

TSS-1: The science mission that got away

Any fisherman knows that a line on a reel can snag. Stretch the average fishing line over 20 kilometers, take away the familiarity of gravity, add a 518-kilogram satellite: Then things begin to get really difficult.

Shuttle astronauts hit mechanical snags from the start of their attempts to deploy the first tethered satellite last week. As originally designed, the Tethered Satellite System (TSS-1) resembles a giant fishing kit, with the 5-foot-diameter satellite attached to the shuttle by a shoelace-thin, 20-kilometer-long cord. The TSS-1 team managed to unreel only 256 meters of this tether before several knotty problems halted all progress, forcing them to retrieve the satellite with its primary scientific goals unaccomplished.

"The science team was very disappointed in the results of the mission," said TSS-1 mission scientist Nobie Stone of Marshall Space Flight Center in Huntsville, Ala., speaking at a NASA briefing last week. "We did not achieve our primary objectives. . . . We didn't approach those."

A joint venture between NASA and the Italian Space Agency, the mission set out to test the physical stability of long-tethered systems and to conduct electrodynamic experiments in the space environment.

Although the unreeled tether stretched less than 2 percent of its planned distance, the mission still achieved two major engineering objectives: the deployment and docking of the satellite, noted lead flight director Chuck Shaw of Johnson Space Center in Houston at the briefing. The system was easier to control in space and more stable than predicted, he added.

The problems encountered involved the satellite-deployment mechanism, built by Martin Marietta Astronautics Group of Denver. After several delays due to technical glitches, deployment stopped entirely when a snag seemed to develop at the end of the deployment boom. By the time the TSS-1 team managed to free the tether, the satellite had used up most of its thruster fuel. The team elected to retrieve the satellite rather than risk its loss.

NASA has formed an official board of investigation to assess the problems and recommend corrective measures.

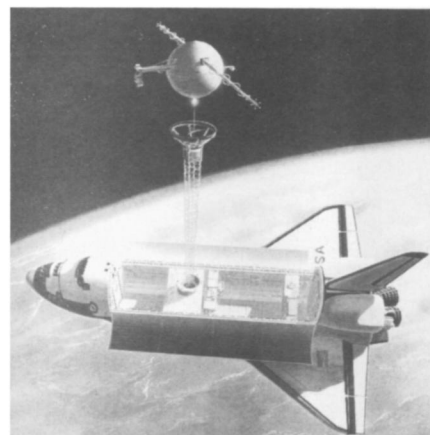
Ironically, all science instruments functioned well. Researchers measured the electrical environment around the shuttle, but the satellite got nowhere near the minimum 10-kilometer distance needed to conduct the primary scientific experiments, says Rick Howard, TSS-1 mission scientist at NASA headquarters in Washington, D.C.

Scientists had hoped to investigate the power-generating capabilities of the teth-

ered system. They had predicted a buildup of 5,000 volts across the electrically conducting tether as it moved through Earth's magnetic field. While unable to observe the phenomena associated with these high voltages, they did demonstrate the system's power-generating properties with a measured electrical potential of 40 volts and a current of 0.015 amp across the tether.

Such results only whetted the scientific appetite, however. "We just got a taste of what we were really out there to do," says Howard. He adds that TSS-1 scientists strongly support another tethered satellite mission. Stone concurs, stating that "the science team is more convinced than ever that the tether system offers us a unique tool for research."

While the Italian satellite was designed to fly three times, NASA has yet to commit to another attempt. The mission will have to compete with other science experi-



Martin Marietta

Artist's rendition of Tethered Satellite System. Deployment stopped soon after this phase.

ments for funds and space on the shuttle, which is currently booked for the next several years, says George Withbroe, director of NASA's Space Physics Division in Washington, D.C.

—K. Hoppe

Aliens wreak havoc in Hawaiian islands

Slithering snakes snacking on endangered birds. Inflammable grasses turning timber stands into tinderboxes. Roving rabbits ravaging acres of vital vegetation.

These are but a few of the alien species under attack by Hawaii's ecologists and conservation managers.

So far, officials have the upper hand against these strangers in paradise, but a report released this week by two environmental groups warns that Hawaii's unique ecosystem may suffer irreversible damage unless state and federal practices are beefed up to stem future alien invasions.

The report — prepared by the Nature Conservancy of Hawaii in Honolulu and the Honolulu headquarters of the Natural Resources Defense Council — calls for Hawaii's agriculture department to take the lead in a multi-agency effort to develop better ways to keep pests from entering and eradicate them if they do arrive. Scientists discussed the report in Honolulu this week at the joint annual meeting of the American Institute of Biological Sciences and the Ecological Society of America.

Alien species "are our number-one problem," says Patrick Dunn, a stewardship ecologist with the Nature Conservancy of Hawaii. He estimates that National Park Service managers in Hawaii spend 80 percent of their time fighting alien species that threaten to disrupt the ecological balance of the islands' national parks.

Roughly 20 additional species of alien insects alone enter Hawaii each year. Some become crop pests, introduce human or animal diseases, or eat native insects important for pollinating plants. Others simply outcompete native insects for re-

sources such as food or breeding areas.

Hawaii is particularly vulnerable to the effects of introduced species. For centuries, a new species traveled the 2,500-mile distance from the nearest land masses only once every 100,000 years. The difficult crossing left Hawaii with no native mammals save a single species of bat, and with no native snakes. Today, when such animals arrive, they have no natural predators and can multiply out of control.

Hawaii has regulations designed to bar unwanted immigrant species — including Customs-like declaration forms for incoming domestic airline passengers — but these have proved ineffective, according to the report. Nearly a dozen state and federal agencies have jurisdiction over some facet of alien-species introduction and control in Hawaii, resulting in "many gaps and leaks for pest entry and establishment," the report states.

Officials from various agencies have agreed to meet later this month to develop new control strategies — such as programs for inspecting samples of arriving cargo, mail, and passengers — and to identify changes needed in regulations. Once these are in place, the report recommends establishing computerized systems for tracking alien species, coordinating research across various agencies on the effects of introducing aliens, and expanding campaigns to publicize the dangers.

"The problem is very serious," says Yukio Kitagawa, chairman of Hawaii's agriculture department. "This report not only identifies the gaps in our alien-species control system, but it also proposes the critical steps we must take to close those gaps."

—C. Ezzell