ROLIS – approaching 67P/Churyumov-Gerasimenko in 3D

21 November 2014

Just three kilometres from Comet 67P/Churyumov-Gerasimenko, the ROsetta Lander Imaging System (ROLIS) acquired images of the 'head' and underlying 'body' of Comet 67P. Immediately below is the planned landing site, Agilkia; in the top right of the field of view, one of the landing gear feet can be seen as the camera on the underside of the lander approaches the comet's surface at walking pace. Two of the images, acquired two minutes apart on 12 November 2014 – about an hour before the first touchdown at 16:32 CET – were used by the ROLIS team under the leadership of Stefano Mottola from the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) to produce this stereographic image. To appreciate the 3D effect, the image must be viewed with red-blue glasses. The resolution is three metres per pixel.

ROLIS sent the first images to the Rosetta orbiter even before the first landing –emptying its memory for the next recordings. "When the camera was developed 20 years ago, memory cards did not exist," says planetary scientist Mottola. "ROLIS therefore has a limited amount of memory – just 16 megabytes, which is one thousandth of the amount of data that can be stored on today's USB sticks." Live transmission of the data was not possible. The camera acquired an image every 10 seconds – that is, approximately every 10 metres during the descent – repeatedly overwrote the previous recordings, and finally sent the last seven images to Earth immediately after the first landing. For researchers, these images are of utmost importance for their scientific work, because they want to analyse the fine structure of the comet surface.

Very close to the comet

At a distance of 10 metres, a single image pixel corresponds to one centimetre. “This means that, from a height of 10 metres, we can see a 10 by 10 metre area of the comet. Within this area we can see objects just one centimetre in size." When Philae is on the comet surface, the camera can acquire images with a resolution of 0.6 millimetres per pixel. "These are the first images of a comet acquired this close and at this high resolution," says Mottola. The camera system was even able to compress the first data and send it to the orbiter during Philae’s two bounces, which caused it to land about one kilometre away from where it touched down initially. This data alone is valuable for Mottola and his team at the DLR Institute of Planetary Research.

After the third and final landing, the ROLIS camera was operated again. During night-time on the comet, it imaged the area directly under the lander while it was illuminated with four different coloured light-emitting diodes (LEDs). One last image was acquired during the night of 14 to 15 November. Once the team at the DLR Lander Control Center (LCC) at DLR had turned the lander and its solar panels towards the Sun, the ROLIS camera acquired an image intended to allow the engineers and scientists to get a clearer picture of the position that Philae is now in.

Interpret and understand

The evaluation of these images of a distant, unknown world begins now. "First we want to find out whether the camera on the bottom side of the lander is looking at the comet surface or at vertical structures adjacent to the lander," says Mottola. "In addition, we expect to use the images to understand the fine structure of 67P/Churyumov-Gerasimenko." They are expected to provide information about the activity of the comet and how erosion – viewed from up close – develops. But to do this, researchers must, among other things, also perform experiments on Earth to simulate and interpret what they have seen on the comet with their camera. "In the ROLIS images, we see a three-dimensional structure, which we will analyse and reconstruct." This is complex, challenging work, because prior to the ROLIS images, the scientists did not

know what they would encounter on 67P/Churyumov-Gerasimenko. “This is really new territory – and we have to explore its mysteries."

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).

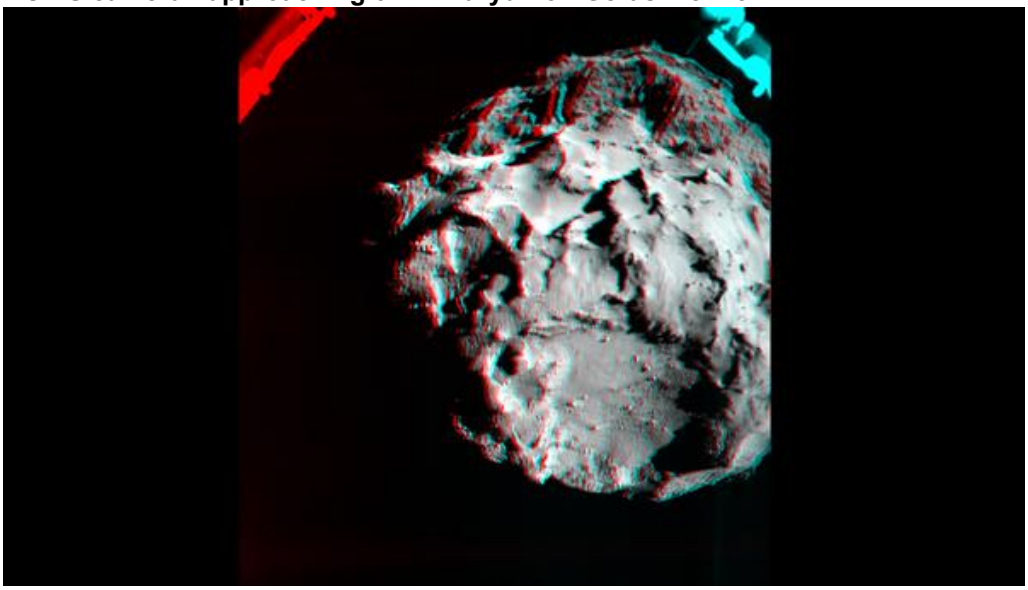
ROLIS was developed by the DLR Institute of Planetary Research in Berlin.

Contacts

Manuela Braun
German Aerospace Center (DLR)
Media Relations, Space Research
Tel.: +49 2203 601-3882
Fax: +49 2203 601-3249
Manuela.Braun@dlr.de

Dr. Stefano Mottola
German Aerospace Center (DLR)
DLR Institute of Planetary Research
Tel.: +49 30 67055-335
Stefano.Mottola@DLR.de

ROLIS camera - approaching 67P/Churyumov-Gerasimenko



This stereographic image of Comet 67P/Churyumov-Gerasimenko was acquired by the ROLIS camera, located on the bottom of the Philae lander . Two of the images, acquired two minutes apart on 12 November 2014 – about an hour before the first touchdown at 16:32 CET – were used by the ROLIS team under the leadership of Stefano Mottola from the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) to produce this stereographic image. To appreciate the 3D effect, the image must be viewed with red-blue glasses. The resolution is three metres per pixel.

Credit: ESA/Rosetta/Philae/ROLIS/DLR.

Comet 67P/Churyumov-Gerasimenko from three kilometres away

This image was acquired by the ROLIS instrument on board Philae at 15:38:41 CET on 12 November 2014 as Philae approached the comet for landing. It was taken from about three kilometres above the comet's surface and has a resolution of about three metres per pixel.

Credit: ESA/Rosetta/Philae/ROLIS/DLR .

ROLIS captures Comet 67P Churyumov-Gerasimenko

This image was acquired by the Rosetta Lander Imaging System (ROLIS) on board the Philae Lander from a height of approximately 40 metres, before the first touchdown. The resolution is four centimetres per pixel.

Credit: SA/Rosetta/Philae/ROLIS/DLR .

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