

Rosetta is now first spacecraft to rendezvous with a comet

6 August 2014



Comet 67P/Churyumov-Gerasimenko by Rosetta's OSIRIS narrow-angle camera on 3 August from a distance of 285 km. The image resolution is 5.3 metres/pixel. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

After a decade-long journey chasing its target, ESA's Rosetta has today become the first spacecraft to rendezvous with a comet, opening a new chapter in Solar System exploration.

Comet 67P/Churyumov-Gerasimenko and Rosetta now lie 405 million kilometres from Earth, about half way between the orbits of Jupiter and Mars, rushing towards the inner Solar System at nearly 55 000 kilometres per hour.

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.

Comets are considered to be primitive building

blocks of the Solar System and may have helped to 'seed' Earth with water, perhaps even the ingredients for life. But many fundamental questions about these enigmatic objects remain, and through a comprehensive, in situ study of the comet, Rosetta aims to unlock the secrets within.

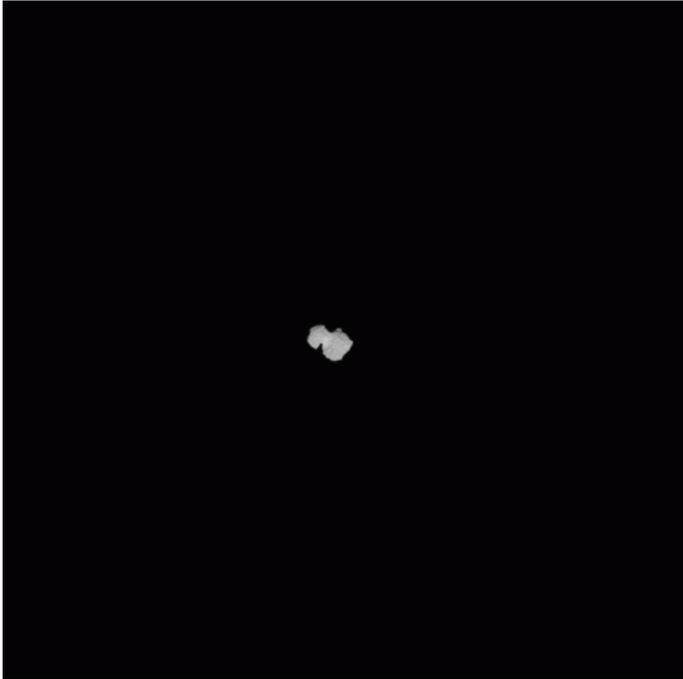
The journey to the comet was not straightforward, however. Since its launch in 2004, Rosetta had to make three gravity-assist flybys of Earth and one of Mars to help it on course to its rendezvous with the comet. This complex course also allowed Rosetta to pass by asteroids Šteins and Lutetia, obtaining unprecedented views and scientific data on these two objects.

"After ten years, five months and four days travelling towards our destination, looping around the Sun five times and clocking up 6.4 billion kilometres, we are delighted to announce finally 'we are here'," says Jean-Jacques Dordain, ESA's Director General.

"Europe's Rosetta is now the first spacecraft in history to rendezvous with a comet, a major highlight in exploring our origins. Discoveries can start."

Today saw the last of a series of ten rendezvous manoeuvres that began in May to adjust Rosetta's speed and trajectory gradually to match those of the comet. If any of these manoeuvres had failed, the mission would have been lost, and the spacecraft would simply have flown by the comet.

"Today's achievement is a result of a huge international endeavour spanning several decades," says Alvaro Giménez, ESA's Director of Science and Robotic Exploration.



This animation comprises 101 images acquired by the Navigation Camera on board ESA's Rosetta spacecraft as it approached comet 67P/C-G in August 2014. The first image was taken on 1 August at 11:07 UTC (12:07 CEST), at a distance of 832 km. The last image was taken 6 August at 06:07 UTC (08:07 CEST) at a distance of 110 km. Credit: ESA/Rosetta/Navcam

"We have come an extraordinarily long way since the mission concept was first discussed in the late 1970s and approved in 1993, and now we are ready to open a treasure chest of scientific discovery that is destined to rewrite the textbooks on comets for even more decades to come."

The comet began to reveal its personality while Rosetta was on its approach. Images taken by the OSIRIS camera between late April and early June showed that its activity was variable. The comet's 'coma' – an extended envelope of gas and dust – became rapidly brighter and then died down again over the course of those six weeks.

In the same period, first measurements from the Microwave Instrument for the Rosetta Orbiter, MIRO, suggested that the comet was emitting water vapour into space at about 300 millilitres per second.

Meanwhile, the Visible and Infrared Thermal Imaging Spectrometer, VIRTIS, measured the comet's average temperature to be about -70°C , indicating that the surface is predominantly dark and dusty rather than clean and icy.

