Space 1997

The new year brings an uncertain launch schedule

By RON COWEN

Gary J. Melnick has every reason to feel frustrated.

This week, he and his collaborators had hoped they would finally be celebrating the launch of their $60 million Submillimeter Wave Astronomy Satellite (SWAS). Designed to detect water, oxygen, and carbon in nearby stellar nurseries, this galactic prospector complements efforts to search for organic compounds throughout the Milky Way. Melnick, an astronomer at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., notes that the satellite could also study the water vapor flung out from Comet Hale-Bopp as that icy body nears the sun this spring. The mission, he says, "has never been more timely."

But once again this small science satellite, originally slated for launch in June 1995, found itself all dressed up with no place to go. No rocket was ready to launch it.

The Pegasus XL, a series of disposable rockets built to carry SWAS and other small payloads into space cheaply, had proven unreliable for the third time. In 1994, the first time a Pegasus XL rocket flew commercially, the rocket had to be destroyed after errors in its flight control software caused it to stray dangerously off course. A year later, ground controllers commanded a second Pegasus to blow up when the rocket's first stage failed to detach fully from the second.

By last fall, an improved version of Pegasus had successfully launched four payloads, including a NASA mission to study Earth's auroras. Only one more launch remained before SWAS could hitch a ride on the rocket, and Melnick and his team began to "get out of hibernation," retesting software for their instrument.

On Nov. 4, a Pegasus XL carried two science payloads into space: the High Energy Transient Experiment (HETE), a suite of instruments intended to search for the source of cosmic gamma-ray bursts, and Satélite de Aplicaciones Cientificas-B, an Argentinean craft designed to study X rays from solar flares. Liftoff proceeded without a hitch. A day later, however, the news changed. Radar tracking revealed that the craft had reached orbit but that the rocket's third stage had failed to separate, leaving HETE permanently trapped in a cagelike enclosure between the Argentinean instrument and the third-stage fuselage. Neither payload would operate.

"It was an international embarrassment," says Alan N. Bunner of NASA's office of space science. "HETE had Japanese collaboration and [NASA Administrator Dan] Goldin had made a personal promise to Argentina that NASA would launch its satellite. We failed."

Melnick had a more visceral reaction. "My heart sank," he says. "We wanted to believe that the XL had shaken off its infant mortality and was now a reliable vehicle. [The Nov. 4 launch] just shattered that illusion."

Adds Bunner, "We are not going to launch SWAS on a Pegasus right now. With a 50-50 success rate and a $60 million payload [at risk], none of us feel that's something we want to do."

Orbital Sciences Corp. of Dulles, Va., the company that built the rocket, says it has identified the problem and hopes to resume flights next month with the launch of a Spanish payload called Minisat.

Pending the conclusions later this month of a NASA review board investigating the latest Pegasus failure, as well as the recommendations of another panel charged with reviewing the agency's policy on testing new launch vehicles, SWAS could suffer an additional delay of up to 21 months.

The satellite is not alone. In line with Goldin's exhortation to build "faster, better, cheaper," nearly half the space science missions planned for 1997 are small, relatively low-cost endeavors scheduled to fly on Pegasus rockets. Another small, expendable rocket, developed by Lockheed Martin Missiles and Space in Sunnyvale, Calif., has had one failure and is still undergoing testing. Unless NASA gets an okay from the White House to use foreign rockets, none of these missions may be launched this year.

With an increasing number of small-scale projects on the horizon, NASA's need for a reliable small-launch vehicle will only intensify. "We have several missions planned for the near future on new rockets that have not really been tested," says Bunner. "The agency is concerned not just about Pegasus but about the policy of flying expensive payloads on [relatively] untested rockets—we could suffer the same problem again."

"NASA is in a bind," says Marcia S. Smith, a space policy analyst at the Congressional Research Service in Washington, D.C. If the agency decides that the Pegasus XL requires considerably more testing before it is deemed flightworthy, "the only choice is to use a Russian launch vehicle, and that choice, given the climate of 'buy American', is not politically popular right now," she says.

How did NASA get into this mess? Agency officials put part of the blame on a congressional mandate that since the early 1990s has directed NASA to contract out rather than build or buy launch vehicles. Such an approach is meant to save money, but in the process the agency may have relinquished too much control in flight testing, Bunner suggests.

Now NASA does not run any tests itself. "Back in the good old days," says Bunner, "we used to have 7 to 10 flights before a launch vehicle was declared flightworthy."

Conducting that many test flights every time a new problem is identified may not be necessary, notes Dan Mulville, NASA's chief engineer. Mulville heads a panel that is reviewing whether current standards for flight testing are adequate. In addition, Mulville says, NASA's extensive experience in developing large rockets may have led the agency to underestimate the difficulty of building smaller rockets.

"It's taken more effort than we had initially anticipated to get to the point where we have a reliable small-launch vehicle," he says. Mulville's panel is scheduled to present its recommendations at the end of the month.

In the meantime, other missions, including two big-ticket items—a major upgrade of the Hubble Space Telescope and a flight to Saturn—are expected to fly

on schedule in 1997. A tentative program of launches and related events follows.

