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Factsheet

Rosetta, the comet-chaser arrives at destination

After an incredible 10-year voyage through the Solar System, Rosetta, the European comet-chaser arrived in the vicinity of the comet 67P/Churyumov-Gerasimenko on August 6, 2014. The designated landing site, recently named Agilkia, is located on the smaller of the two lobes of the comet. On 12th November, at 08:35 GMT/09:35 Swiss time - when it will be 22.5 km away from the comet's center - Rosetta will release its lander Philae. Touch-down is expected about seven hours later and confirmation should reach the Earth at around 17:00, Swiss time.

Aim of the mission

Rosetta is the satellite for ESA's comet-chasing mission to 67P/Churyumov-Gerasimenko where it will make the most detailed study of a comet ever attempted. It will follow the comet on its journey through the inner Solar System, measuring the increase in activity as the icy surface is warmed up by the Sun. The lander will focus on the composition and structure of the comet nucleus material. It will also drill more than 20cm into the subsurface to collect samples for inspection by the lander's onboard laboratory.

Rosetta has become the first spacecraft to rendezvous with a comet, opening a new chapter in Solar System exploration. Comets are considered to be the most primitive building blocks of our cosmic neighbourhood, surviving the Solar System's chaotic 4.6 billion-year history more or less intact. Laced with ice and organic materials, comets likely helped to 'seed' Earth with water, and perhaps even the ingredients for life. But many fundamental questions about these enigmatic objects remain, and thanks to this ambitious mission of ESA, we should now be able to significantly increase our knowledge in this area. Rosetta gets its name from the famous Rosetta stone that led to the deciphering of Egyptian hieroglyphs almost 200 years ago. Similarly, scientists hope that Rosetta will unlock the mysteries of how the Solar System evolved.

Voyage through the Solar System

The comet is in an elliptical 6.5-year orbit that takes it from beyond Jupiter at its furthest point, to between the orbits of Mars and Earth at its closest to the Sun. Rosetta will accompany it for over a year as they swing around the Sun and back out towards Jupiter again.

Launched on March 2, 2004, Rosetta has traveled for 10 years and has had to make three gravity-assist flybys of Earth (4 March 2005, 13 November 2007 and 13 November 2009) and one of Mars (25 February 2007), to help it on course to its rendezvous with the comet. This complex course also allowed Rosetta to pass by asteroids Šteins and Lutetia, obtaining unprecedented views and scientific data on these two objects. The comet and Rosetta are now at over 500 million km away from the Earth.

At launch, Rosetta was about 150 million km from the Sun, but at its furthest point it was close to the orbit of Jupiter, nearly 800 million km away. In August 2015, the spacecraft will return to within 185 million km when the comet is between the orbits of Earth and Mars. This greatly changing distance translates into wide ranges in solar intensity and heating, and has required special planning.

When Rosetta woke up from deep-space hibernation in early 2014, there was still a 9 million km gap to close before meeting its

target. A series of critical 'braking' manoeuvres with Rosetta's thrusters between May and August reduced the speed of the spacecraft relative to its target, and images of the distant comet against the background of stars were taken by Rosetta to refine the approach trajectory. At the beginning of August and at a reduced speed, Rosetta arrived at a distance of around 100 km, making history as the first mission to rendezvous with a comet.

In summer 2014, Rosetta was orbiting at an altitude of 30–10 km above the comet, allowing detailed mapping of its nucleus with resolution of 20–50 cm on the surface. This phase also made it possible to choose the landing site « Agilkia » for Philae.

Over and above the selection of Agilkia and thanks to Rosetta's extensive suite of multi-wavelength cameras, spectrographs, mass spectrometers and other scientific instruments, it will be possible to obtain a comprehensive understanding of the characteristics of the comet, its composition and environment, both by studying the nucleus itself remotely and by measuring the properties of the gas, dust and plasma in the halo around the comet.

This initial 'close-in' phase - before the comet becomes more active and Rosetta needs to move further away - is particularly critical. One of the unique aspects of the mission is that it will ride along with the comet for more than a year, in tandem as they pass through the closest approach to the Sun in August 2015 and beyond. The observations made in 2014 will provide initial activity measurements and a detailed characterisation of the nucleus that will be fundamental in following the evolution of the comet during the entire escort phase.

Historic Premières

Rosetta is the first mission ever to orbit a comet's nucleus and land a probe on its surface. It will also be the first spacecraft to fly alongside a comet as it heads towards the inner Solar System, watching how a frozen comet is transformed by the warmth of the Sun.

Rosetta is the first space mission to journey beyond the main asteroid belt and rely solely on solar cells for power generation, rather than the traditional radio-isotope thermal

generators. The new solar-cell technology used on the orbiter's two giant solar panels allows it to operate over 800 million km from the Sun, where sunlight levels are only 4% of those on Earth.

Instruments & Swiss participation

The main spacecraft measures 2.8 x 2.1 x 2.0 m with two 14 metre long solar panels. It carries instruments for remote sensing and radio science, and instruments to study the composition, mass distribution and dust flux of the comet's nucleus, as well as the comet plasma environment and its interaction with the solar wind. The orbiter's scientific payload is provided mainly by scientific consortia from institutes across Europe. The orbiter's 11 scientific instruments are accommodated on one side of the spacecraft, which will permanently face the comet during the operational phase of the mission.

Until its release, the 100kg Philae lander is carried on the opposite side of the orbiter. As Philae touches down on the comet, two harpoons will anchor it to the surface; the self-adjusting landing gear will ensure that it stays upright, even on a slope, and then the lander's feet will drill into the ground to secure it to the comet's surface in the low gravity environment. Philae carries 9 scientific instruments, including a drill to sample subsurface material.

The mission benefits from significant contribution by Swiss participants, including among others: APCO Technologies (ROSINA [Rosetta Orbiter Spectrometer for Ion and Neutral Analysis] - RTOF sensor, ground support equipment), Clemessy (ground electrical equipment), the CSEM (microcameras), EMPA (ROSINA ion-optic sensors), Fisba Optik (panoramic and stereo camera lens), Realtechnologie AG (lander-lab engine), RUAG (ROSINA DFMS sensor, relay antennae, solar panel pointing mechanisms), Syderal (ground electrical equipment) and UniBE (development, testing et management of ROSINA), also the lead for the experiments which will determine the composition of the atmosphere and the ionosphere of the comet, as well as the temperature, speed and gas density.

Throughout the day, live coverage of the key events will be provided by ESA TV from the ESA European Center for Space Operations (ESOC) in Darmstadt (Germany). In addition, on November 12th, a dedicated event co-organised by the CSEM and UniBE with

the support of the SERI will be held in Bern from 16:00.

For more information and participation :
<http://www.csem.ch/site/forms/2014-event-philae.htm>

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