Have NASA's scientists been the victims of excessive expectations?

The failure of the Mars Polar Lander may have been the result of NASA's high demands. But aiming lower could mean cancelling missions.

Officials at the US space agency NASA were quick to admit after the Mars Polar Lander was pronounced dead last week that the Mars programme is in trouble and needs a complete rethink.

Their hints that the next lander, scheduled for launch in 2001, may be postponed must have had engineers at the Jet Propulsion Laboratory (JPL) sighing with relief. The engineers have known all along that the space agency's plan — launching to Mars every 26 months, and beginning sample collection, a vastly more complicated task, in 2003 — was unrealistic.

But despite occasional warnings, mostly *sotto voce*, that the Mars programme is overburdened and underfunded, top managers at JPL and NASA have been shutting out such negative thoughts (see page 721 in this issue and *Nature* **382,** 481; 1996).

The 1997 Mars Pathfinder landing was taken as proof that the 'better, faster, cheaper' approach works. Failures and near failures in other quarters — such as SOHO, Deep Space 1, Lewis and Clark, and the Wide-field Infrared Explorer — were chalked up to other factors, such as miscommunication or a failure to follow the rules.

The loss of four spacecraft in ten weeks, however, has shaken that faith, and the fallout will extend beyond Mars: NASA's entire science programme is based on optimistic assumptions about how far money, manpower and technology can be stretched.

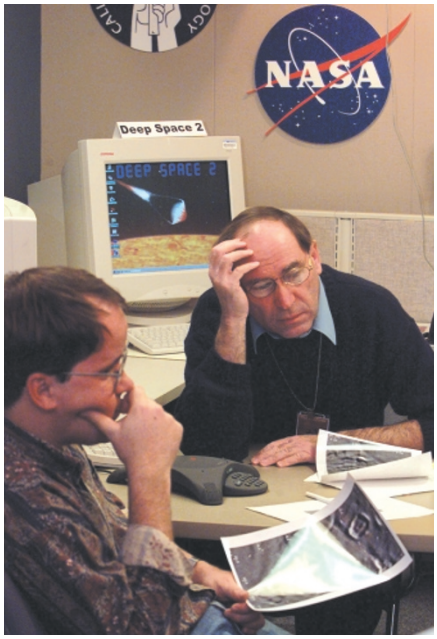
Problems ahead

Responding to the charge that his push for economy has gone too far, NASA administrator Dan Goldin counters that the United States cannot go back to billion-dollar missions or just throw money at the problem.

Most scientists who work with NASA agree. And many agree with Stamatios Krimigis, head of the space department at the Johns Hopkins University Applied Physics Laboratory (APL) in Maryland, who says that 'better, faster, cheaper' is "getting a bum rap".

But David Black, director of the Lunar and Planetary Institute near Houston and a veteran of NASA science advisory committees, says it is dangerous to put "too much emphasis on the 'cheaper' side of the equation".

JPL has had a hard time adapting to the new way of doing business, say critics. They say that the lab — which leads the effort to explore Mars and the outer planets, and plays a key role in other large ventures including the Space Interferometry Mission and the Space Infrared Telescope Facility — too often underestimates the complexity of technologically challenging projects, and its managers are too willing to agree to unrealistic demands from NASA.



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We have a problem: NASA researchers wait for news of the missing Mars Polar Lander.

JPL may be more vulnerable in this regard, as its staff are contractors rather than secure government employees. This means that NASA is a customer, and the customer has to be satisfied.

Other JPL-run programmes are having difficulty as a result, and one outside observer says "the worst is yet to come". Several planetary scientists told *Nature* that planning for the Europa Orbiter mission, which NASA hopes to launch in 2003, and for the Pluto-Kuiper Express the following year, is in serious financial and technical disarray.

Other parts of NASA's science programme have had more success with the 'better, faster, cheaper' approach. Four Discovery planetary missions have made it to the launchpad on time and on budget, although only two — Pathfinder and the Lunar Prospector — have yet completed their respective missions.

APL's Near Earth Asteroid Rendezvous spacecraft missed its encounter last year but is now on track to reach the asteroid Eros in February. The difference with Discovery missions, says Steven Squyres, a Cornell University planetary scientist who heads NASA's science advisory council, is that they are subject to competitive peer review, which helps to weed out proposals with unrealistic technical or financial assumptions.

Tight deadlines

This is not the case with JPL's Mars programme, however, the requirements for which come down from NASA headquarters. The agency has called for a visit to the planet at every 26-month opportunity, so JPL is designing and building several Mars spacecraft at once, with no possibility of letting the schedule slip, and with far less money and staff than it had when the launch rate was more leisurely.

"The sudden onslaught of many missions has been the challenge," says Tony Spear, who led the successful Pathfinder project before leaving for private industry. He is heading a comprehensive study of 'better, faster, cheaper' missions for NASA headquarters, due next month.

Cancelling the 2001 lander would provide some breathing space in the schedule but may not make sense because much of the spacecraft is already built. JPL managers do not yet know if the Mars Polar Lander failed because of a technical problem or was just unlucky enough to land in an unsafe place.

Squyres, who has been building the scientific payload for the 2001 mission, says that future landers may need a camera to scout out the landing site during descent, along with a way to avoid obstacles if necessary. Asked whether it is possible to visit Mars every 26 months, given the current budget, he admits that he does not know.

NASA needs to ask this question for each science mission. Brad Parkinson, a Stanford University professor who heads the agency's overall advisory council, supports the 'better, faster, cheaper' approach, but concedes that the agency "probably has more on its plate than it can afford". With no budget relief in sight, the inevitable decision will be about which projects to cancel.

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