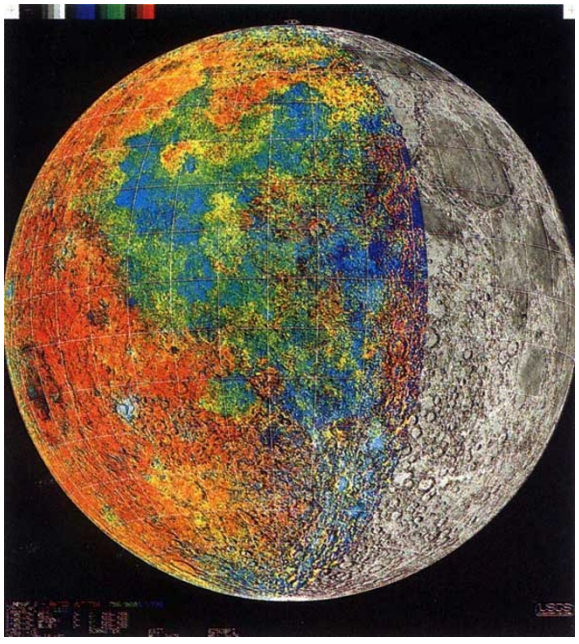
# Shake-up planned for Galileo as it steals quietly past Earth and on to Jupiter

**Washington.** After passing Earth at close range for the second time on 8 December, the Galileo spacecraft is now finally on its way to Jupiter, its ultimate destination. Its main antenna remains partially unfurled, severely curtailing its data transmission capacity, but mission planners at the National Aeronautics and Space Administration (NASA) are still confident that the stuck hardware can be jiggled loose by a series of manoeuvres scheduled to begin later this month.



**The Moon, pictured by Galileo during this week's fly-by. The colours represent surface brightness in different wavelength bands, from infra-red to ultraviolet, and can be interpreted in terms of surface composition. Green and yellow indicate higher concentrations of iron and magnesium.**

Engineers at the Jet Propulsion Laboratory (JPL) in Pasadena, California, believe the umbrella-like antenna failed to open fully because three of its 18 ribs are caught against a supporting tower. The spacecraft has been repeatedly turned on its axis, taking the antenna in and out of direct sunlight, in the hope that thermal stress would release the ribs. But this trick has failed, and JPL engineers now have a more aggressive plan. Starting on 29 December, they will send rapid pulses to a drive motor, hoping to pop the ribs loose.

This will be a last-ditch effort, and project managers have already decided that if it fails they will begin to design a scaled-down mission using only a smaller, low-gain antenna to transmit data from Jupiter. The low-gain antenna transmits only a paltry 10 bits per second, compared to the 134 kilobits per second that the high-gain antenna should have provided. By strengthening receiving stations on Earth and using data compression techniques, JPL engineers believe they can squeeze one kilobit per second from the low-gain antenna, but that is still less than one per cent of Galileo's planned capability.

If only the low-gain antenna is working when Galileo reaches Jupiter, it will not be possible to transmit data-intensive digital images in real time. Instead, they will have to be tape-recorded on the spacecraft and played back slowly during quiet periods between encounters with Jupiter's moons. Only 3,000–4,000 images would be obtained in a scaled-down mission, out of an originally planned total of 50,000.

Scientists studying the dynamics of the Jovian atmosphere would be especially hard hit, because much of the planned imaging was intended for the compilation of movies showing Jupiter's swirling weather patterns; they would be obliged to select only a few small areas for limited time-sequence photography. Similarly, 'fields and particles' instruments designed to map Jupiter's magnetic field and its interaction with the solar wind would yield data with much less spatial resolution.

Studies of Jupiter's satellites would fare better in a scaled-down mission. The number of images available would be smaller, but it should still be possible, as Galileo visits different moons, to obtain all the highest priority images. Project scientist Torrence Johnson points out that most of the important scientific information contained in the Voyager images came from a few per cent of the 100,000 pictures taken during the mission, and says that with Galileo it will be possible to predict which are the most essential images. "We are not just going in and wildly shooting frames, hoping to find something interesting", he says.

Unaffected in even a low-gain mission would be the science returned by Galileo's probe, which will split off from the main spacecraft months before the encounter and plunge into Jupiter's atmosphere in December 1995, as Galileo enters Jovian orbit. Data from the probe will be relayed complete back to the orbiter, stored on tape, and transmitted to Earth at leisure. The probe will obtain the first *in situ* measurements from the atmosphere of a giant gas planet, and because these data are so valuable Johnson suggests that even in a scaled-down mission, without full movie coverage, 80 per cent of atmospheric science objectives can still be met.

Although the Galileo team is hopeful that the high-gain antenna can be brought into full service, Johnson isn't counting on it. He says that if the mission has to be scaled down, project scientists and engineers will quickly start looking for ways to regain as much of the original mission's capability as possible. "My gut feeling is that when people starting thinking about the tools available to us," he says, "they will get very innovative." **Tony Reichhardt**

# New human gene therapy institute in Pennsylvania

**Washington.** Biologist James Wilson, whose gene therapy programme for cystic fibrosis gained government approval last week, will move to the University of Pennsylvania next March to direct a new Institute for Human Gene Therapy. Institute scientists will work on gene therapies for cancer and viral diseases as well as for genetic diseases, which have been the focus of Wilson's research so far. By the end of the century, the Institute is expected to employ 25 researchers and occupy 40,000 square feet of space.

The gene therapy programme Wilson leaves behind at the University of Michigan, in which he treated several patients with low-density lipoprotein receptor deficiency, is similar to the work he will direct at the Pennsylvania institute. The resemblance is not accidental: the Michigan programme was founded by William Kelley, who was chair of Michigan's department of internal medicine and a graduate advisor to Wilson, and is now dean of Pennsylvania's School of Medicine. Kelley seems keen to duplicate Michigan's thriving gene therapy programme at Pennsylvania, which has few gene therapy researchers outside the School of Veterinary Medicine. At Pennsylvania, Wilson plans to recruit researchers and establish ties to the biomedical industry, but his first priority is to start treating cystic fibrosis patients. **Traci Watson**