

## **Rosetta Mission: way to the comet length of 10 years**

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Rosetta mission's safe landing gives scientists their first chance to ride a comet and study close up what happens as it gets closer to the sun.

Scientists understand the broad strokes of solar system evolution, and how one like ours could come about. But to work out the details, we need to examine primordial material close-up — and it just so happens the ESA's Rosetta probe is studying a comet right now. One of the prevailing theories is that magnetic fields helped to bringing together the beginnings of planets, moons, and comets, but the latest analysis of data from comet 67P/Churyumov-Gerasimenko doesn't support the magnetic field hypothesis. Interestingly, we might never have known this if the Rosetta/Philae mission had gone exactly to plan.

The Rosetta mission consists of two main components. There's the Rosetta probe, which was launched a decade ago en route to rendezvous with 67P as it approached the sun. Then, once it reached and entered orbit of the 2.5 mile-long object, Rosetta released a lander called Philae. This robot descended to the surface, and was supposed to deploy harpoons to anchor itself after it made contact.

The signal broke a seven-hour wait of agonising intensity and sparked scenes of jubilation at the European Space Agency's mission control in Darmstadt. The team of the Rosetta mission achieved as the saying goes an impossible task. They land a robotic spacecraft on a comet for the first time in history.

The moment of tension was broken shortly after 1600 GMT when the Philae called home. "We are there. We are sitting on the surface. Philae is talking to us," said a Stephan Ulamec, Philae lander manager at the DLR German space centre. "We are on the comet."

Andrea Accomazzo, the Rosetta flight operations director, added: "We cannot be happier than we are now."

But the celebrations were marred by the late discovery that the probe's two harpoons had not fired to secure the craft down into the ultra-gravity. Scientists now think that the probe could bounce off

after the first contact with the surface. Ulamec said: “Maybe today we didn’t just land once, we landed twice.”

Instead of setting down at the intended location, Philae has experienced two different landings and several small rebound. The last bounce was a grazing collision with a crater rim that sent it tumbling to its final resting place in a shadowy area of terrain near a cliff. Lack of sufficient sunlight Philae led to premature shutdown, but gravity data of his trip across the surface of the comet is very useful.

Safe, though unstable, touchdown of the lander gives scientists a unique opportunity to ride aboard a comet and study the surface what happens as its activity ramps up as it gets closer to the sun. The first images from the lander showed the stunning landscape of pits and cliffs, craters and boulders. Nevertheless, there were gaps in his radio communications with orbital mother ship Rosetta.

It was a long way to the surface of a comet for the Philae. The Rosetta mission launched toward Comet 67P/C-G in 2004 and traveled about 4 billion miles through the solar system before reaching the comet in August. Since then, the two spacecraft have been warming up their instruments and prepare for landing, learned to fly in an orbit around the strange shape of the comet. “We are the first to do this, and that will stay forever,” said Jean Jacques Dordain, director general of the ESA.

£ 1bn (\$ 1.58bn) for the Rosetta mission, aimed at disclosing the secrets of comets, made of ancient material prior to the birth of the solar system. In the data Rosetta and Philae collect, researchers hope to learn more about how the solar system formed and how comets carry water and complex organic chemistry on the planet, preparing phase of life on Earth.

From its vantage point on the surface, the lander can drill down 20cm and collect samples of subsurface material for on-the-spot testing. On board Philae are 10 instruments, including one from the Open University named Ptolemy, which will bake the pieces of the comet material and analyze the evolved gases, to create a picture of the composition of the comet. Another tool will show the internal structure of the comet's carrying radio waves through the icy body to the Rosetta comet on the other side.

It is planned that the mission Rosetta will run until December 2015, but if there is enough fuel left in the tanks of a spacecraft, mission controllers can extend her life for six months and give mothership more tasks with a high degree of risk, such as flying through one of gas and dust streams escaping from the comet. Philae has an initial capacity of the battery for 40 hours of work, but then switch to batteries that are recharged by sunlight.

The lander can continue to run until March next year, when the electronics heat up enough to operate properly. Even when Philae packs up, it may still cling on to the comet, perhaps for several 6.45-year-long laps around the sun, before enough material erodes from the comet's surface for the lander to lose its grip.

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