Life on Mir: Aftermath of a collision in space

Astronaut Mike Foale no longer has the toothpaste he carried to Russia's Mir space station. The same goes for his toothbrush, shaving kit, and sleeping bag. As for the set of life science experiments he had tended in one of Mir's research modules: Forget about it!

Life aboard the aging space station changed dramatically for Foale and his two Russian crewmates on June 25, when the unmanned supply vehicle Progress crashed into the research module Spektr during a test of Mir's manual docking system. No one was hurt, but the collision smashed a solar panel, dented a radiator on the outside of Spektr, and tore a hole in its hull. With Spektr's air supply leaking into space, the crew scrambled to cut power cables and seal off the module from the rest of Mir.

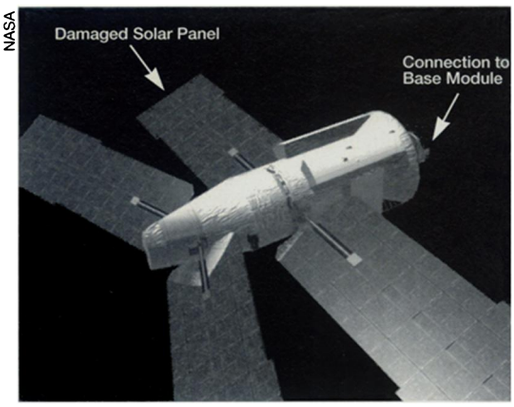
"I heard the big thump and a thud and [flight engineer Aleksandr Lazutkin], who was actually anchored to the floor at that time, got a pretty big jolt," said Foale in a recent radio communication. "We heard a hiss and felt the pressure falling in our ears."

Since then, the 11-year-old station, which critics have long derided as a space jalopy, has had only half its normal operating power. The crew has dimmed lights and shut down nonessential equipment to conserve energy. Foale and his two colleagues are waiting in the dark for the arrival of a new Russian cargo ship carrying the tools they need to try to repair the damage.

NASA, too, is waiting, reserving judgment about whether to continue sending astronauts to Mir. Astronaut Wendy Lawrence is scheduled to replace Foale in September. House science committee chairman James Sensenbrenner (R-Wisc.) has requested that NASA not send additional crew until an investigation can demonstrate that the space station meets the agency's safety standards.

NASA has shuttled crew and supplies back and forth to Mir since 1995, in preparation for the construction of an international space station (SN: 5/20/95, p. 312), now scheduled to begin in July 1998. Tardiness by the Russians in delivering a module for the station recently forced NASA to delay plans by 11 months.

Since February, Mir has suffered a variety of mishaps and malfunctions, including a fire triggered by a chemical oxygen generator, the loss of a primary oxygen generator, and leaks in the station's cooling systems. "The deterioration of the [Mir] systems was not a surprise," notes space policy analyst Marcia S. Smith of the Congressional Research Service in Washington, D.C. "It happens with all aging systems, whether it's a car or a space station."



Drawing of the Spektr module.

Nonetheless, she adds, not all of the problems stem from age, and the collision involved relatively new components

Given that several astronauts have already lived on Mir for months at a time, "and since the international space station is just around the corner . . . I think that unless the astronauts are conducting science, it is going to be a difficult sell for NASA to say that we should put somebody up there for 4 or 5 months only for the operational experience," says Smith.

She remarks that if NASA decides that astronauts should no longer live on Mir, the agency could still continue shuttle flights but limit them to delivering supplies without exchanging crew. As for the health of Mir, she adds, much will depend on events in the coming week.

A new Progress vehicle, loaded with needed supplies, is scheduled for launch on July 5, with arrival at Mir 2 days later. The two cosmonauts plan to enter Spektr, in the hope of reattaching severed power cables from its solar panels, as early as July 11. Contaminants from science experiments in the module, as well as the difficulty of working in the dark, could present problems. Foale will be stationed in the Soyuz vehicle attached to Mir, in case the crew needs to make a fast getaway.

One lesson to be learned from the accident, says Charles P. Vick, a space policy analyst with the Federation of American Scientists in Washington, D.C., is that Mir and the planned international space station would benefit from a "virtual-reality type approach system that will show you where you are in relation to everything else and what's going on in different perspective views."

The Russian Space Agency has suggested that the old Progress, loaded with garbage, was carrying more weight than the crew estimated. For a given amount of thrust, a more massive vehicle can't brake as rapidly as a lighter one. —*R. Cowen*

Clinton accepts new clean air proposals

Last week, President Clinton sided with his Environmental Protection Agency chief, but against his White House advisors, when he announced his formal backing for tough—and highly controversial—new regulations to cut allowable concentrations of smog ozone and airborne particles.

His support for these rules to protect human health now all but assures they will be adopted next month as part of a major revision of federal air standards. The Clinton administration is under a court order to issue the rules by July 19.

Ozone, formed by the interaction of hydrocarbons and nitrogen oxides, is the primary irritant in urban smog. Studies have shown that it can temporarily reduce lung capacity and aggravate respiratory disease, notably asthma.

Proposed last November, the first new regulation would limit ozone to 80 parts per billion (ppb) in air, averaged over an 8-hour period, replacing the current 1-hour limit of 120 ppb.

The second new standard would change the focus of pollution controls aimed at soot and dust. Numerous studies have linked the legally allowed concentrations of these airborne particles to increases in severe respiratory disease (SN: 7/1/95, p. 5).

Current federal standards regulate particles 10 micrometers (μm) or smaller, which are inhaled into the lungs' passages. Their concentrations in air have been limited to no more than 150 micrograms per cubic meter ($\mu g/m^3$), averaged over any 24-hour period, and to an annual average of no more than 50 $\mu g/m^3$.

The new standard would instead regulate only those particles 2.5 μm or smaller. This finer fraction, the majority of particulates in many industrial areas, is believed to pose the greatest risk to health by lodging most deeply in the lungs. The rules would set the maximum allowable 24-hour-average concentration to 65 $\mu g/m^3$ and the annual average concentration to 15 $\mu g/m^3$.

Industrial leaders have campaigned vociferously against the proposals, charging that they are based on incomplete science and would deter new firms from moving into industrial centers where pollution is already near the proposed limits. As a concession, Clinton postponed implementation of the new rules to 2003 for the particulates and to 2008 for smog ozone.

However, some congressional leaders from the industrial belt have pledged to fight the rules by rewriting the laws upon which they are based. —*J. Raloff*