A Bad Week for Soviet Space Flight

The loss of Phobos 1 was the most serious; the drama of the stranded cosmonauts was the most gripping

TWO HUMAN ERRORS, both involving computers, made the first week in September a tumultuous one for the Soviet Union's space program. The first incident ended happily when a Soviet cosmonaut and his Afghan copilot safely returned to Earth after spending an extra day aloft in their malfunctioning space capsule. The second incident ended far less happily after a mistyped command resulted in the almost certain loss of the unmanned Phobos 1 spacecraft, one of two that were headed toward a rendezvous with Mars and its largest moon next spring.

According to National Aeronautics and Space Administration (NASA) sources who have been in contact with their Soviet counterparts, the loss of Phobos 1 has been traced to an erroneously typed command sent from the Soviet mission operations center near Moscow on the night of 29–30 August. The center does have a computer that ordinarily checks all such commands before they are sent to the spacecraft. On that night, however, the computer had crashed. So the ground controller who had typed the commands sent the instructions up anyway.

As events were reconstructed later, the effect of the mistyped command was to tell the spacecraft to drop its "lock" on the sun and on the star Canopus, which are the celestial landmarks Phobos uses to maintain its orientation. Unfortunately, its on-board computer was not programmed to demand a verification. (A U.S. probe such as Voyager would respond to such a command only after being told to do so at least three times.) As a result, Phobos 1 began to tumble. And with its solar panels no longer facing the sun, it lost its ability to recharge its batteries.

The upshot was that when ground controllers next tried to contact Phobos 1 two days later, they could not. The spacecraft was tumbling and its batteries were essentially dead. There might have been some hope of reestablishing communications even so, except for another complication: the communication antenna used on the Phobos spacecraft is skimpy even for normal operations. When the twin Phobos probes were being built by Glavkosmos, the Soviet Union's civilian space agency, a problem with internal vibration in the spacecraft had led the engineers to redistribute mass the quick-and-dirty way: by reducing the antenna to a third its original size.

A more principled fix is in the works for the planned Mars 1994 mission, which will also use the Phobos spacecraft design. But that did not help the flight controllers last week. Their repeated attempts to contact the tumbling spacecraft produced no results. And on 9 September, Roald Z. Sagdeev, director of the Soviet Union's Space Research Institute, told the Associated Press in Moscow that he and his colleagues had essentially given up hope. "Only a miracle can save it," he said.

Meanwhile, the Soviets are reportedly being very careful with Phobos 2. Unfortunately, that spacecraft does not duplicate two of Phobos 1's solar instruments, making it impossible to carry out a planned cooperative experiment in which readings from Phobos and the U.S. Solar Maximum Mission satellite would have been used to triangulate the location of activity in the Sun's corona.

Although the Phobos error was ultimately much more serious, it was far overshadowed by the dramatic plight of the cosmonauts. For Western observers the most striking thing about the incident was not the problem per se, which was never quite as dire as many press reports made it seem, but the fact that the Soviets were so open about what was going on. Even in the era of glasnost, Soviet officials have generally kept quiet about their difficulties until well after the crisis is past; witness their handling of the Chernobyl nuclear accident in 1986.


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Cosmonauts Lyakhov (left) and Mohmand (right).

"There were live reports throughout the day in Moscow, and so far as we know they have not done that before," says Samuel W. Keller, NASA's Deputy Associate Administrator for space science and applications, and a frequent visitor to the Soviet Union.

According to Soviet press reports, the mishap occurred on the morning of 6 September, as veteran cosmonaut Colonel Vladimir Lyakhov, 47, and his copilot, 29-year-old Afghan Air Force pilot Abdul Ahad Mohmand, were returning from a routine visit to the Soviet Union's Mir space station. The flight plan called for them to fire the retrorockets of their Soyuz TM-5 capsule at dawn over the South Atlantic; this would bring them down some 20 minutes later at the prearranged landing point in Kazakhstan, Central Asia.

Apparently, however, the rays of the rising sun interfered with an infrared sensor that orients the spacecraft with respect to the horizon. As a result, the confused onboard computers cut the rockets off after only 60 seconds, instead of the full 230 seconds required for reentry.

Lyakhov and Mohmand made a second attempt to descend three hours later, only to have the rocket engine cut off early once again. This time the culprit was the computer's backup reentry program, which no one had remembered to alter. In exasperation, Lyakhov apparently overrode the computer and for a moment started to fire the engines manually. He later accepted the blame for not following proper procedure. "I am not excusing myself," he said at a post-flight press conference. "There was fault there."

In any case, the flight controllers decided to postpone further activity for one day to give themselves time to fully understand the computer problem. The delay would also allow for a landing at the originally planned site. To NASA's Keller and others, this indicates that the Soviets were never seriously worried about the cosmonauts' running out of air, since the manual controls were working perfectly and they could have come down very quickly if they had needed to. Indeed, when NASA called to offer its help in tracking and communication, the Soviets declined with thanks, and said that they had things under control.

Apparently they did. On the third try, Lyakhov and Mohmand came safely back to Earth at precisely their scheduled landing point, exactly 24 hours late.

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