure purchase aboard 67P, it is expected to function until roughly March when increasing temperatures from the comet's approach to the Sun will produce failure in its electronics. The orbiter is expected to continue to function throughout the close approach to the Sun, eventually requiring deactivation when distance from the Sun produces insufficient power to operate its instruments.

The excitement surrounding Rosetta and Philae is not merely for the technical challenge of orbiting around and landing on a comet. The frozen volatile materials in comets, kept in “cold storage” for most of the age of the solar system at far distances from the Sun, are a window into the early formation of the Solar nebula from which the Sun and the planets formed.

The nine scientific instruments aboard Philae will image the surface, measure the properties of the comet's solid material including sound waves generated as its material volatilizes and sends jets of debris into space, determine the chemical composition of the volatile gases and the non-volatile dusts, and study the interaction of the solar wind and magnetic fields with the comet as it approaches the Sun.

Such studies may also provide insight into the origin of life on Earth. Comets are largely ice and it is suspected that many of them crashed into our planet during and after its formation, providing the water that now acts as the critical component of life on our world. Comets also may have provided Earth's first complex organic molecules in a similar fashion.

These questions have been explored on other worlds by previous landings. Spacecraft have successfully landed on two planets, Venus (first by USSR probe Venera 7 in 1970) and Mars (first by USSR probe Mars 3 in 1971, which failed shortly after landing and the US Viking probes of 1976, which were fully successful). The first unmanned landing on the Moon was made by USSR probe Luna 9 in 1966: another nineteen landings would follow, including the six epochal US Apollo manned landings between 1969 and 1972.

Saturn's moon Titan became the most distant object to be landed on in 2005 when the Huygen's probe, part of the NASA Cassini mission, touched down. A probe was dropped in 1995 into Jupiter's atmosphere from the US Galileo mission to slowly parachute downwards until it was crushed by the immense pressure of Jupiter's lower atmospheric layers.

Aside from these major solar system bodies, only one additional landing has been made until now: the US Near Earth Asteroid Rondezvous (NEAR) mission orbited asteroid Eros in 2000, and though it had no landing gear and was not engineered for a landing, the gentle gravity of Eros permitted the spacecraft to be gently set down on its side at the end of the mission in 2001. Another “accidental” landing occurred by the Japanese probe Hayabusa in 2005, which tried to gather a sample from asteroid Itokawa and ended up using an unconventional approach to stay on the asteroid for 30 minutes.

Rosetta and Philae are testaments to the ambition, planning and technical capacity of humanity, even while under the burden of the endless pursuit of profits by the ruling elite. This most recent achievement is but one small indication of what will be achieved when the power of science is freed from those shackles.