February

● The first mission of the new year features a return flight of the space shuttle to the Hubble Space Telescope. No longer the publicly belittled, optically impaired craft it had been before a 1993 repair mission, Hubble is about to get a combination camera and spectrometer that will extend the telescope's vision into the infrared, as well as a spectrograph that will analyze light emissions over a broad range of wavelengths—all the way from the ultraviolet to the near infrared. If all goes well, astronauts will need just a single space walk to remove two of the telescope's 1970s ultraviolet detectors—the Goddard high-resolution and faint-object spectrographs—and replace them with the two new instruments.

One of these devices, the Near-Infrared Camera and Multi-Object Spectrometer (NICMOS), examines the cosmos at a broad range of near-infrared wavelengths, between 0.8 and 2.5 micrometers. Interference by Earth's atmosphere restricts near-infrared telescopes on the ground to a much narrower range of wavelengths. NICMOS should further unveil dust-shrouded regions of starbirth in the Milky Way and continue the search for primeval galaxies billions of light-years distant. A light-blocking device called a coronagraph may help NICMOS search for nearby brown dwarfs lost in the glare of their companion stars.

The other new instrument, the Space Telescope Imaging Spectrograph (STIS), can in a single observation measure the composition of a faraway galaxy at wavelengths ranging from the ultraviolet to the near-infrared. By tracking the velocity of stars and gas swirling at the heart of nearby galaxies, STIS should be particularly adept at unmasking galactic black holes, says NASA chief scientist Edward J. Weiler.

In three other space walks during the 14-day space shuttle mission, astronauts plan to install new tape recorders, replace a faulty gyroscope, and add a new fine-guidance sensor to improve the telescope's ability to zoom in on celestial targets.

June

● The Near Earth Asteroid Rendezvous mission will pass by and photograph the asteroid 253 Mathilde, a member of the main asteroid belt that lies between Mars and Jupiter.

July

● On its second flight, the International Extreme Ultraviolet Hitchhiker, a pair of instruments that rides in the space shuttle's payload bay, will look for long-term changes in the sun's output of extreme-ultraviolet radiation. In tandem with the Galileo spacecraft's close-up exploration of the Jovian system, it will also study emissions from the doughnut-shaped region of charged particles surrounding Jupiter and its moon Io.

● This Independence Day, Earth will invade the Red Planet. If all goes according to plan, the Mars Pathfinder, now en route, will land on Mars and a small, unmanned rover will explore the landing site. The mission may pave the way for low-cost, robotic exploration of the planet's entire surface.

Month	Event
February	Shuttle mission to upgrade the Hubble Space Telescope
June	Near Earth Asteroid Rendezvous mission passes by 253 Mathilde
July	International Extreme Ultraviolet Hitchhiker Mars Pathfinder lands on Mars
August	Advanced Composition Explorer
September	Mars Global Surveyor enters orbit around Mars
October	Cassini Geostatationary weather satellite Lunar Prospector Spartan 201-4
November	Tropical Rainfall Measuring Mission

August

● Carried aloft by a Delta II rocket, the Advanced Composition Explorer will study the origin and evolution of the solar system by analyzing energetic particles coming from interplanetary space, the sun, and regions far beyond.

September

● Following a 10-month voyage, the Mars Global Surveyor is scheduled to enter orbit around Mars. Each orbit lasts about 2 hours and takes the craft over a different section of the planet's surface.

October

● The long-awaited Cassini mission begins its journey to Saturn. The craft's 4-year exploration of Saturn and its moons is expected to begin in 2004. Soon after Cassini enters orbit about the ringed planet, a small probe called Huygens will detach and parachute onto Saturn's cloud-bedecked moon Titan. Featuring a camera and a host of other detectors, the probe may determine whether Titan contains an ocean or lakes of methane, as some observations have hinted. Cassini will study Saturn's atmosphere, rings, magnetic fields, and plethora of tiny, icy moons.

● NASA sends aloft another in a series of geostationary weather satellites. Orbiting at high altitude, these craft rotate at the same rate as Earth, which allows them to continuously monitor weather over a particular site.

● During its single year of exploration, the Lunar Prospector will orbit 100 kilometers above the pock-marked lunar surface, surveying the moon's composition and gravitational and magnetic fields. It will also detect the release of lunar gases. A variety of spectrographs will collect data. By searching for regions that contain large amounts of hydrogen, the craft may verify whether a large basin near the moon's south pole harbors a reservoir of water-ice (SN: 1/4/97, p. 11).

● A space shuttle will launch the fourth in a series of missions to examine the sun. Deployed from the shuttle and retrieved after 40 hours, Spartan 201-4 is to examine the sun's hot outer atmosphere using instruments similar to those aboard the SOHO spacecraft (SN: 8/31/96, p. 136). These studies will help determine to what extent the performance of SOHO's instruments may have degraded during that craft's 18 months in space.

November

● The Tropical Rainfall Measuring Mission is the first satellite devoted to measuring tropical and subtropical rainfall and also the first to use spaceborne radar to detect rain. This 3-year exploration, intended to increase understanding of how rainfall drives atmospheric circulation, is conducted in collaboration with the Japanese space agency.

Depending on the recommendations of NASA review panels, several smaller missions scheduled for launch on Pegasus XL rockets might be attempted later this year. These include a craft designed to study the ocean's role in the global carbon cycle, a satellite that will trace the emergence of the solar magnetic field from beneath the sun's visible surface to its outer atmosphere, and student-built instruments to study Earth's atmosphere. □