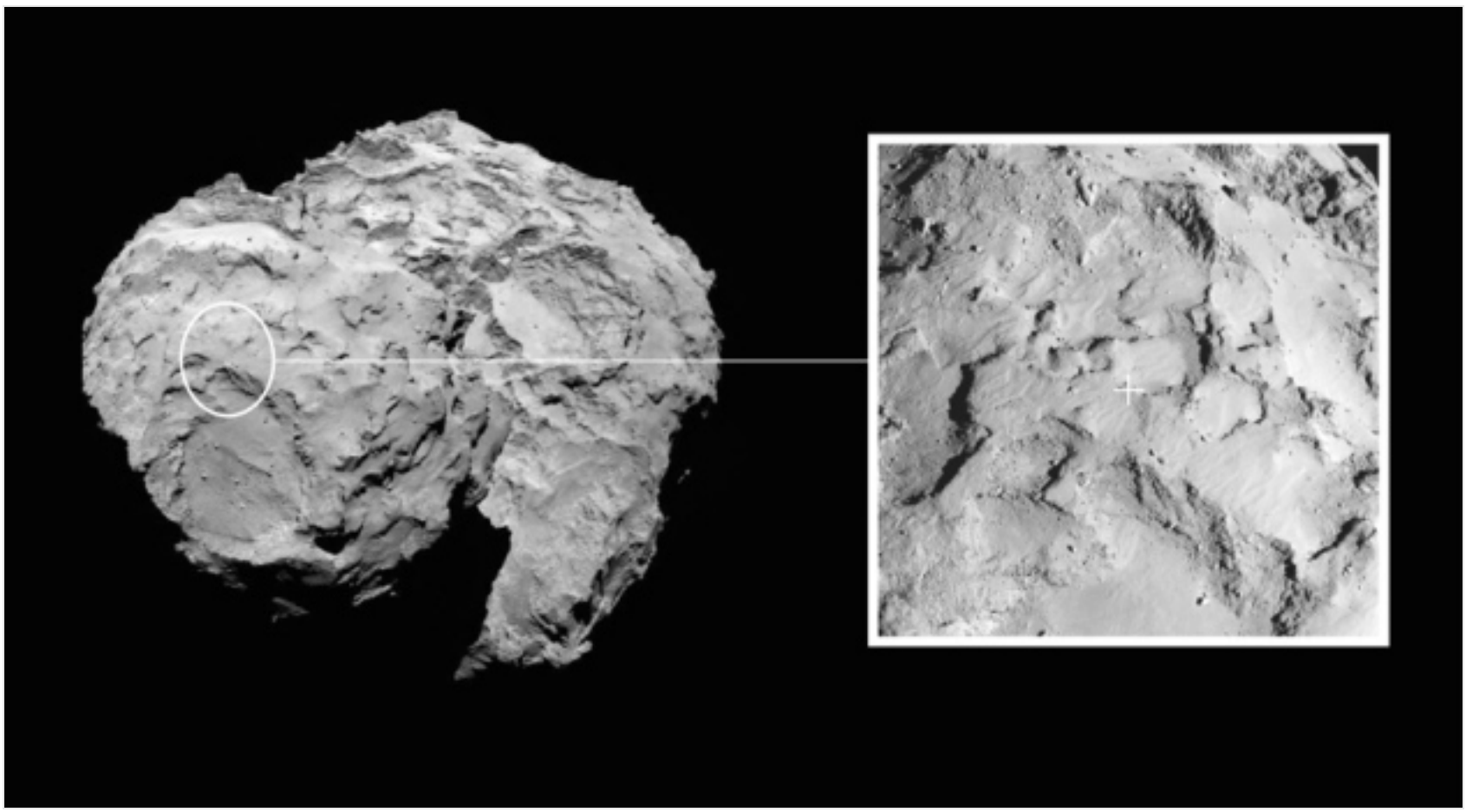
Rosetta comet lander gets a touch-down site



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A region with relatively few boulders offers the lowest risk for landing the Philae probe, mission scientists concluded.

Rosetta mission scientists have selected a landing spot on the comet that the European spacecraft has been orbiting since August. They say the target site, on the 'head' of the rubber-duck-shaped object, will give them the best chance of safely landing Philae, a washing-machine sized robotic probe.

