MIR SPACE STATION

Fiery Demise Spells End of Longest Research Run

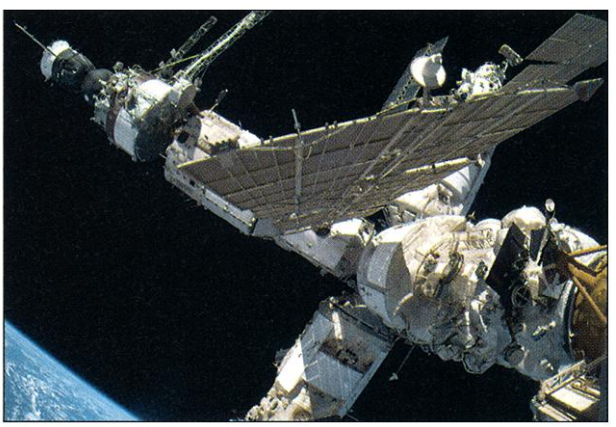
Although disappointed at losing the opportunity to perform planned experiments, scientists are celebrating Mir's 15 years as a research platform

MOSCOW—This spring, cosmonauts on the Mir space station were to have assembled and launched an innovative solar-powered spacecraft—a prototype for a new generation of Mars explorers. It would have been "a very big and beautiful experiment," says Alexandr Chernyavsky of Energia Corp., a Moscow-based titan that has produced hardware for spacecraft from the first artificial satellite, Sputnik. But plans for the so-called "M-Module" are now history, along with Mir, which comes to a blazing end next week along with some $80 million worth of research equipment and the jobs of hundreds if not thousands of engineers, scientists, and technicians.

While Chernyavsky and his Energia colleagues rue a lost opportunity, many others are feting the creaky old station for 15 years of unexpectedly robust research—the longest running space laboratory ever. Although increasingly hobbled by declining budgets and aging equipment, cosmonauts made important findings, from measuring the ratio of heavy helium atoms in the interstellar medium—a key value for evaluating models of how the universe evolved—to learning how to grow food in space for long-duration flights. "It will be a long time before such experiments are repeated," says Vladimir Sychev of the Institute for Biomedical Problems in Moscow. And Western researchers hail the station for providing vital data and experience on the road to the international space station now under construction, which began, ironically, as the West's Cold War response to Mir.

Denounced by many former cosmonauts, the decision to bring down Mir proved impossible to reverse. "No experts can guarantee that no failures or shortcomings could happen" if the station were kept in orbit, says Yuri Koptev, general director of the Russian Aviation and Space Agency. And Energia's longtime chief Yuri Semyonov blames Mir's fate on "the irreversible processes of aging." So next week, the 137-ton Mir is scheduled to be guided into a low-angle descent through Earth's atmosphere. Although most of the station will burn up, several truck-sized pieces will survive and—it is hoped—plunge into the Pacific.

Mir was the product of more than a decade of Soviet experience with space stations, which were prized as high-profile examples of socialist technical competence. Its main module was launched in 1986; smaller pressurized labs were added later. The first, an astrophysics facility called Kvant, went up the next year. Kvant 2, mostly for housing equipment, followed in 1989. The next year brought Kristal, which carried furnaces for materials research. After long delays, Spektr and Priroda were added in 1995 and 1996; both contained mainly Earth-observation equipment as well as room for U.S. experiments.



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Stellar research. Mir provided valuable data on everything from bone tissue loss to the evolution of the universe.

Although Mir primarily served as a testbed for space hardware, its list of scientific achievements is long. More than 100 cosmonauts and astronauts from a dozen countries conducted some 23,000 experiments. Data from Kvant, for example, allowed Swiss and Russian astrophysicists last November to define the ratio of helium-3 and helium-4 in the interstellar medium—the first solid data that should yield insights into the universe's evolution, says Georgi Zastenker of Moscow's Institute of Space Research.

Of prime research importance were studies of the effects of microgravity on living things, from wheat to people. In humans, the results were "unique data on various medical aspects—from cardiovascular changes to bone tissue losses," says Valery Polyakov, deputy chief of the Institute for Biomedical Problems and a veteran of the longest space flight, 438 days. These data, he says, "will enable the biomedical support for a human flight to Mars." Japanese quail hatchlings showed that in space the birds' embryos were not obviously affected by microgravity—but the chicks did not adapt to weightlessness and died, notes Sychev. Adult birds, however, coped just fine. And researchers grew wheat in a small greenhouse, showing that microgravity does not affect photosynthesis. "It was a hugely successful experiment," says John Uri, a life scientist at NASA's Johnson Space Center in Houston.

But Russian research methods proved to be sloppy compared to Western procedures. Much of the human physiological data, for example, was not presented in reports. "Individuals carried the information, and you went to them, not to libraries," says Dieter Andresen, a European Space Agency (ESA) manager in Noordwijk, the Netherlands. Data evaluation "was not done in ways that in our judgment [were] efficient or systematic," says Andresen. But he adds that ESA's own physiological experiments on Mir proved "tremendously successful."

Likewise, French officials say their 11 years of life sciences and fluid research experiments on Mir were a solid investment and good preparation for the international space station. Frustrations, however, included severe limitations in transmitting data that crimped the ability of scientists on the ground to control experiments, says Lionel Suchet, a French space agency manager who oversaw many of those missions.

Although a relative latecomer to Mir, NASA conducted batteries of experiments in a variety of fields—such as snapping more than 20,000 detailed images of Earth—in exchange for much-needed funds for the ailing Mir and the overall Russian space program.

Mir's lasting legacy may be in the area of neither engineering nor biology, but sociology. Unlike NASA, Russian officials put great emphasis on selecting crew members that could get along, conducting frequent stress tests and giving them substantial flexibility in day-to-day duties. "The cosmonauts had room to improvise and an incredible amount of freedom," says one NASA scientist. The result, she says, was high productivity over crushingly long missions. And that may prove an invaluable lesson for the multinational crew building Mir's successor.

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