VEGA's 1 and 2 Visit Halley

Soviet spacecraft obtain photos showing Halley is king of the comets

Moscow, 10 March.

COMET Halley has proved to be big, blustery, brutal—and shy. Soviet researchers and colleagues from other nations here have been tracking the comet as data pour in from the VEGA spacecrafts. Halley buffeted the Soviet VEGA 1 spacecraft as it penetrated nearly to the comet's heart on 6 March, and the VEGA 2 spacecraft that followed yesterday, apparently knocking out some instruments. After running Halley's 100,000-kilometer wide gauntlet, the VEGA's emerged battered but with the first views of the tiny hunk of dirty ice that gives rise to all the previously known aspects of comets.

Halley had lived up to its reputation for being the king of comets. The VEGA's first detected the gas sublimated from its icy nucleus about 35 million kilometers away. The first dust particles hit the VEGA detectors more than 200,000 kilometers out. All this from a nucleus of dirty ice that pre-encounter estimates held to be no larger than 10 or 15 kilometers.

As the VEGA's closed in on the nucleus at more than a quarter million kilometers per hour, they encountered many of the same phenomena as the International Cometary Explorer (ICE) did last September when it passed Comet Giacobini-Zinner, only these features were scaled up to fit Halley's grandeur. Instead of the comet's gases gradually slowing the thin solar wind of charged particles at a distance of 100,000 kilometers, as in Giacobini-Zinner, Halley's shock region formed at a distance of 1 million kilometers. Unlike ICE, which passed 8000 kilometers down the tail of the comet, the VEGA's passed about 8900 and 7900 kilometers ahead of the nucleus, where VEGA 1 at least may have managed to penetrate the innermost region surrounding the nucleus. That is where cometary gases charged by solar ultraviolet radiation hold off the solar wind and remain unperturbed by it.

By this point, as expected, dust was pummeling the spacecraft millions of times per second, with some effect. Dust damage reduced the power output of solar panels on VEGA 1 by 45 percent and on VEGA 2 by 80 percent. Dust apparently knocked out two of VEGA 1's 15 experiments near closest approach to the nucleus, the victims being the ones that are perched unprotected on the solar panels. On VEGA 2, three instruments went out at nearly the same time near closest approach.

It was at this hazardous moment that the VEGA's attempted to pierce the shroud of dust that has hidden the nucleus. After initial doubts it appears that they succeeded. As the best false-color image appeared on the screens here at the Space Research Institute, a reddish brown, ellipsoidal nucleus floated in a band of garish greens, blues, and yellows. The nucleus appeared to be about 5 kilometers across its widest dimension, but the true nucleus was not yet in sight. Either the smokelike dust being blown away from the surface was still too thick, or there is a permanent cloud of larger particles floating within a kilometer or so of the surface. As VEGA 1 sped by, a bulge in the nucleus came into view, presumably a burst of dust recently ejected from the nucleus. Such outbursts from Halley have been identified in 1910 photographs of its previous visit, and during this apparition in early March by Stephen Larson of the University of Arizona. In fact, VEGA 1 seems to have passed through a dense burst or jet of dust shortly after closest approach.

VEGA 2 passed the nucleus 3 days later, by chance on the less active side of the nucleus. The view was clear, but the failure of the primary camera pointing system required the use of a less precise backup system and led to all but two or three close-ups of the nucleus being overexposed. These did reveal several faint jets of dust streaming from the nucleus. The few good nucleus images showed an irregular 6-kilometer object, which is about the size traditionally expected. But its albedo or reflectivity is about 7 percent, which is that of a dark chocolate bar and darker than once thought possible. Although image processing has probably revealed a nucleus surface, no features have yet been reported.

Beside the nucleus was a second object that some experimenters suspect may be another nucleus, but most believe it is a recently released outburst of dust. The European Giotto spacecraft may decide which it is when the spacecraft encounters Halley on the night of 13–14 March. ■

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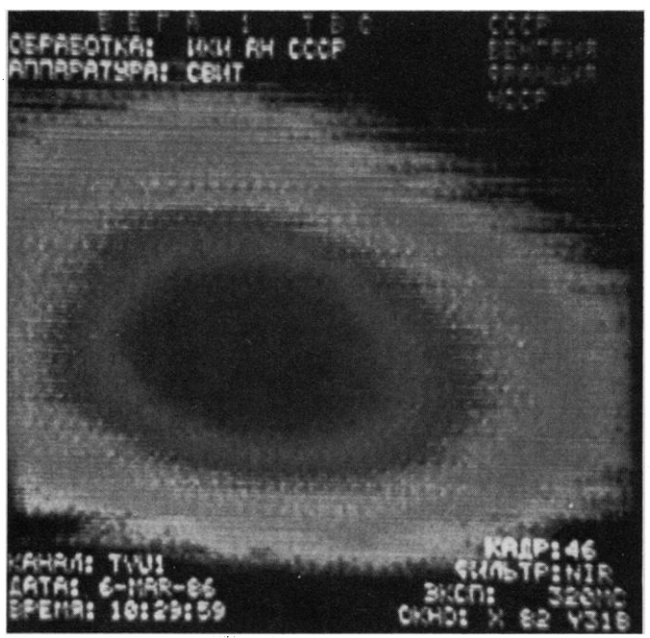

At the core

VEGA-1 relayed its view of Halley's dust-shrouded nucleus to the Soviet space research center in Moscow, where the waiting scientists saw this enhanced image displayed on a television monitor.