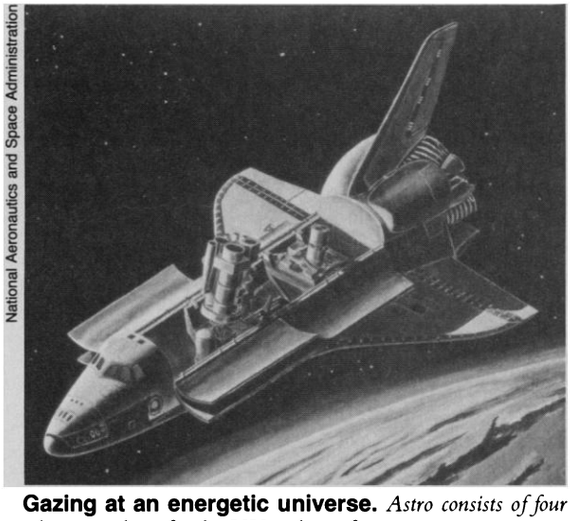
Astro: The First and Last of Its Kind?

The space shuttle's payload bay is at best an awkward place to do astronomy; witness the saga of the one payload that tries it

FOR THE ASTRONOMERS who have been waiting for the launch of the Astro-1 payload aboard the space shuttle Columbia, the sense of excitement has been equaled only by their feelings of frustration and anxiety.

The excitement comes from the mission's potential payoff. During the 10-day flight, scheduled to begin on 30 May (just after this issue of *Science* went to press), the shuttle astronauts will direct Astro's three ultraviolet telescopes and one x-ray telescope at massive young stars, quasars, active galaxies, neutron stars, Jupiter's volcanic moon Io, Supernova 1987A—anything in the universe that can emit hot, energetic photons. None of these observations can be made from the ground because the atmosphere absorbs ultraviolet radiation and x-rays. In all, the instruments will peer at more than 200 sources, generating a host of brand-new questions for Astro's next flight.



National Aeronautics and Space Administration

Gazing at an energetic universe. *Astro consists of four telescopes: three for the UV and one for x-ray.*

And that is precisely what the Astro astronomers find so frustrating: after spending more than a dozen years to develop the payload, they may never have a next flight. National Aeronautics and Space Administration (NASA) officials announced late last year that the $150-million telescope package, which was designed to fly again and again, may have to be grounded after the first flight because of tight budgets and even tighter shuttle launch schedules. Moreover, the inevitable launch delays on Astro-1—it was originally supposed to fly on 9 May—have made it touch and go whether the astronomers will even be able to make efficient use of the time they do have.

"Everyone is upset," says Jeffrey Clayton, Astro manager at NASA headquarters. "We have very nice instruments. And if they were on a free-flying satellite [instead of the shuttle] they would have been able to operate for a long, long time."

Clayton certainly gets no argument from anyone else on that score—now. But back in the mid-1970s, things looked very different. Agency planners were fully expecting the shuttles to fly 40 or 50 times per year and were eager to prove that the vehicles could be workhorses for science. Indeed, NASA never gave any consideration to putting the Astro instrument package on a free-flying satellite, although it could have been done. Instead, Astro was penciled in for at least eight flights as part of the Spacelab series of shuttle-based science missions. And the astronomers had no strong objections at first: eight flights seemed to give them plenty of opportunity to digest each round of observations and go back for more.

But it was not to be. By the late 1980s, in the post-Challenger, post–Gramm-Rudman era, the shuttle's planned flight rate had dwindled to no more than 12 to 14 per year. And the number of scheduled Astro flights had dwindled along with it: from eight, to six, to three, to two. And then in December 1989, when budgetary negotiations with Congress and the White House seemed likely to limit the flight rate even further, NASA officials tentatively axed Astro-2.

"Astro-2 is at the bottom of the list" in terms of priority, sighs NASA space science chief Lennard A. Fisk. The fact is that NASA is already doing lots of other astrophysics missions, he says—including the Hubble Space Telescope, whose ability to observe in the ultraviolet somewhat overlaps Astro's. The highest priority has to go to "microgravity" missions to study materials processing and life sciences in weightlessness, Fisk says: for these fields, Spacelab is the only game in town.

Astro scientists say they understand the logic. But even so, says Arthur Davidsen of Johns Hopkins University, principal investigator on the Hopkins Ultraviolet Telescope instrument, "It was like the Grinch that stole Christmas."

Worse, says Arthur Code of the University of Wisconsin, principal investigator on a photopolarimeter nicknamed WUPPE, the news came too late for the scientists to do much about changing the Astro-1 observing schedule, which is choreographed like a celestial ballet. "It was all planned on the basis of having reflights," he says. "If we had known that we only had one mission, we would have made much more effort to single out our 'Top Ten' targets."

Fisk is sympathetic—and indeed, points out that a second Astro launch is not completely out of the question. He is trying to protect the opportunity for another Astro launch at least until this summer, he says, when the agency will have a clearer picture of its flight schedule and budgets for the next few years. "But when we commit," he says, "I want there to be a real chance of flying. The worst thing we could do for the Astro-2 team is to hold them together and then never deliver a flight. It's just not fair."

Be that as it may, there is still Astro-1 to get through. And from all reports, that will not be easy. The biggest single headache is that observing schedule, says mission scientist Theodore Gull of NASA's Goddard Space Flight Center. Every time the launch is delayed—and shuttle launches are almost always delayed—the earth moves a little bit further in its orbit and the changing celestial geometry makes the existing schedule a little bit further out of date.

As it is, says Gull, Columbia will blast off on 30 May with an observation schedule from its previously scheduled launch date, 16 May: NASA flight rules decree that no updated time lines can go on board beyond a certain time before launch to make sure that the crew, the ground controllers, and the field operations people are *all* working from the same documents. Revisions based on the exact time and date of launch will be radioed up to Columbia once it is in orbit, says Gull. But he expects that he and his team will spend the entire 10-day mission in panic mode to produce those revisions. The resulting improvisations may not make the best use of Astro's time, he says. "So we may lose some science opportunities. But mostly it's going to affect our peace of mind."

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