

Rosetta's lander Philae will target Site J

September 15 2014



Philae's primary landing site will target Site J, the centre of which is indicated by the cross in this OSIRIS narrow-angle image. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

(Phys.org) —Rosetta's lander Philae will target Site J, an intriguing region on Comet 67P/Churyumov–Gerasimenko that offers unique scientific potential, with hints of activity nearby, and minimum risk to the lander compared to the other candidate sites.

Site J is on the 'head' of the comet, an irregular shaped world that is just over 4 km across at its widest point. The decision to select Site J as the primary site was unanimous. The backup, Site C, is located on the 'body' of the comet.

The 100 kg lander is planned to reach the surface on 11 November, where it will perform indepth measurements to characterise the nucleus in situ, in a totally unprecedented way.

But choosing a suitable [landing site](#) has not been an easy task.

"As we have seen from recent close-up images, the comet is a beautiful but dramatic world – it is scientifically exciting, but its shape makes it operationally challenging," says Stephan Ulamec, Philae Lander Manager at the DLR German Aerospace Center.

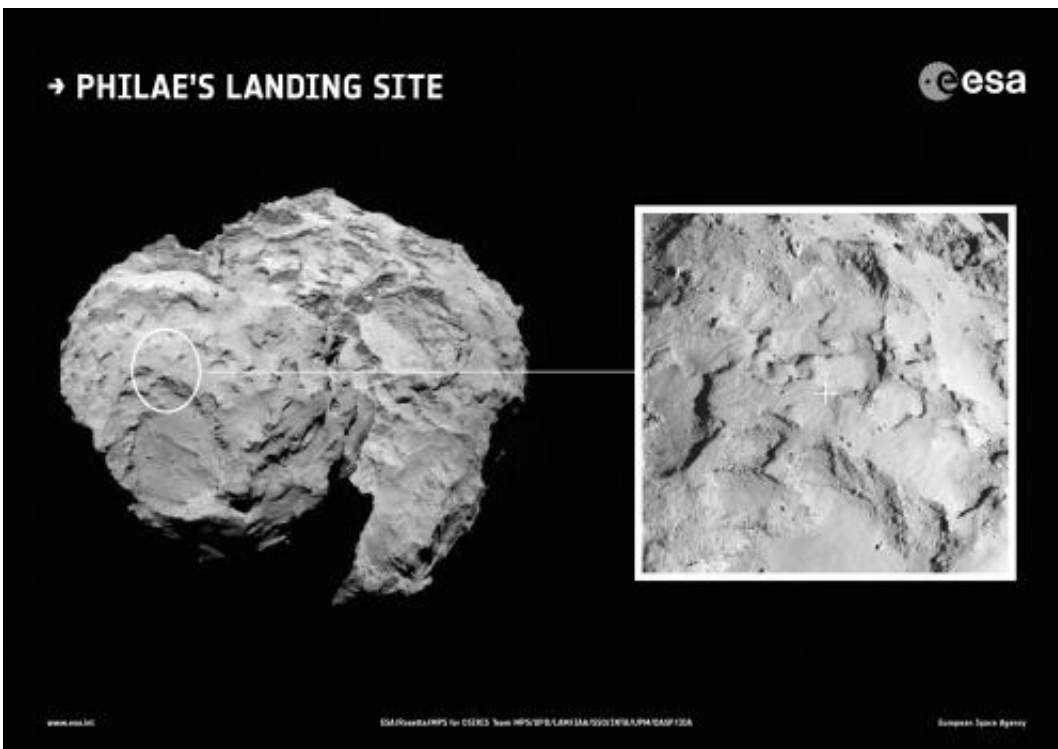
"None of the candidate landing sites met all of the operational criteria at the 100% level, but Site J is clearly the best solution."

"We will make the first ever in situ analysis of a comet at this site, giving us an unparalleled insight into the composition, structure and evolution of a comet," says Jean-Pierre Bibring, a lead lander scientist and principal investigator of the CIVA instrument at the IAS in Orsay, France.

