

## Balky tape recorder plagues Galileo

Talk about rotten timing. Already hampered by a main antenna that never unfurled, the Jupiter-bound Galileo spacecraft depends on its tape recorder to store data until those times when a smaller antenna can slowly beam the information to Earth. Now, just as the craft is closing in on Jupiter, the tape recorder has developed a problem.

But project manager William J. O'Neil of NASA's Jet Propulsion Laboratory in Pasadena, Calif., says that the craft can still use 90 percent of the recorder's storage capacity.

On Dec. 7, the craft begins a 2-year tour of the giant planet and its moons. Technicians discovered the tape malfunction on Oct. 11, after the craft imaged Jupiter and its main moons. Engineers commanded the recorder to partially rewind after storing the images, but it continued past the stopping point.

Test commands relayed on Oct. 20 revealed that the recorder could still play and that it had probably gotten stuck rewinding at the extreme end of the tape. As long as scientists don't play back data at either end of the tape, O'Neil says, the craft can carry on its mission as planned.

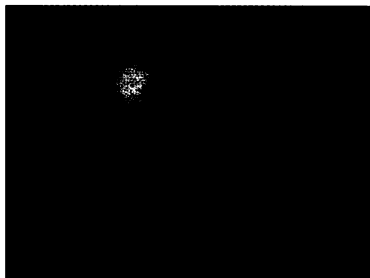
The malfunction won't prevent NASA from obtaining the bulk of the data gathered by Galileo's free-flying probe, which will plunge into Jupiter's atmosphere on Dec. 7 (SN: 8/5/95, p.89). That's because scientists had previously arranged for the probe to send a truncated version of the data collected during its 70-minute Jovian free fall to the parent craft's computer. The computer, however, can't entirely substitute for the tape recorder during Galileo's upcoming tour, because it contains only a fraction of the storage space of the reel-to-reel device.

## The strange case of 4179 Toutatis

Sporting a complex tumbling motion and a chaotic orbit that defies long-term prediction, the potato-shaped near-Earth asteroid 4179 Toutatis ranks as one of the stranger objects in the solar system. That's what planetary scientists conclude from a computer analysis of radio images obtained in 1992, when Toutatis came within 3.2 million kilometers of Earth.

"The vast majority of asteroids, and all the planets, spin about a single axis like a football thrown in a perfect spiral, but Toutatis tumbles like a flubbed pass," says R. Scott Hudson of Washington State University in Pullman. In the Oct. 6 SCIENCE, he and Steven J. Ostro of NASA's Jet Propulsion Laboratory in Pasadena, Calif., note that the tumbling stems from a combination of two different rotations, one with a period of 5.4 days and the other with a period of 7.3 days. Together, these motions ensure that Toutatis never repeats its orientation.

Even though all asteroids are thought to have suffered violent collisions that could set them tumbling, most of the known ones rotate about a single, fixed axis. Tumbling stresses an asteroid, creating a source of internal friction, or heat, that ultimately damps out the erratic motion. But because Toutatis tumbles so slowly—over a period of about 6 days rather than several hours—the asteroid won't generate enough heat to damp the motion for another trillion years, Hudson notes. Thus, its rotation represents a well-preserved relic of impacts that most asteroids have undergone.



NASA

*Computer-generated view of the near-Earth asteroid 4179 Toutatis shows shallow craters and linear ridges. The deep "neck" has two interpretations. Either Toutatis consists of two separate objects bound in a loose embrace, or it's a single body pelted by debris that sculpted the narrow feature.*

## Rescuing memories with age. . .

Take out your notebooks and listen up. A group of professors at the University of California, Berkeley, has a lesson to impart about overcoming the memory losses that often accompany aging. Today's theme: Intelligent people who stay mentally active into their 60s and beyond can give their memories more staying power.

"Efficient use of memory strategies developed during adulthood may compensate for biological aging effects, such as generalized slowing [of mental functions]," assert Arthur P. Shimamura, a Berkeley psychologist, and his coworkers.

Shimamura's group administered a battery of memory and cognitive tests to 72 professors recruited from a wide spectrum of disciplines on the Berkeley campus. Volunteers fell into three age groups of about the same size: young professors, age 30 to 44; middle-aged professors, ranging from 45 to 59 years old; and senior professors, age 60 to 71.

Senior professors scored lower than their younger comrades on several tasks that typically become more difficult with age, the researchers report. Such tasks include the ability to press an appropriate computer button as quickly as possible in response to simple directives or symbols flashed on the screen, as well as the ability to recall pairs of faces and names after a single viewing.

Intelligence and a vigorous mental life apparently cannot fend off age-related declines in the overall ease of manipulating information and memorizing arbitrary pairings, such as names to faces, the scientists contend.

However, senior professors held their own on two memory tests that require mental planning, organization, and problem solving. Scores on these tasks usually decline sharply in the elderly, Shimamura's group notes. One test assesses the ability to remember which individual geometric patterns one has already tagged in successive presentations of an array of 16 such designs; the other probes memory for details of recorded text passages.

Because professors must frequently integrate new information into an existing knowledge base, they may devise memory strategies that overcome some of the biological glitches of the aging brain, the investigators propose in the September PSYCHOLOGICAL SCIENCE.

## . . . and losing them to schizophrenia

In contrast to the mentally energetic elderly, relatively young people suffering from schizophrenia show signs of deep-seated memory disturbances. Working memory—the ability of the brain to store and use information over brief time periods—is particularly hard hit in schizophrenia, apparently because of widespread brain malfunctions, according to a study in the October AMERICAN JOURNAL OF PSYCHIATRY.

Daniel C. Javitt, a psychiatrist at Albert Einstein College of Medicine in New York City, and his coworkers recruited 20 psychiatric patients diagnosed with schizophrenia and 20 mentally healthy adults. The average age of both groups was 37 years. Volunteers tried to identify whether pairs of tones played through headphones matched in pitch. Some trials presented tones at the same time, making no demands on memory; others presented the second tone about one-third of a second after the first, thus invoking working memory.

Schizophrenic patients made many more errors in matching tones after brief delays than the comparison group did, the scientists report. Both groups performed equally well on simultaneously presented tones. Working memory problems are often attributed to disturbances at the front of the brain. But the new findings suggest that flaws in other cerebral regions handling sensations such as hearing help to undermine working memory in schizophrenia, the researchers assert.