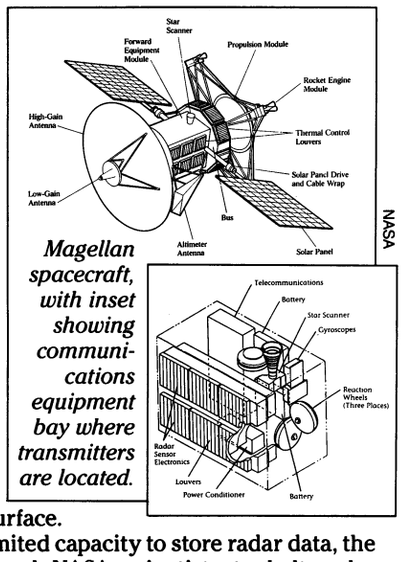
Planetary Science

Magellan resumes mission to map Venus

Thanks to a flawed but still functioning backup transmitter, the Magellan spacecraft was set to resume its radar mapping of Venus on Jan. 24, nearly three weeks after the main transmitter failed. A spurious electronic "whistle" in the backup unit, however, will reduce by 43 percent the rate at which Magellan beams its radar data back to Earth. This will force the craft to image smaller swatches of the Venusian surface, says Magellan project engineer David Okerson of Space Applications International Corp. in Washington, D.C.

Problems with the main transmitter began Jan. 4, when the craft attempted to send its newest data to a radio receiver on Earth. Although it broadcast a clear carrier frequency — the electronic signal that normally carries the mapping data — for unknown reasons the transmitter stopped adding the Venus data to the monotone carrier signal. In effect, the transmitter beamed to Earth a single note of music rather than the symphony of information describing Venus' surface.



Magellan spacecraft, with inset showing communications equipment bay where transmitters are located.

NASA

Since the craft has a limited capacity to store radar data, the transmission failure forced NASA scientists to halt radar studies until Magellan resumed full communication with Earth. (Despite the equipment problem, the craft could still receive electronic signals critical to maintaining its proper orbit around Venus, Okerson notes.)

Mapping came to a halt during Magellan's 3,880th orbit around Venus. Since September 1990, the craft's radar has pierced the clouds enshrouding Venus to image 95 percent of the planet's surface — a rugged terrain marked by volcanoes, craters and sinuous channels (SN: 12/21&28/91, p.424).

With the main transmitter out of commission, switching to the backup would normally entail a relatively simple series of operations, Okerson observes. But the backup unit had its own problems: Engineers had turned it off in March after electronic noise, known as a whistle, impaired its ability to send clear signals to Earth. The electronic frequency of the whistle drifts and its intensity increases as the transmitter's temperature rises. Researchers believe a crack in a computer chip may account for the whistle, since such a fracture would shrink or expand with temperature changes.

Earlier this month, NASA engineers managed to circumvent most of the whistle by choosing a lower-than-normal electronic frequency — well-separated from the obscuring noise — for the radar data, Okerson says. They also decided to leave the backup transmitter turned on instead of powering it up only when sending information, so that its temperature — and, they hoped, the whistle — would remain constant.

At the lower frequency, notes Okerson, the backup transmitter relays data at a rate of 115 kilobits per second — less than half the previous rate. This slowdown decreases the area Magellan can map during each orbit.

Because the other part of Magellan's mission — probing the planet's interior by measuring its surface gravity — depends only on the standard carrier signal, the transmitter's slower relay of radar data does not affect it, Okerson says.

Science & Society

Elizabeth Pennisi reports from the Transportation Research Board's annual meeting in Washington, D.C.

Paying as you go

By the year 2000, tollbooths may be extinct. Developments in automatic vehicle identification are paving the way for electronic toll collection, in which cars don't even have to slow down to pay. "All that may be necessary is a bridge above the highway on which to install the reader," says Thomas F. Humphrey, a traffic engineer at the Massachusetts Institute of Technology. Eventually, readers may be built right into the pavement, eliminating the need for overhead structures, he adds.

Texas, Oklahoma, Louisiana, Colorado, Florida and Michigan have already automated their toll collection to some extent, says Humphrey. New York, New Jersey and Pennsylvania will soon follow. In these nine states, drivers open an account and receive a transponder or tag that identifies their car. As they go through a tollgate, a sensor reads the tag or transponder and deducts the toll from their account.

Since June 1990, Humphrey has been working with representatives of New England toll agencies and Logan Airport in Boston to set up an electronic toll and traffic management system that all states in the region could use. However, New England's varied climate challenges the existing identification technology, he says. Snow can hinder video readers, while strong winds distort vertical sound waves used as identifiers. In addition, to make the system more amenable to drivers, the various toll agencies need to devise a way for one account to cover any of the region's roads or bridges, he says. Agencies must also address privacy concerns.

Although these issues have not yet been worked out, Massachusetts will try out several technologies for automated toll collection this spring at Boston's Tobin Bridge, says Humphrey. New Hampshire has already begun testing these new technologies on some of its roads.

Highway hues: Forget the blues

Fluorescent yellow and orange should be the highway designer's colors of choice for catching a driver's eye, according to two engineers from Ohio University in Athens.

Helmut T. Zwahlen and Uma D. Vel tested detection and color recognition of four fluorescent and six nonfluorescent, 12-by-6 inch targets, which they placed in full sunlight against backgrounds representing fall colors, spring foliage or a typical city. They flashed the targets 20, 30 and 40 degrees to the right of the line of sight of a dozen volunteer "drivers," who noted the colors they saw.

The volunteers detected fluorescent yellow best and recognized fluorescent orange more readily than other colors, Zwahlen and Vel report. The results indicate that drivers glancing to the side see the fluorescent colors much better than their nonfluorescent counterparts.

Credit cards to cover bus fares

Phoenix, Ariz., took a big step toward allowing riders to pay bus fares with credit cards last year by rigging the fare boxes to read magnetic stripes on plastic cards. To set up this system, the city added card readers to about 350 electronic fare boxes that had been installed on buses during the 1980s. Since April 1991, the readers have accepted monthly and employee passes and a special bus credit card, says Thomas J. Ross, an engineer with the Phoenix Transit System.

The reader checks the card's number against a list of bad or recently used cards and then beeps to verify that the payment has been logged into its memory. The user receives monthly bills showing the date, fare and location of each trip made with that card. Eventually, the city plans to work out ways to use credit cards in addition to — and ultimately, instead of — transit passes, says Ross.