"Site J in particular offers us the chance to analyse pristine material, characterise the properties of the nucleus, and study the processes that drive its activity."

The race to find the landing site could only begin once Rosetta arrived at the comet on 6 August, when the comet was seen close-up for the first time. By 24 August, using data collected when Rosetta was still about 100 km from the comet five candidate regions had been identified for further analysis.

Since then, the spacecraft has moved to within 30 km of the comet, affording more detailed scientific measurements of the candidate sites. In parallel, the operations and flight dynamics teams have been exploring options for delivering the lander to all five candidate landing sites.



Philae's primary landing site in context. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

Over the weekend, the Landing Site Selection Group of engineers and

scientists from Philae's Science, Operations and Navigation Centre at France's CNES space agency, the Lander Control Centre at DLR, scientists representing the Philae Lander instruments and ESA's Rosetta team met at CNES, Toulouse, France, to consider the available data and to choose the primary and backup sites.

A number of critical aspects had to be considered, not least that it had to be possible to identify a safe trajectory for deploying Philae to the surface and that the density of visible hazards in the landing zone should be minimal. Once on the surface, other factors come into play, including the balance of daylight and nighttime hours, and the frequency of communications passes with the orbiter.

The descent to the comet is passive and it is only possible to predict that the landing point will place within a 'landing ellipse' typically a few hundred metres in size.

A one square kilometre area was assessed for each candidate site. At Site J, the majority of slopes are less than 30° relative to the local vertical, reducing the chances of Philae toppling over during touchdown. Site J also appears to have relatively few boulders, and receives sufficient daily illumination to recharge Philae and continue science operations on the surface beyond the initial battery-powered phase.

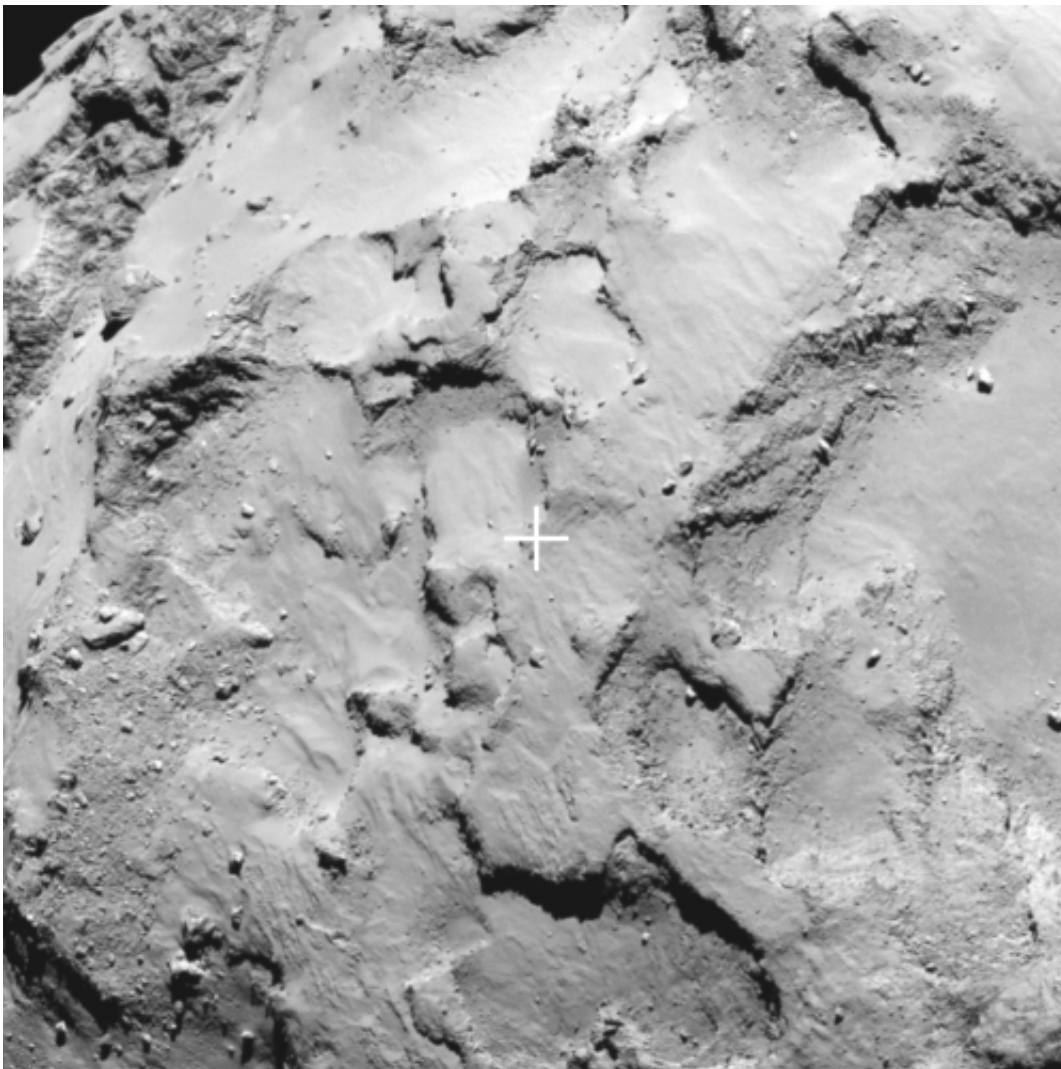
Provisional assessment of the trajectory to Site J found that the descent time of Philae to the surface would be about seven hours, a length that does not compromise the on-comet observations by using up too much of the battery during the descent.

