German Aerospace Center

DLR

ARCHIVED

News-Archiv

Philae and Rosetta gear up for asteroid Lutetia

5 July 2010

Update on 6 July: According to latest estimates, Rosetta's closest approach is scheduled for 17:44:56 CEST (spacecraft event time) on 10 July. At this time, Lutetia will be 3162 km from the spacecraft.

Where is Rosetta?

The Rosetta orbiter, which carries the DLR lander Philae, has completed more than two thirds of its journey to the comet Churyumov-Gerasimenko. The most comprehensive cometary investigation ever, the mission will deliver DLR's Philae lander to the comet's surface for in situ studies. The spacecraft and lander are due to close in on 21 Lutetia, a large Main Belt Asteroid on 10 July.

Artist's impression of Rosetta asteroid fly-by

Since launch, Rosetta has travelled roughly 5 billion kilometres. The solar-powered orbiter was launched on an Ariane 5 in 2004. It has used several gravity assist manoeuvres – three from Earth and one from Mars – to gain the necessary momentum, refine its trajectory and match the orbit of the comet once it reaches the outer Solar System. The orbiter will circle the comet and, after delivering Philae to the surface, eventually escort the comet on its way to the Sun.

At 100 kilometres in size, 21 Lutetia is one of the larger Main Belt Asteroids. The lander will investigate whether the asteroid has a magnetic field and an exosphere, and study their characteristics.

Philae will first be switched on between 12:45 and 15:05 CEST on 7 July so the team can prepare the lander for activities around closest approach. The lander will perform science observations on 10 July.

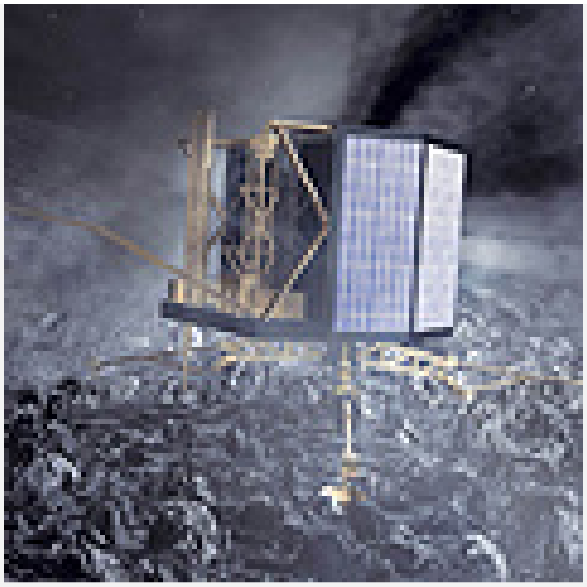
Philae to help uncover Lutetia's true nature

OSIRIS image taken during Rosetta's last Earth swingby (2009)

This observation sequence will take place during the asteroid flyby itself, with the lander switching on at 08:45 CEST on 10 July. It will be on throughout the flyby; closest approach is scheduled for 17:45 CEST. The lander and orbiter will be 3169 kilometres from Lutetia, according to recent estimates.

Three instruments on the lander will be switched on during the flyby:

- The Rosetta Lander Magnetometer and Plasma Monitor, ROMAP, is a magnetometer and plasma monitor that will study the local magnetic field and monitor the interactions between the comet - the asteroid in case of the Lutetia flyby - and the solar wind.
- MODULUS PTOLEMY is one of two evolved gas analysers, which obtains accurate measurements of isotopic ratios of light elements by heating solid samples to release volatiles. For the flyby, the instrument will perform 'sniff' measurements as the asteroid will be at quite a distance from the spacecraft.
- The Cometary Sampling and Composition experiment, COSAC, is also an evolved gas analyser. It detects and identifies complex organic molecules from their elemental and molecular composition.



Philae landing on the comet

ROMAP will be measuring continuously while it is on (between 7:06 am and 5:50 pm CEST) and will be looking for interactions between the asteroid's magnetic field and the solar wind. COSAC and PTOLEMY will perform a series of sniff measurements (five by PTOLEMY and two by COSAC), which will be used to help determine whether or not the asteroid has an exosphere.

Scientists are not sure whether Lutetia is an M-class (metallic) asteroid or if it is a C-type (chondrite). The lander observations will help to ascertain this by studying the composition of the possible exosphere, and by studying the asteroid's thermal history and the presence of magnetic minerals. This will help identify Lutetia's age and asteroid type.

The orbiter began refining its path to Lutetia using its optical navigation cameras on 31 May. Unusually, the lander will be illuminated by the Sun around the time of the Luteita flyby. This is why the team will put the lander into a special thermal configuration to keep it within its nominal thermal range.

Operating Philae

At closest approach, Rosetta will be travelling past Lutetia at 15 kilometres per second – or 54,000 kilometres per hour. This is comparable to sending a radio-controlled car down an autobahn at roughly 100 kilometres per hour to take pictures of a stationary object it passes in the next lane (just about six metres away), with the exact timing of the commands fixed a month in advance. If that doesn't sound hard enough, the planning would also have to be done from so far away that the autobahn would be twice as far as the Moon is from Earth.

The DLR team at the Philae Lander Control Centre in Cologne works closely with ESA's European Space Operations Centre, ESOC, where the Rosetta Mission Control Centre is located.

The Lander Operations Team in the control room

The Lander Control Centre is responsible for operating the lander, but the Lander Operations Team cannot command the lander directly themselves in such a way as to push a button and have a command sent. The Mission Control Centre is informed of the commands to be sent to the lander by the team in Cologne via a formal interface, and the Rosetta Mission Operations Team in ESOC uploads them to the orbiter. The orbiter stores these commands in its mission timeline and then relays these commands to the lander at a specified time; finally, the lander executes those commands at another specified time.

Using a similar method to that employed for telecommanding, the lander passes its telemetry to the orbiter, which then transmits it back to Earth. It is worth noting that the commands and telemetry are radio transmissions, which travel at the speed of light – but even so, the enormous distance between Rosetta and Earth means it will take 25 minutes for these messages to travel to or from the spacecraft. Thus, when a command is sent, it takes almost an hour before confirmation of receipt of that command sent by the spacecraft arrives back on Earth. Because of this delay, all commands are stored in the spacecraft's mission timeline well in advance of an event; indeed, the commands for the flyby are already on board. The spacecraft will execute them automatically at the relevant time, although it would still be possible to send additional commands in the event of an emergency.

During the flyby on 10 July, the team will be monitoring the lander telemetry very closely from the control room and will keep an eye on the lander's health. Since all the commands for the flyby are already in the orbiter's mission timeline, the team does not expect to have to send any commands during the event.

Your DLR online team will cover the flyby on the 10th via the DLR website and Twitter channels. Stay tuned.

Contact

Henning Krause
German Aerospace Center

Corporate Communications
Tel: +49 2203 601-2502
Fax: +49 2203 601-3249
E-Mail: henning.krause@dlr.de

Dr. Stephan Ulamec
German Aerospace Center
Space Operations and Astronaut Training
Tel: +49 2203 601-4567
E-Mail: Stephan.Ulamec@dlr.de

Contact details for image and video enquiries as well as information regarding DLR's terms of use can be found on the DLR portal imprint.