The unkindest cut: Tethered satellite lost

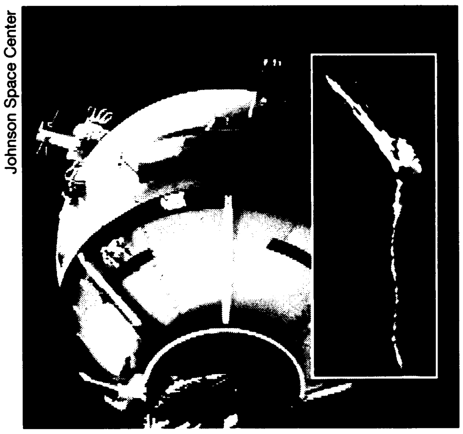
This time, it was supposed to work.

And for just under 5 hours, as the crew of the shuttle Columbia reeled out a satellite on the end of a 20-kilometer-long umbilical cord, the experiment in space went like clockwork. Designed to probe Earth's ionosphere and to test an innovative way of generating electricity, the conducting tether swept through our planet's magnetic field at 8 km per second. The motion created an electric potential as great as 3,500 volts between the shuttle and the satellite. At times, when the satellite, the shuttle, and the ionosphere formed a complete circuit, the tether generated as much as half an ampere of current.

Late on Feb. 25, the crew had unreeled the shoelace-thin cord to 19.7 km, nearly its full length. Suddenly, the cord snapped near the top of a launching boom in Columbia's cargo bay, and the $440 million Italian-built satellite floated away like a lost balloon.

Tether scientist Brian Gilchrist of the University of Michigan in Ann Arbor says that the experiment had collected intriguing data before the cord broke.

Johnson Space Center



The satellite before the break; inset shows the frayed end of the snapped tether.

Notably, the cord had generated a larger current than expected. But, he added, "clearly, we did not meet the key objectives" of the mission, a joint enterprise of NASA, the European Space Agency, and the Italian Space Agency.

The crew had planned to retrieve the satellite 2 days after deployment. Instead, after only hours, they reeled in about 10 meters of frayed cord—minus the satellite, now destined to burn up in Earth's atmosphere within a month.

A 1992 experiment, the only other shuttle mission to deploy a tether, had also failed. During that mission, the reel jammed, and the shuttle crew could play out only a few hundred meters of the tether.

With the reel redesigned and three other test flights—using smaller or nonconducting tethers—succeeding in the interim, researchers had hoped this second shuttle flight would go well. "This was a real weirdy," says William J. Webster Jr. of NASA's Goddard Space Flight Center in Greenbelt, Md. "We were caught by surprise."

The tether wasn't taut when it broke, making it seem unlikely that the fault stemmed from a mechanical problem, says Webster. "We [may have] been hit by an unusual electrical effect," he conjectures. Discoloration of the severed cord also suggests an electrical malfunction. Inspection of the cord when the shuttle returns to Earth should determine the culprit, Webster adds. *— R. Cowen*

Element 112 debuts in fusion of lead, zinc

Researchers have added a chemical element to the periodic table.

So far unnamed, this new atom has a nucleus consisting of 112 protons and 165 neutrons, giving it an atomic mass of 277. It's the heaviest nucleus yet created in the laboratory.

The detection of a single nucleus of element 112 is the latest in a series of discoveries at GSI, the center for heavy ion studies in Darmstadt, Germany. In late 1994, a GSI team produced elements 110 and 111 (SN: 1/7/95, p. 5).

This sequence of experiments brings nuclear physicists tantalizingly close to creating element 114. Theorists have long predicted that a combination of 114 protons and about 184 neutrons would be more long-lived than other superheavy atoms in the periodic table. Uranium, with atomic number 92, is the heaviest naturally occurring element.

Sigurd Hofmann of GSI and his collaborators announced their discovery of element 112 last week in a paper submitted to ZEITSCHRIFT FÜR PHYSIK A.

The researchers made element 112 by accelerating zinc ions to high energies, then slamming them into a lead target. Very rarely, when a zinc ion had just the right energy, it would fuse with a lead nucleus to create a new element.

Collecting data for several weeks earlier this year, the GSI group ended up detecting a single nucleus of element 112. It decayed after less than a millisecond by emitting an alpha particle, which consists of two protons and two neutrons, to create an isotope of element 110 with an atomic mass of 273. That isotope, in turn, decayed by emitting an alpha particle to form a new isotope of element 108, and so on.

The pattern of the isotope lifetimes helps establish that nuclei with about 162 neutrons hold together more strongly than nuclei with a smaller or larger number of neutrons (SN: 9/24/94, p. 206). Theories of nuclear structure assume that neutrons and protons are arranged in layers, or shells, and predict that certain numbers of these particles lead to particularly stable configurations.

Recent calculations suggest that a narrow "peninsula" of relatively stable isotopes, including element 112, may link the known superheavy elements to the putative "island" of stability at atomic number 114, says Yuri A. Lazarev of the Joint Institute for Nuclear Research in Dubna, Russia. He and his coworkers have confirmed this picture in recent experiments that produced the heaviest known isotopes of elements 104, 106, 108, and 110.

At GSI, researchers are now preparing experiments involving even heavier projectiles than zinc to produce elements 113 and 114. The results may answer questions about the maximum size and weight that atomic nuclei can attain—a fundamental issue in understanding the structure of matter in the universe.

— I. Peterson

Gene variants link Alzheimer's forms

The mysteries of Alzheimer's disease have proved as tough to unravel as the characteristic nerve tangles in sufferers' brains. In fact, doctors do not know for certain whether Alzheimer's is one, two, or several similar diseases.

Now, scientists have found genetic evidence in 208 patients that the two main forms of Alzheimer's—one emerging early in life and another after age 65—may actually be versions of the same illness.

The "unifying" puzzle piece is the *presenilin-1* gene, says geneticist John Hardy of the University of South Florida in Tampa. This gene is one of three whose variants can trigger early-onset Alzheimer's—a rare freefall into dementia in people under the age of 65 (SN: 8/19/95, p. 118).

A different variant of *presenilin-1* can increase a person's risk of the late-onset disease. An individual with two copies of this variant, one from each parent, is twice as likely to develop late-onset Alzheimer's as a person with just one copy, report Hardy and his colleagues at South Florida and Washington University in St. Louis in the Feb. 24 LANCET. "The disease mechanisms are similar to each other, whatever the age of the patient," he says.

Researchers believe a cascade of genetic and environmental events produces late-onset Alzheimer's, which accounts for most cases. Yet scientists have nailed down just one genetic risk for late-onset disease—the gene for apo E-IV, a protein that ushers cholesterol through the bloodstream. In 1993, a