Planned for 11 November, the soft-landing will be the first ever attempted on a comet, and the effort is fraught with risk. Scientists for the European Space Agency mission had expected the object, known as 67P/Churyumov-Gerasimenko, to be a regular, potato-shape comet, and they estimated the chance of success at 70-75%. But when Rosetta began to take a closer look at the comet, its shape startled experts (see 'Duck-shaped comet could make Rosetta landing more difficult').

Now, although no revised calculations exist, the chances are undoubtedly lower, experts say. Mark McCaughrean, a senior science advisor at the ESA directorate of science and robotic exploration, puts the chance of success versus failure at roughly "fifty-fifty".

The team of mission scientists unanimously chose the landing spot, known as site J, from the shortlist of five, says planetary scientist Jean-Pierre Bibring of the University of Paris-South, a lead lander scientist. It emerged as an immediate favourite after the first day of a weekend-long meeting of engineers and scientists at the French National Centre for Space Studies (CNES) in Toulouse.

“This site is not the best for every one of the technical and scientific criteria, but overall it’s by far the best for mission success,” says Bibring.

In a precisely choreographed fly-by, Rosetta will release Philae from a distance of about 10 kilometres. From there, the probe will drift unguided towards the landing target, all the time using up precious energy from its primary batteries.

Once at the surface, the lander should secure itself with harpoons and screws and start work. Although the instruments aboard Philae are smaller than those on Rosetta, they will still help to calibrate the data collected from orbit, says McCaughrean. “The big, powerful instruments are on the orbiter, but there are many things that we can only do on the surface,” he adds.

A major advantage of site J is that its position allows for a relatively short 7-hour drop from Rosetta, compared to the other sites that had been shortlisted. The shorter the flight time, the higher the chance that there will be enough energy left to run all of Philae’s instruments to their full capability at least once in the two days following landing, before sunlight can charge the lander’s solar powered batteries.

The region also has relatively few boulders that could capsize Philae on landing, although the site still contains both cliffs and boulders. “There is no one big Heathrow airport on the surface where you can say ‘no problem’,” says McCaugheran. “It really is a numbers game.”

The golf-course-sized patch of comet — an ellipse about 1 square kilometre in area — is also scientifically interesting, as it sits just a few hundred metres from two pits that scientists believe will become more active, spewing out gas and dust, as the comet moves closer towards the Sun and heats up. The position of the lander relative to Rosetta’s orbit will also offer the best chance of success for an instrument that sends radio waves between the two, designed to map the comet’s interior, says Bibring.

The mission team said they reached their decision quickly and then largely spent the second day of the meeting picking a back-up, a spot on the comet’s body known as site C.

An alternative spot on the comet's body deemed by many to be most scientifically interesting — from which Philae would have been able to observe both lobes of the comet and its very active ‘neck’ region — was effectively ruled out even before the meeting, says Bibring. To send Philae there, Rosetta would have needed to drop to an orbit that was too close to the comet and risked losing the entire mission, he says. Another site, a crater initially nicknamed 'the heliport' for its apparent flatness, was beaten to second place by C, which has better levels of illumination.

From now on, the mission will have to run “pretty much like clockwork”, says Stephan Ulamec, Philae lander manager at the German Aerospace Center, near Cologne. Rosetta is currently orbiting at a distance of just under 30 km, but the scientists hope to drop it to lower altitudes to better examine the surface before 12 October, when ESA is scheduled to give the go-ahead for landing. The team is rushing to gather as much data as possible and to land Philae by November, after which the increased comet

activity could damage the orbiter.

“You’d like to love to spend the next three years working it all out, but we don’t have that luxury,” says McCaughrean.

Rosetta has been chasing the clump of ice and dust for a decade. After waking from hibernation in January, it arrived at its destination in August. The spacecraft has been charting its target from ever-shrinking orbits ever since, and will follow it as it journeys around the Sun.

Comet 67P/Churyumov-Gerasimenko is believed to have changed little in the 4.6 billion years since the Earth formed, and so it could be a source of precious information about the early Solar System, including on whether comets played a role in seeding early Earth with both water and the building blocks of life.