

Mars bosses 'rejected trajectory revision'...

Washington

The US space agency NASA declared its Mars Climate Orbiter a total loss last week, after a targeting error apparently caused it to burn up in the Martian atmosphere just as it was about to enter orbit.

Project managers at the agency's Jet Propulsion Laboratory in Pasadena, California, were stunned on 23 September to learn that the \$125 million spacecraft, which they had predicted only a day before would skim the planet at a safe altitude of 140 km, had come only 60 km from the surface — close enough for atmospheric friction to destroy it.

The loss of a second Mars spacecraft in four attempts during the 1990s has been a distressing surprise to scientists and engineers who have come to expect pinpoint targeting of planetary spacecraft.

Investigators are likely to examine a discrepancy between two types of tracking information — one based on Doppler shifting of radio signals from the craft, the other on range data — that emerged several days before the orbiter was lost.

According to project manager Richard Cook, the discrepancy was not large, nor was it unprecedented in planetary missions. But it did prompt a discussion among project



Cook: targeting margin was thought to be adequate.

engineers, some of whom argued that the spacecraft should perform another 'trajectory correction manoeuvre' just before reaching Mars. Project managers decided against the manoeuvre, believing that the potential targeting error was within safe limits, says Cook.

The orbiter was to have spent two years studying the Martian climate, making daily weather observations similar to those returned by satellites around the Earth, says Daniel McCleese, principal investigator for one of the orbiter's two scientific instruments.

The mission would also have investigated the exchange of water between the Martian atmosphere and the surface. NASA has no plans to fly a replacement climatology mission, says McCleese, but atmospheric sensors could be included on future Mars orbiters.

Carl Pilcher, who heads NASA's planetary exploration programme, plays down the loss. He says the climate orbiter's role in

supporting another Mars mission — a lander due to touch down in December — can be filled by other means, and that some failures had to be expected when the agency was launching so many spacecraft.

But the news comes when NASA space scientists are demoralized by cuts to their budget proposed by the US Congress. The Senate last week voted for a spending bill that would trim NASA's science budget request by \$184 million next year.

This is better than the \$265 million cut recommended by the House of Representatives, but NASA says it would still result in significant losses.

Rather than cancelling missions, the agency would opt to delay programmes such as the Discovery planetary series and the MDEX astronomy explorers. NASA estimates that some 500 research grants — a third of each year's total for academic scientists — would be in jeopardy, and the agency's advanced technology programme would be gutted.

That, in turn, would slow the development of several spacecraft missions integral to the Origins programme to investigate phenomena ranging from galactic evolution to the nature of life in the Universe. **Tony Reichhardt**

... and Europe considers insuring its X-ray satellite

London

Concerns over the possible failure of the launch of an X-ray satellite on Europe's new Ariane 5 rocket, scheduled for December, have led the European Space Agency (ESA) to consider taking out insurance on a scientific payload for the first time.

Fears for the X-ray Multi-Mirror (XMM) mission surfaced at ESA's science programme committee last week (see opposite), when the question of whether payloads should be insured was discussed.

Originally XMM was to have been the ninth launch on Ariane 5. But postponements by other customers of Arianespace, the company that administers Ariane launches, have brought XMM forward to the fourth launch of a vehicle that does not yet have an established track record.

Ariane 5's maiden flight was a disaster, exploding after lift-off and destroying ESA's Cluster mission (see *Nature* 381, 541; 1996). Arianespace has since conducted two more validation launches. The first, dogged by problems, placed its payload in the wrong orbit. The second was a success.

Ken Pounds, professor of space physics at Leicester University, says he is not aware of unusual concerns among researchers about

a launch failure. "Most people assume XMM will have the usual more than 90 per cent chance of getting into the right orbit," he says. But Pounds acknowledges that it is "not usual" for a science mission to be insured.

The insurance premium might be found from XMM's budget of 671 million euros (US\$700 million). Payload instruments supplied by national agencies are worth a further 171 million euros. Given the tensions that arise within ESA over the supply of such payloads, it may consider it worth insuring against their loss.

Meanwhile those responsible for the mission are looking closely at reports of problems with some of the detectors on the US space agency NASA's equivalent telescope, Chandra, launched in July. The front-side illuminated chip of the imaging spectrometer, ACIS, has been suffering from degradation, perhaps from the impact of



Mirror in the sky: will Ariane give it a safe lift-off?

soft protons that have penetrated the telescope's shield.

Martin Weisskopf, project scientist for Chandra, says NASA has been working closely with ESA and with researchers who may be affected by the problem. So far, the only effect appears to be a reduction in the efficiency of the telescope. "Our mission is not impaired," he says. "It is not a crisis, [although] it is annoying and a nuisance."

But Pounds says his group is studying Chandra's performance "keenly". He adds: "We need to satisfy ourselves that there is no parallel danger for XMM, and ensure we are not vulnerable to similar problems."

NASA is still working on the source of the problem. One theory is that the damage results partly from Chandra's deep-space orbit. This brings it into contact with the Earth's outer radiation belts, in particular the Van Allen belt, which consists of high-energy electrons, protons and other energetic particles.

ACIS may have been damaged by particles passing down the telescope while in this belt. NASA has removed the instruments from the focal plane of the telescope during this period. Weisskopf says the degradation has ceased.

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