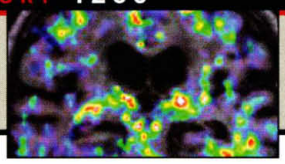
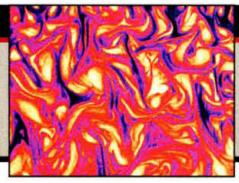




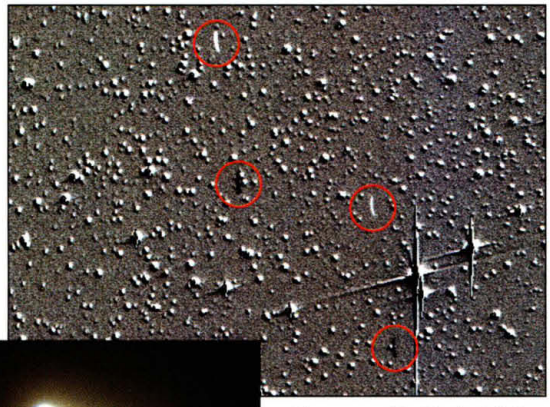
CONTOUR MISSION

Comet Craft in Pieces, Astronomers Fear

Scientists may have lost their best shot at understanding how comets evolve with the apparent destruction of the $159 million Contour spacecraft. The NASA payload is thought to have broken into at least two pieces last week while accelerating to leave Earth orbit.

"We aren't sure that the spacecraft is completely gone," says Contour mission director Robert Farquhar of the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, "but this news is not very encouraging."

Contour (short for Comet Nucleus Tour) was launched into Earth orbit 3 July (*Science*, 5 July, p. 44). On 15 August, ground controllers ordered the spacecraft to fire its onboard solid-propellant rocket motor. The rocket burn should have put Contour on a trajectory to comets Encke and Schwassmann-Wachmann 3, one very old and one relatively new. Astronomers had hoped that high-resolution close-ups of the nuclei of the two comets would shed light on the diversity of these small frozen remnants of the solar system's birth.



Shattered? Circled blips (*above*) might be fragments of NASA comet probe.

The rocket maneuver took place 225 kilometers above the Indian Ocean, out of sight of NASA's Deep Space Network antennas. But some 45 minutes later, when Contour's signal should have been picked up again, the screens at mission control stayed black. At first, mission operators were optimistic that radio contact with the spacecraft would be restored. When radar and optical telescopes showed no sign of Contour in Earth orbit, scientists assumed that the rocket burn had occurred on Thursday as expected. "We had a lot of hope," Farquhar says.

But on Friday, astronomers at the University of Arizona in Tucson detected two objects close to Contour's predicted path. Using the 1.8-meter Spacewatch telescope at Kitt Peak, which normally hunts for near-Earth asteroids, they spotted the faint objects some 460,000 kilometers from Earth. The objects were 460 kilometers apart, suggesting that the two pieces are moving away from each other at a relative velocity of just over 20 kilometers per hour. That information might help investigators gauge the force of the explosion that blew them apart, information that could narrow down what went wrong.

"The loss of Contour would be a basic setback for the near future of cometary science," says Gerhard Schwehm of the European Space Research and Technology Centre in Noordwijk, the Netherlands, the project scientist for the upcoming European Rosetta mission to comet Wirtanen. By studying both the old comet Encke and the "fresh" comet Schwassmann-Wachmann 3, whose nucleus split into three parts in 1995, Contour could have shed light on the evolution of these icy objects—something other comet probes are not expected to do. But an even bigger impact, Schwehm says, might be a loss of confidence in the "faster, cheaper, better" approach of NASA's Discovery program, of which Contour is the sixth mission. Earlier Discovery missions also encountered technical mishaps, although none this serious.

The cause of the breakup might never be learned unless mission operators improbably succeed in reestablishing radio contact with Contour. The rocket burn maneuver "was not considered to be very risky," Farquhar says. "I was more worried about the launch." As for taking another shot at the comets, Farquhar says that any proposed replacement would have to rejoin the queue: "By then, it's unclear how this mission would fit in the general scheme" of cometary science.

–GOVERT SCHILLING

Govert Schilling is an astronomy writer in Utrecht, the Netherlands.

CREDITS: THE SPACEWATCH PROJECT, LUNAR AND PLANETARY LABORATORY, UNIVERSITY OF ARIZONA; NASA/JHU-APL/CORNELL UNIVERSITY

MATHEMATICS

Medals Honor Work on Linkages and Proof

Two bridge builders have won mathematics' highest honor. The 2002 Fields Medals—presented this week at the opening ceremonies of the International Congress of Mathematicians in Beijing—went to Laurent Lafforgue of the Institute for Advanced Scientific Study in Bures-sur-Yvette, France, and to Vladimir Voevodsky of the Institute for Advanced Study in Princeton, New Jersey. Madhu Sudan, an information theorist at the Massachusetts Institute of Technology (MIT), received the Rolf Nevanlinna Prize, an analogous award for work in computer science.

The Fields and Rolf Nevanlinna awards are presented together every 4 years at the congress, traditionally to researchers under 40 years of age. Both Lafforgue and Voevodsky worked on questions that linked seemingly dissimilar subdisciplines of mathematics.

Lafforgue, age 35, was honored for his work on the Langlands Program, an ambitious mathematical quest begun in 1967 by Robert Langlands, then a young professor at Princeton University. Langlands conjectured that two different-looking mathematical beasts—automorphic forms and Galois representations—were intimately connected. Broadly speaking, automorphic forms are mathematical objects that can be distorted in certain ways and still retain their original properties. Galois representations, on the other hand, reveal the relations between solutions of equations.

These two abstract ideas live in very different sections of the mathematical zoo, yet both are related to some of the deepest problems in mathematics. When Princeton mathematician Andrew Wiles proved Fermat's Last Theorem in 1994, for example, he relied on a proof that the Langlands Conjecture was true