—all these things would have systematically been done and they would have been in a database accessible to the world community," says Albee.

Looking at the future

In addition to raining a torrent of data of immediate interest down on Earth-bound researchers, Mars Observer was expected to provide a key stepping stone toward future trips to the planet. Russian scientists were hoping to use Observer's maps to help choose sites to land instruments on the planet's surface in missions scheduled for 1994 and 1996. And they were planning to use a French-built relay system on Observer to transmit back up to 10 times as much data as their own orbiter could handle.

Observer's data would also have fed directly into NASA's Mars Environmental Survey (MESUR), a proposed mission to land as many as two dozen geophysical probes on different regions of the planet. Although photographs from the Viking mission can pinpoint relatively safe sites to land, Observer's detailed mapping would have allowed NASA to pick from among many more targets and would have indicated which ones would be of greatest scientific interest. "Without the measurements of geochemistry [from Observer], intelligently choosing the sites will be difficult," says Boynton.

Considering the importance of Mars Observer, Boynton and his colleagues in the planetary science community are already urging that the mission be repeated. The next launch windows for a return to Mars are late 1994 and 1996, which means that decisions would have to be made quickly. Rebuilding the spacecraft itself might not pose a great problem: Once NASA realized Observer would be a one-of-a-kind mission, it bought backups for the major components (see box, page 1266). There are also spare parts for most, if not all, the instruments. For example, says Christensen, "we can rebuild our [thermal emission spectrometer] in 6 months to a year, given the funding."

Funding, of course, is the biggest problem. A repeat Observer mission should cost significantly less—perhaps 20% to 30% of the original mission's cost says Boynton—but in the current funding climate, NASA will be hard pressed to muster political support for funding the space station and also get additional money to try Observer again. Nevertheless, *Science* has learned that NASA has inquired at Lockheed, which is now managing the Russian Proton launch system, about the availability and feasibility of a rocket to launch a carbon copy of Observer.

Another alternative under consideration involves the Clementine series of military satellites that were scheduled to test technology for the Ballistic Missile Defense Organization. NASA declines to comment publicly, but space agency officials have asked whether a small fleet of Clementines, outfitted with one or two of Observer's instruments, might be ready by November 1994.

For the moment, however, the shaky hope of another foray to Mars offers little solace to a scientific community that is reeling from the loss of Observer. "With planetary science, there's a 10- to 15-year gap between experiments. That's what really hurts. Most experimental scientists can redo an experiment in a few months," says Christensen. Still, he and his colleagues aren't about to give up. "Planetary scientists, because it's a risky business, are an incredibly optimistic group. The process of looking to the future is already starting."

–John Travis

With reporting by Jon Cohen in Pasadena.

NASA's Troubles Come in Droves

August was a very bad month for the U.S. space program. In addition to the lost link to Mars Observer, three spy satellites blew up, a weather satellite went dead, and a space shuttle launch was delayed three times. Although none of the incidents appear to be related, they will inevitably be linked in the public mind. And National Aeronautics and Space Administration (NASA) officials are nervous that they may face a backlash when Congress returns next week to decide the fate of the agency's 1994 budget. Last month's black eyes include:

- An Air Force Titan IV rocket carrying three secret spy satellites worth nearly $1 billion exploded shortly after launch on 2 August. The Titan IV is considered the main heavy-lifter for the space program for the rest of the century, and it has already suffered two test engine failures on the launch pad. With the space shuttle on its way out, and exotic alternatives still on the drawing board or in early experimental versions, NASA is worried about the fate of future heavy payloads.
- Engine problems delayed the latest shuttle launch for the third time in a month. Because the main engines were ignited just before the last launch was scrubbed, NASA engineers must replace them, adding to the delay. And the researchers behind its scientific cargo, the Orbiting Far and Extreme Ultraviolet Spectrometer (ORFEUS) telescope, must find a replacement for one key target—3C273, the brightest quasar in the sky—no longer in view because of the 2-month delay.
- A National Oceanic and Atmospheric Administration (NOAA) weather satellite known as NOAA-13 went dead on 21 August, less than 2 weeks after it had been launched. Preliminary indications point to faulty connections between the satellite's solar cells and batteries. Although most of the instruments in the failed NOAA-13 were duplicates of others already orbiting, two were unique science experiments that had tagged along for the ride—the Energetic Heavy Ion Composition Experiment (EHIC) designed to study the composition of the sun, and the Magnetospheric Atmospheric X-Ray Imaging Experiment for studying high-speed atmospheric phenomena. An earlier version of EHIC was launched more than a decade ago on a military spy satellite that failed, and the explosion of the Challenger space shuttle delayed the search for a suitable replacement vehicle. Now, as NOAA-13 orbits lifelessly, EHIC researchers are scrambling to place yet another incarnation of the ill-fated experiment on the next NOAA craft.
- Finally, a moment planned as a NASA highlight—Galileo's encounter last week with its second asteroid, Ida—was flawlessly choreographed but served as a reminder of continuing problems with Galileo. Because the Jupiter probe's main antenna failed shortly after its launch in 1991, first pictures from the encounter will take at least 2 weeks to make it to Earth, rather than the 10 minutes or so that designers intended.

Opinions vary on what all this disarray will mean for the space program, but even optimists agree it can't help. "It's certainly further ammunition for NASA opponents and critics," says Steven Aftergood of the Federation of American Scientists. He suggests that opponents of the space station will capitalize on NASA's misfortunes to argue that the agency can't be trusted with a $20 billion project. But Lori Garver, executive director of the National Space Society, says that history suggests that legislators understand the risks of space: "In the past, when you've had a series of events like this, Congress has tended not to take it out on [NASA] politically" she says. What might really cripple NASA, however, would be the failure in December of its shuttle mission to repair the Hubble Space Telescope, says Glenn Mason of the Association of American Universities space scientists working group. August's disasters "raise the ante tremendously for the Hubble repair mission," he says.

–Christopher Anderson