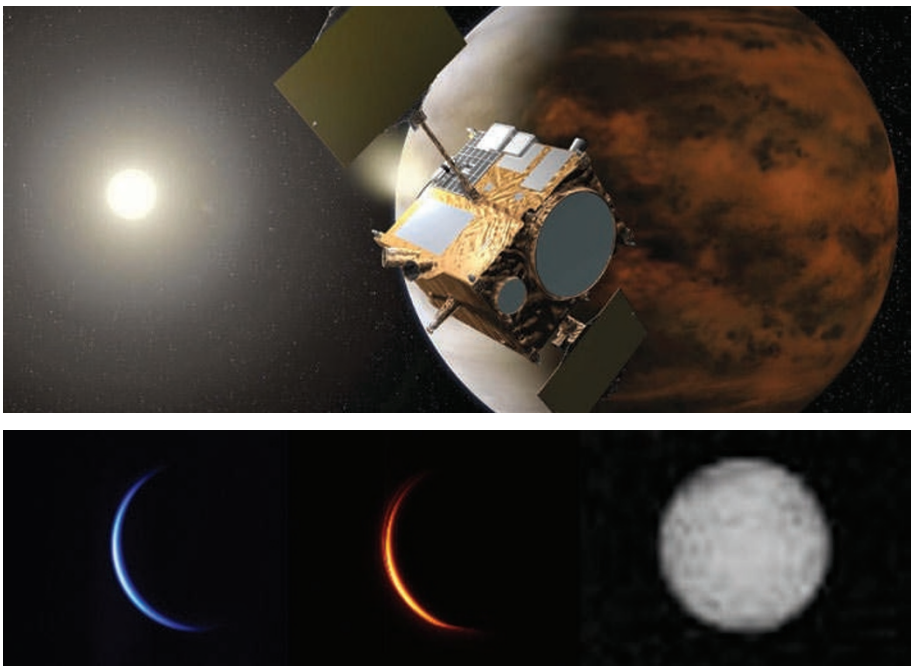
ASTRONOMY

Venus miss is a setback for Japanese programme

Akatsuki mission on hold for six years before next attempt to approach planet.

JAXA



Top: the craft was set to monitor Venus's atmosphere. Bottom: images taken as Akatsuki sped away.

BY DAVID CYRANOSKI

Few events can be as gut-wrenching for a planetary scientist as a multi-million-dollar spacecraft going silent while executing a crucial manoeuvre. Loss of signal at such times usually spells disaster, and the spacecraft may never be heard from again.

Researchers and engineers working with Japan's Akatsuki spacecraft were spared that worst-case scenario on 6 December. Although Akatsuki failed to make contact for more than an hour after the scheduled engine burn that was to place it in orbit around Venus, it did eventually call home. But the news was not promising. Not only had Akatsuki been tumbling out of control for a period of time, it had failed to enter orbit. It will now have to circle the Sun for six years before it gets a second chance.

The failure derails an ambitious programme of research into Venus's atmosphere, and marks the third time that the Japan Aerospace Exploration Agency (JAXA) has battled mechanical problems on a mission to another Solar System body. In 1998, a faulty valve caused a loss of fuel on JAXA's Nozomi spacecraft, which ultimately prevented it from orbiting Mars. And the Hayabusa probe, which returned a minute quantity of asteroidal material to Earth this year, experienced a variety of near-fatal problems.

At a press conference on 10 December, officials reported that Akatsuki's engines fired for less than 3 minutes, far short of the 9 minutes and 20 seconds required to slip into orbit. "We are trying our best to get rid of any preconceived notions and figure out what happened," a project team member told *Nature*.

Akatsuki was to scour Venus with an infrared camera for evidence of volcanic activity, study lightning in the atmosphere and investigate the dense cloud layer that hides the planet's surface from view. Its planned equatorial orbit — timed to match the 'super rotation' of Venus's atmosphere, which spins about 60 times faster than the planet beneath it — would have allowed it to follow the long-term evolution of features in the cloud layer. Such data would have complemented the global coverage of Venus Express, the European Space Agency (ESA) probe that has been orbiting Venus since 2006.

"This is very disappointing for all of us," says Håkan Svedhem, an ESA project scientist for Venus Express. "We had hoped to do many things jointly."

Engineers will now pore over telemetry data from Akatsuki and conduct tests with backup hardware on Earth to try to identify the source of the failure. The spacecraft's fuel system is likely to get close scrutiny: Akatsuki uses the same two-fluid hydrazine–nitrogen tetroxide thruster as Nozomi, although the valve issue has been addressed.

A series of images taken as Akatsuki sped away from Venus shows that its cameras are working well and may yet be put to use if the spacecraft survives its unplanned detour. One hurdle faced by Nozomi on its second attempt to enter orbit — frozen fuel — will probably not affect Akatsuki, because of the probe's proximity to the sun. Solar radiation might, however, take a toll on the craft's sensitive instruments.

If Akatsuki does reach Venus in 2016, it might still be able to join forces with other probes. Last month, ESA agreed to extend the Venus Express mission to 2014, and it is considering a further extension to 2017 or 2018, although this would require modifications to the craft's orbit to save fuel. Meanwhile, NASA is planning SAGE, a Venus lander that could launch in 2016.

Akatsuki failed to make contact for more than an hour after a scheduled engine burn.

"Understanding Venus is important because it informs us about the evolution of the climate on Earth," says Sanjay Limaye, an atmospheric scientist at the University of Wisconsin–Madison and a co-investigator on Akatsuki. "Not going into orbit now does not translate into a diminished interest in Venus, as the questions do not go away," he says. ■

CORRECTION

The News story 'Self-plagiarism case prompts calls for agencies to tighten rules' (*Nature* **468,** 745; 2010) stated that Reginald Smith had escaped censure for research misconduct for publishing duplicate papers. In fact, Smith was formally reprimanded for reuse of published materials and data in multiple publications, although separate allegations of data falsification and plagiarism were not upheld.