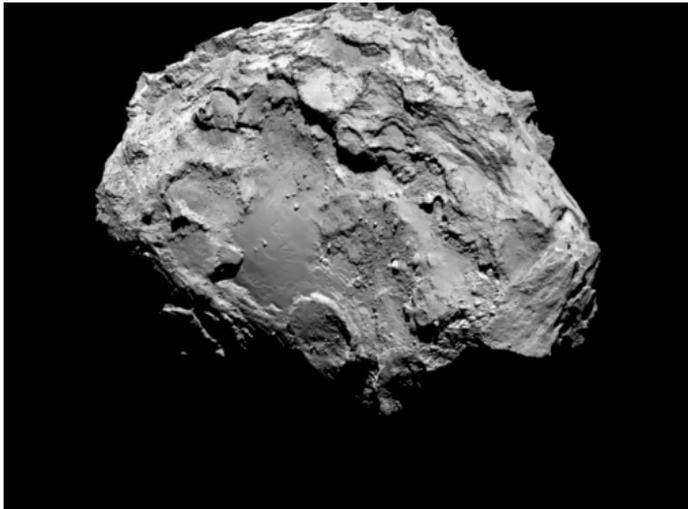
Then, stunning images taken from a distance of about 12 000 km began to reveal that the nucleus comprises two distinct segments joined by a 'neck', giving it a duck-like appearance. Subsequent images showed more and more detail – the most recent, highest-resolution image was downloaded from the spacecraft earlier today and will be available this afternoon.

"Our first clear views of the comet have given us plenty to think about," says Matt Taylor, ESA's Rosetta project scientist.

"Is this double-lobed structure built from two separate comets that came together in the Solar System's history, or is it one comet that has eroded dramatically and asymmetrically over time? Rosetta, by design, is in the best place to study one of these unique objects."

Today, Rosetta is just 100 km from the comet's surface, but it will edge closer still. Over the next six weeks, it will describe two triangular-shaped trajectories in front of the comet, first at a distance of 100 km and then at 50 km.

At the same time, more of the suite of instruments will provide a detailed scientific study of the comet, scrutinising the surface for a target site for the Philae lander.



Comet 67P/Churyumov-Gerasimenko by Rosetta's OSIRIS narrow-angle camera on 3 August from a distance of 285 km. The image resolution is 5.3 metres/pixel. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

Eventually, Rosetta will attempt a close, near-circular orbit at 30 km and, depending on the activity of the comet, perhaps come even closer.

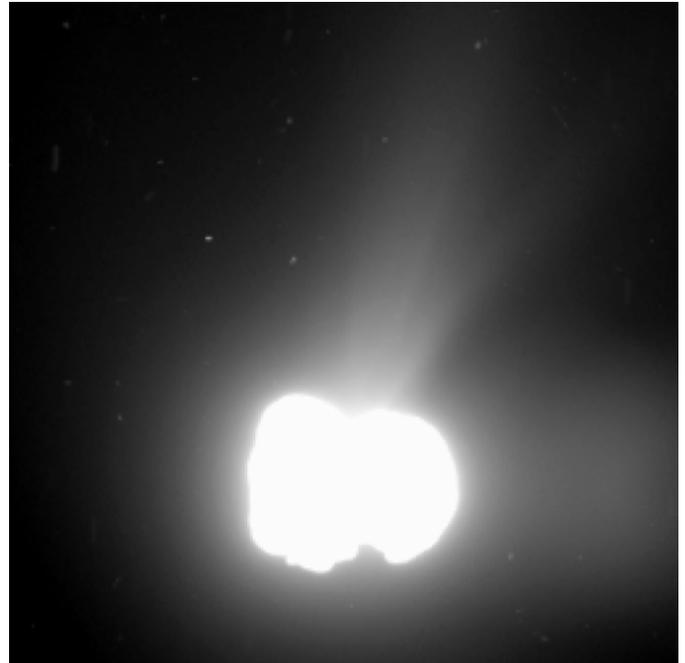
"Arriving at the comet is really only just the beginning of an even bigger adventure, with greater challenges still to come as we learn how to operate in this uncharted environment, start to orbit and, eventually, land," says Sylvain Lodiot, ESA's Rosetta spacecraft operations manager.

As many as five possible landing sites will be identified by late August, before the primary site is identified in mid-September. The final timeline for the sequence of events for deploying Philae – currently expected for 11 November – will be confirmed by the middle of October.

"Over the next few months, in addition to characterising the [comet nucleus](#) and setting the bar for the rest of the mission, we will begin final preparations for another space history first: landing on a comet," says Matt.

"After landing, Rosetta will continue to accompany the comet until its closest approach to the Sun in

August 2015 and beyond, watching its behaviour from close quarters to give us a unique insight and realtime experience of how a comet works as it hurtles around the Sun."



Comet 67P/Churyumov-Gerasimenko activity on 2 August 2014. The image was taken by Rosetta's OSIRIS wide-angle camera from a distance of 550 km. The exposure time of the image was 330 seconds and the comet nucleus is saturated to bring out the detail of the comet activity. Note there is a ghost image to the right. The image resolution is 55 metres per pixel. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

Rosetta woke up from deep space hibernation at 18:18 GMT on 20 January 2014, nine million kilometres from comet 67P/Churyumov-Gerasimenko. Following wake-up, the orbiter's 11 science instruments and 10 lander instruments were reactivated and readied for science observations. Ten orbital correction manoeuvres were carried out between 7 May and 6 August, reducing the spacecraft's velocity with respect to the comet from 775 m/s to 1 m/s, equivalent to walking pace. Each of these manoeuvres was critical: if any had failed, no rendezvous would have been possible.

The latest 'arrival' image will be presented in the science session of today's 'Rosetta [comet rendezvous](#)' event at ESA's Space Operations Centre, ESOC, in Darmstadt, Germany, and in parallel will be published online on the ESA Portal.

Provided by European Space Agency

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