Bound for Halley: Surviving the unknown

A decade ago, no one knew whether a spacecraft could survive a trip through the asteroid belt between the orbits of Mars and Jupiter. The big, known asteroids could easily be avoided, but hitting even a tiny particle at spacecraft speeds could be fatal. When Pioneer 10 set off on the Jovian trail in 1972, estimates of the odds of a damaging collision ranged from a mere 1 in 100,000,000 to 1 in 10.

A similarly unknown hazard confronted scientists planning Pioneer 11's 1979 path through the plane of Saturn's rings, given ambiguous signs that the rings might extend well outside the portion that could be seen clearly from earth.

Four spacecraft have now survived the asteroid belt, and three of them have gone on to safely penetrate the Saturnian ringplane. Another source of potentially damaging particles, however, is comet Halley, to which several spacecraft will be directed shortly after it rounds the sun in early 1986. Scientific interest in Halley is worldwide, and it will be the subject of a host of sophisticated earth-based instruments and techniques that did not even exist when the comet last came around in 1910. But it will be the close-flying spacecraft that provide some of the most valuable measurements, such as direct samplings of the enveloping coma and tail, and for them survival has been a real concern.

The spacecraft scheduled to take the closest look is Giotto, built by the European Space Agency and tentatively planned to fly within 500 kilometers of Halley's nucleus. Two Soviet craft, more heavily instrumented and designed to gather data for longer periods, are expected to pass about 10,000 km away. All three probes are equipped with dust shields to protect them from bombardment as the comet warms in the sun's heat and gives off the particles and gases that become its tail and coma, but no one knows for sure what to expect.

In trying to predict what the spacecraft will encounter, says Zdenek Sekanina of Jet Propulsion Laboratory, "data deconvolved from old, unsophisticated observations of Halley are generally preferred to superior data on more recent comets, primarily because it has become increasingly obvious that no two comets are quite alike." Nonetheless, at the recent international meeting of COSPAR (the Council On SPAce Research) in Ottawa, Sekanina reported on some of the diverse findings that may hold keys to Halley's waiting environment.

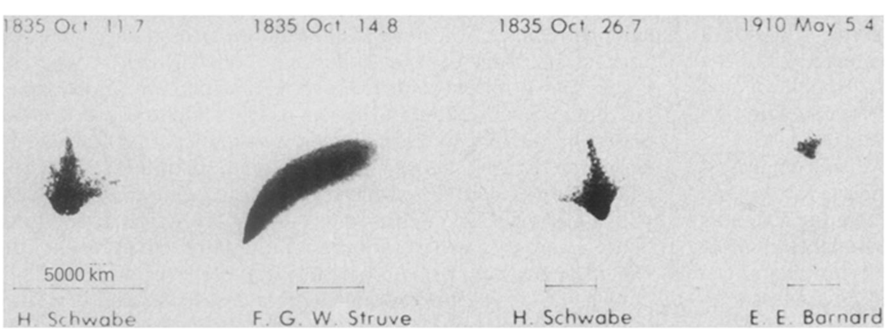
Predicting the pattern of dust, rock chips, ice grains and other particles expected to come from Halley's warming nucleus is no easy matter. Harvard's Fred Whipple has concluded that comet nuclei rotate, like planets, in Halley's case with a period of about 10.3 hours. Complicating the picture, Sekanina says, is the likelihood that "physical and chemical changes on (and in) the rotating nucleus of a comet should be nonuniform, even if initially the comet were perfectly uniform." Furthermore, he says, Halley's nucleus is probably nonuniform in shape as well, "causing the comet's activity to change markedly with position on the surface on a very short time scale, perhaps as short as a fraction of an hour." (One consequence of this should be that the dust content in the comet's atmosphere should also be highly variable, "and a flythrough probe's particle-impact profile registered by onboard detectors should not follow a simple, smooth curve.")

It is also possible, Sekanina notes, that one hemisphere of Halley may turn out to be generally more bland than the other — such an asymmetry has been reported on comet Swift-Tuttle. If it can be established in advance that Halley indeed shows such a two-faced appearance, he says, "the science return, especially from imaging and dust experiments, can be optimized by properly targeting and timing a spacecraft so it avoids facing the 'dull' hemisphere about the time of closest approach."

To spot such an asymmetry in advance, however, he notes, "one must first achieve a significant progress in 'reading' the maze of jets and other dust phenomena in the coma." And understanding that maze could turn out to be valuable in appraising the hazards facing a visiting spacecraft. "Unfortunately," says Sekanina, "the jet pattern in Halley is so complex that, unlike in Swift-Tuttle, no recurrence period has been recognized as yet. The observed variety of jets, from pinwheel-shaped and of variable orientation to straight and stationary, suggests emissions of different durations and emanating from sources on the nucleus whose positions range from equator to pole."

There are more such uncertainties, and once Halley's approach has been spotted (astronomers have been looking at least since 1977), unraveling them will be a key task in planning the coming spacecraft encounters. —*J. Eberhart*

Halley's varied jets, as seen by various observers in its 1835 and 1910 appearances.



Z. Sekanina/JPL

Industry-university rapprochement

Although industry has been contributing financially to university research for some time, scientific collaboration between industry and universities now seems to be growing as never before. For instance, new recombinant DNA companies are tapping university scientists as consultants (SN: 11/29/80, p. 341). And now the Monsanto Co. in St. Louis has entered into an unprecedented biomedical research agreement with Washington University in St. Louis. Monsanto will not only give the university $23.5 million to spend on basic biomedical research and on research aimed at new-drug discovery, but Monsanto scientists will work with university scientists.

Investigators from various departments at Washington University will be able to compete for Monsanto grant money and will be free to publish all findings deriving from Monsanto-funded research in scientific journals. Washington University will hold patents on any drugs or other marketable products that emerge from Monsanto-funded studies and collect royalties on them. Monsanto, in contrast, will have the right to review research findings emerging from its funded research before they are published to determine whether they contain any potentially patentable products and will also have the exclusive right to manufacture and market such products. □

Slaughter to leave NSF

National Science Foundation Director John B. Slaughter will leave his post in January to become chancellor of the University of Maryland at College Park, university President John S. Toll announced June 5. Slaughter, a 48-year-old electrical engineer, was appointed to a six-year term as NSF president by President Carter in 1980 (SN: 12/13/80, p. 373). Slaughter said he is not leaving because of bad relations with the new administration but because he wants the "rare opportunity" to serve as U.M.C.P.'s chancellor. He will wait until January to assume the chancellorship to give President Reagan time to find a replacement. □