who have attempted suicide have reduced responses to a drug that increases brain serotonin—regardless of whether they have a mood or personality disorder. Coccaro believes that serotonin acts as a "brake" for violent impulses.

Other research suggests that people who actually commit suicide—rather than just attempt it—may have serotonin deficiencies even in the absence of violent histories. That work was reported by Pittsburgh neuroanatomist and receptor pharmacologist Victoria Arango, whose team has been comparing the brains of 20 suicide victims with those of 20 sex- and age-matched controls. Arango has produced autoradiography images showing that certain brain areas associated with mood (in the prefrontal cortex and hippocampus) show an increase, in the suicide victims, in serotonin binding sites—which, researchers believe, means that extra receptors have been created to compensate for a serotonin deficiency. Arango says this finding is consistent with the data on attempters.

Researchers warn that no single set of factors—much less a single neurotransmitter system—is adequate to explain suicide. Hence the need to plant themselves "at the intersection of psychiatry, biology, personality, sociology, and culture," as Maris put it. Otherwise, he said, "we are going to continue to have a very rudimentary science of suicidology."

–Constance Holden

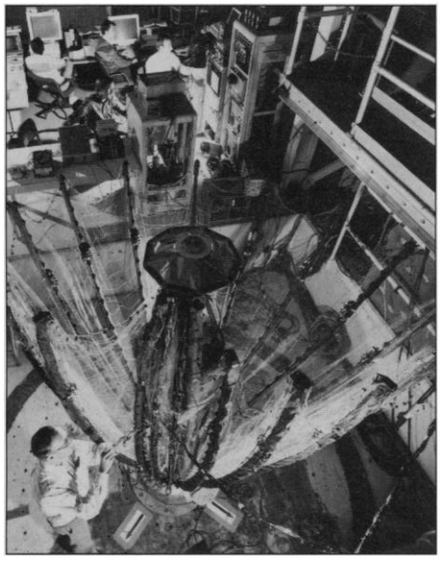
SPACE SCIENCE

Galileo Gets a Boost; UARS Goes Bust

A homeowner knows the feeling. As soon as you fix the furnace, the air conditioner goes on the fritz. You repair the leaky roof, and termites show up in the basement. Spacecraft seem to work the same way. At a press conference on 11 June, engineers and scientists at the Jet Propulsion Laboratory (JPL) announced that they had figured out how to bypass the disabled main antenna of the Jupiter-bound Galileo spacecraft by funneling critical information through a far less powerful secondary antenna. Most of the mission will be saved.

But the next day officials at NASA's Goddard Space Flight Center had to announce that the Upper Atmosphere Research Satellite (UARS), whose 10 instruments had been studying the atmosphere and the sun since the satellite's launch last September, had been crippled by a malfunctioning solar array. Whether engineers can match the success of their Galileo colleagues and come up with a fix to salvage the rest of the planned 3-year mission remains to be seen.

Just getting around Galileo's simple problem, its snared main antenna, will take some ingenious dodges. Unless the antenna can be unjammed and fully opened (*Science*, 23 August 1991, p. 847), Galileo's transmissions from Jupiter through its secondary antenna will be 10,000 times weaker than planned. A weaker signal would ordinarily mean that data transmission, to be intelligible, would have to be that much slower, rendering Galileo nearly mute. But at the press conference, Leslie Deutsch, who manages technology development for NASA's Deep Space Network of receiving antennas, explained how Galileo's rate of data transmission could be increased by a factor of 10. Part of the improvement would come from combining the signals received by several ground antennas and upgrading the amplifiers attached to those antennas. More powerful techniques for catching and correcting transmission errors would also help. All told, these improvements would allow the Galileo spacecraft to return about 0.1% of the planned number of data bits.



JPL

Worse than a leaky roof. Engineers at JPL are fiddling with a stuck Galileo-type antenna in hopes of freeing the one in space.

That may not sound impressive, but this data trickle will be rich in information: Some types of observations will be digitally compressed into one-tenth to one-twentieth the usual number of data bits before they are transmitted. Even sending back images—ordinarily among the most data-intensive of observations—"will not be as hard as I thought it would be," says project scientist Torrence Johnson of JPL. Engineers have found that Galileo has enough spare computing power for the job in the spacecraft's attitude control computer. In quieter moments it will have time to "redraw" the images mathematically using only 5% to 10% of the original number of data bits. Added to the improvements in reception, data compression will enable Galileo to accomplish 70% of the mission objectives, Johnson said.

Within that average, not all Galileo science will fare equally well. Researchers interested in the behavior of Jupiter's magnetosphere can look forward to about 75% of the data the mission had originally promised. But meteorologists expecting to sort out why the Jovian winds blow the way they do by studying pictures of its clouds will get only a few hundred of the tens of thousands of images they were counting on.

On the whole, though, the mood among Galileo scientists is definitely upbeat again, even though what had seemed the engineers' best hope of freeing the main antenna has not panned out. After six of a planned seven cycles of warming and cooling of the central tower, where three ribs of the umbrella-like antenna are stuck, project manager William O'Neil of JPL concedes that "if it was going to work, it would have worked by now." O'Neil still holds out some hope for one more temperature manipulation—simply letting the antenna warm as Galileo sweeps closer to the sun at the end of the year. If that doesn't do the trick, engineers will take the brute force approach—rapidly cycling the motors that open the antenna on and off in order to double the force tending to free the stuck ribs. "That by far is the most promising thing that we've had," O'Neil now says.

UARS engineers wish they had some similar plans of their own. On 1 June the lone solar array supplying power to UARS stopped rotating, which means that it cannot be kept facing the sun to maintain full power levels. After the spacecraft switched to the backup drive unit, all went well until the next day, when the backup began misaligning the array. That's just the sort of mundane but catastrophic mechanical problem, crippling an entire array of instruments in one stroke, that last fall prompted a review panel to recommend that NASA scale back its plans for Earth Observing System (EOS) satellites. The EOS satellites, successors to UARS, would have put 50% more instruments on a single platform, where they would be vulnerable to a single glitch (*Science*, 27 September 1991, p. 1481).

While NASA ponders the lessons of the UARS failure, the array has been fixed in one position that supplies enough power for only two of the 10 instruments, and troubleshooting continues. One thing seems clear: A fancy electronic fix à la Galileo will probably not help. UARS deputy project manager John Donley of Goddard suspects the team may have a clutch problem on its hands. And you car-owners know what that's like.

–Richard A. Kerr