Both Sites B and C were considered as the backup, but C was preferred because of a higher illumination profile and fewer boulders. Sites A and I had seemed attractive during first rounds of discussion, but were dismissed at the second round because they did not satisfy a number of

the key criteria.

A detailed operational timeline will now be prepared to determine the precise approach trajectory of Rosetta in order to deliver Philae to Site J. The landing must take place before mid-November, as the comet is predicted to grow more active as it moves closer to the Sun.

"There's no time to lose, but now that we're closer to the comet, continued science and mapping operations will help us improve the analysis of the primary and backup landing sites," says ESA Rosetta flight director Andrea Accomazzo.



Philae's primary landing site close-up. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

"Of course, we cannot predict the activity of the comet between now and landing, and on landing day itself. A sudden increase in activity could affect the position of Rosetta in its orbit at the moment of deployment and in turn the exact location where Philae will land, and that's what makes this a risky operation."

Once deployed from Rosetta, Philae's descent will be autonomous, with commands having been prepared by the Lander Control Centre at DLR, and uploaded via Rosetta mission control before separation.

During the descent, images will be taken and other observations of the comet's environment will be made.

Once the lander touches down, at the equivalent of walking pace, it will use harpoons and ice screws to fix it onto the surface. It will then make a 360° panoramic image of the landing site to help determine where and in what orientation it has landed.



Philae landing site context Context image of Comet 67P/Churyumov–Gerasimenko with the original five candidate landing sites for Rosetta’s lander Philae, and with the backup, Site C, indicated. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

The initial science phase will then begin, with other instruments analysing the plasma and magnetic environment, and the surface and subsurface temperature. The lander will also drill and collect samples from beneath the surface, delivering them to the onboard laboratory for analysis. The interior structure of the comet will also be explored by sending radio waves through the surface towards Rosetta.

"No one has ever attempted to land on a comet before, so it is a real challenge," says Fred Jansen, ESA Rosetta mission manager. "The complicated 'double' structure of the comet has had a considerable impact on the overall risks related to landing, but they are risks worth taking to have the chance of making the first ever soft landing on a [comet](#)."

The landing date should be confirmed on 26 September after further trajectory analysis and the final Go/No Go for a [landing](#) at the primary site will follow a comprehensive readiness review on 14 October.

Provided by European Space Agency

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