Voyager 1 affects Voyager 2 mission

The Voyager 1 spacecraft's remarkable discoveries about Jupiter and its moons have prompted project officials to begin devising several significant changes in the observation program of Voyager 2, which will fly past the giant planet on July 9. Such changes are difficult to make, not only because of the technical complexity of the interlocking "science sequences" of computer commands that must be sent to the probe's on-board computer, but also because each addition means the sacrifice of some previously scheduled observation in the chock-full schedule. There is sometimes disagreement among the scientists about what must be omitted, but little if any about the importance of reexamining the major new findings:

- The existence of active volcanoes on Jupiter's moon Io was Voyager 1's biggest discovery, and Voyager 2 will be re-programed to make what amounts to a movie of the eruptions in progress, snapping photos every few minutes for as long as 10 hours. (Voyager 1 used a similar time-lapse technique to show Jupiter in rotation, as well as the circulation patterns around the planet's Great Red Spot.) Seven active volcanoes, "all going off at once," have been identified so far in the Voyager 1 photos, says imaging team leader Bradford Smith of the University of Arizona, and the pictures do not cover all of Io's surface. Furthermore, says Smith, it is at least possible that the tidal-dissipation heating effect believed to account for Io's activity may produce a similar but lesser effect on the next moon out from Jupiter, Europa, to which Voyager 2 will get about four times closer than did Voyager 1.
- Jupiter's ring, discovered from a single one of Voyager's 1's 18,770 photos (though it has since been located in two others), was seen edge-on, as the spacecraft passed through the ring plane. Voyager 2 will take a look from a few degrees above and below the plane, in hopes of revealing whether there are actually several rings. (The viewing angle will still be small because such a thin ring structure might be invisible to a vertical view.)
- Jupiter's night side proved a veritable light show for Voyager 1's cameras, revealing huge lightning bolts and widespread auroras, as well as "fireballs" produced by incoming meteorites striking the atmosphere. Voyager 2's night-side coverage is now being expanded to seek the extent of all these phenomena. One hope is that the fireball photos will give scientists an idea of the numbers of meteorites hitting the outer planets, possibly indicating how or if the meteorite flux varies with distance from the sun.
- The distinctive torus of charged particles around Io's orbit was shown by Voyager 1 to be far more intense and diverse than previous spacecraft data and earth-based observations had indicated. Some of Voyager 1's ultraviolet measurements, consisting of wide sweeps that extended to 20 times Jupiter's radius on both sides of the planet, will be tightened in on Voyager 2 to concentrate on Io's orbit, whose radius is about six times Jupiter's.
- One observation that Voyager 1 missed was a planned stellar occultation, in which a star would have been photographed as it disappeared behind the limb of the planet, in hopes of producing a vertical profile of the upper atmosphere's density. The experiment was missed because of Voyager 1's nearness to Jupiter's intense radiation belts, so it is now being scheduled for Voyager 2, which will pass more than twice as far from the planet.

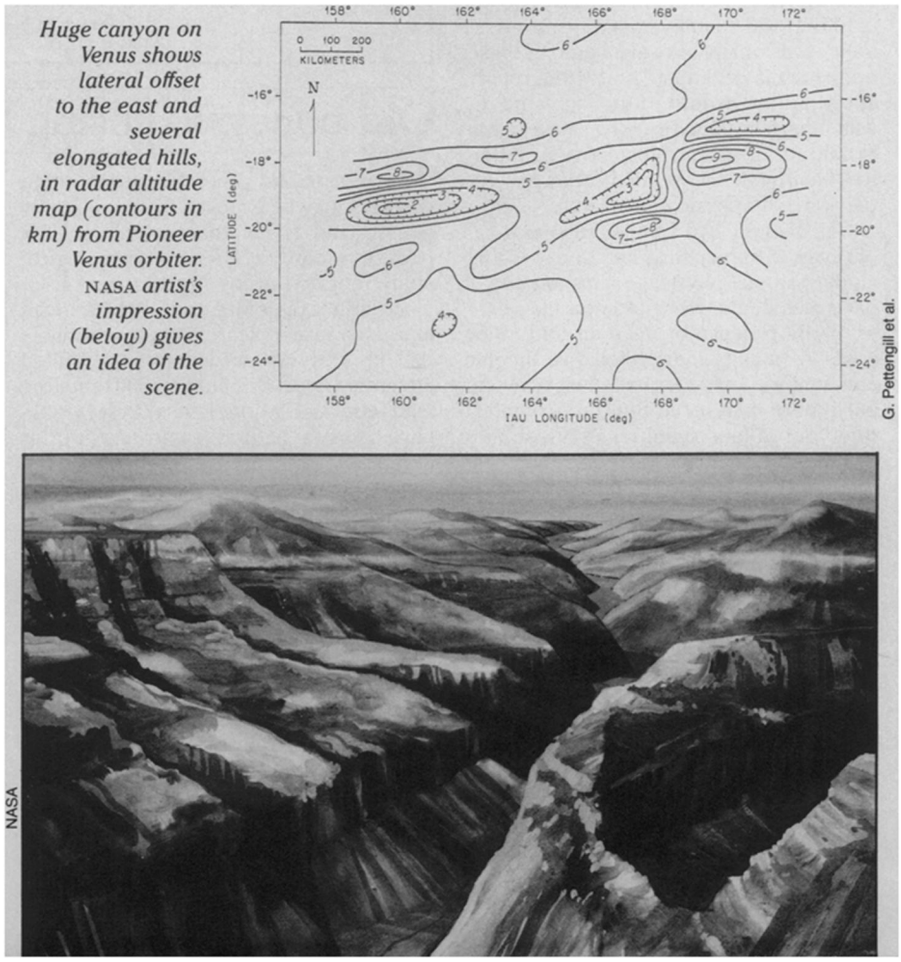
Most of these changes and additions will not occur until the climactic few days of the July encounter, more than two months away. Many of the Voyager observations, however, are long-range affairs: Voyager 2 took its first scheduled photo of the planet last Wednesday. □

Venus radar watch continues

Although the orbiting Pioneer Venus spacecraft is essentially blind to its target planet's surface — the probe's camera records only the clouds — its radar continues to reveal striking details about the Venus that human eyes have never seen. One major find has been a huge canyon, possibly a tectonic crack (judging in part from an abrupt lateral offset similar to those in earth's rift valleys), that apparently runs for 1,400 km or more across the planet. Additional radar coverage of the region in August, says Gordon Pettengill of the Massachusetts Institute of Technology, may indicate its full extent. In places the canyon is as much as 280 km wide, and about 4.6 km deep. With the surface atmospheric pressure equal to about 90 times earth's, calculates Ronald Prinn of MIT, the pressure at the bottom of the canyon should be about 30 atmospheres greater than at the top.

In sharp contrast to the canyon's rugged contours, however, another radar traverse has recorded what Pettengill and colleagues have called "a monotonous, gently rolling plain" — or at least a smooth strip — about 1,000 km long.

Another recent find has been what resembles a group of huge impact craters perhaps 600 to 700 km across, two of them complete with characteristic central peaks. The features are only about 500 to 700 meters deep, however, and Pettengill believes them to be quite old. In a previously identified plateau known as Maxwell, the orbiter's radar has identified a seeming ridge that may represent what Pettengill calls "some of the highest mountains yet seen on Venus," reaching — together with the plateau — some 10 km above the planet's mean surface. □



Huge canyon on Venus shows lateral offset to the east and several elongated hills, in radar altitude map (contours in km) from Pioneer Venus orbiter. NASA *artist's impression (below) gives an idea of the scene.*