amount of money, we could pull out."

According to UKAEA spokesman Chris Carpenter, Germany and Italy "effectively have a veto because there is not enough money in the box without their participation."

For his part, Gill maintains that the staff dispute and JET's continuation are separate issues. Peter Simpson, an engineer and the lead representative of UKAEA's trade unions, agrees: "The decision to close or continue JET in the near term rests solely with the people funding the project and not with the litigants in the staff case."

An uncertain future

If the facility stays open, France's Jérôme Pamela will take the helm in January. The plan is to operate the tokamak in four six-week blocks a year, maintained by a small on-site staff, with experimenters sent from their home labs. The new setup, says Jacquinot, "will offer a mechanism to have better integration of [Europe's fusion] programs and transfer of expertise from one scientific or technical area to another. It's possible that there will be more synergy, but I also expect that the system will take some time to find the proper rhythm."

Meanwhile, the uncertainty about JET's future is taking a toll. Over the past three years, about 18% of the British staff have left, and the overall number of staff has dropped by more than 25%, to around 500. Because of the change in management, JET's EC employees have to leave by the end of the year, and of those who have already left, only about a quarter have stayed in fusion research, says Jacquinot. "We have lost expertise due to people going out of the field."

What's more, the hubbub may already have caused severe damage to Europe's fusion program, says JET council chair Francis Troyon. JET is noted for its success as a large international project in the European fusion program, he says. "I am afraid the field's image has been tarnished in the political and public spheres by this long conflict, and that we may pay for this loss of image later, particularly when important decisions on the next large fusion device—an ITER—need to be taken."

Toni Feder

University Satellite Is Set to Probe the Early Universe

The Far Ultraviolet Spectroscopic Explorer, the most costly and complex satellite yet to be built by academics, was at press time scheduled to be launched on 23 June from Cape Canaveral, Florida. But what with the US aerospace industry's recent spate of rocket launch failures—which were partly responsible for previously delaying FUSE's launch and adding $12 million to its $108 million tab—nobody will count on it until after liftoff.

Originally managed by NASA, FUSE was canceled in 1994 as part of the agency's move to be "faster, better, cheaper." But FUSE was spared the ax when NASA accepted Johns Hopkins University's bid to build it for less than half of what NASA would have spent, plus $40 million to operate the satellite for three years.

With FUSE, scientists plan to measure deuterium and, accounting for stellar fusion of deuterium with hydrogen to form heavier elements, to deduce how much of the hydrogen isotope was present in the early universe. Deuterium is a sensitive tracer for the first few minutes after the Big Bang, says Bill Blair, a FUSE scientist. "Knowing how much there was tells you something about the primordial soup—when matter condensed out, its temperature, density, and how much baryonic matter was produced in the Big Bang."

By picking out a series of transitions in the 90–120 nm range, FUSE will distinguish deuterium from the more preponderant hydrogen. Absorption spectra will be collected for hundreds of stars in the local universe, including our galaxy, the nearby Magellanic Clouds, and the intergalactic medium; farther away, the deuterium transitions are redshifted out of FUSE's wavelength range, though a few can be seen by the Hubble Space Telescope and ground-based instruments.

NASA/KSC

AWAITING LAUNCH at Cape Canaveral is the Far Ultraviolet Spectroscopic Explorer satellite.

If scientists find that deuterium is distributed highly nonuniformly, it would mean that not all deuterium was created in the Big Bang. That would be "really exciting," says Kenneth Sembach, FUSE's chief science planner. "It would make us have to think of other methods of destruction and construction of deuterium."

Another experiment planned for FUSE will study the mixing of hot gases by looking at highly ionized oxygen. Explains Sembach, "It has a transition in the far ultraviolet, and it's a good tracer of supernovae, because the primary way of heating gases to a few hundred thousand degrees is to have a supernova explode. That kicks material around, and it eventually rains back down—kind of like a fountain." Also planned is an experiment to study molecular hydrogen, the universe's most abundant molecule.

Counting down

Shifting responsibility for FUSE from NASA to Johns Hopkins not only rescued the mission but created savings by speeding up development time. But cutting costs also meant that scientific optical observations were scratched. And the satellite's planned orbit was lowered from 74 000 km to 768 km, where Earth blocks the view approximately half the time. Says principal investigator Warren Moos, "To be absolutely blunt, we are in a new mode. We are asking, How can we do the most science with constrained dollars?"

Taking on such a project is beyond most universities' means, adds Moos. "I don't think you can just set out to do this. The typical academic campus doesn't have the infrastructure. We have a large team and a deep bench. We're lucky." Having a university run FUSE is giving students and faculty hands-on involvement in the project. For example, students have helped build and test electronics, mirrors, and spectrographs, and they will participate in data analysis. The control room has been set up in Johns Hopkins's physics and astronomy department. That, Sembach says, "allows for a really good exchange between science ideas and desires and realistic mission capabilities."

Working with Johns Hopkins on FUSE are the University of Colorado at Boulder; the University of California, Berkeley; the French and Canadian space agencies; about a dozen companies; and NASA, which acts as a technical adviser and will oversee the allocation of time to guest observers.

Toni Feder