Two-comet spaceflight sought

Comets, besides occasionally providing spectacular views in the night sky, are believed by many astronomers to represent the most pristine, primordial material available for studies of the solar system. They may have been major sources of organic materials in the atmospheres of the terrestrial planets and may even contain particles that pre-date the formation of the solar system itself. But with only earth-based evidence to go on, no one is certain. That's why the National Aeronautics and Space Administration this week asked scientists to suggest experiments for a proposed unmanned spacecraft that would fly past Halley's comet in 1985, shoot a probe into the comet's "head" and then fly off to spend a year cruising side by side with a second comet, known as Tempel 2.

"Halley is the only bright comet which displays the full range of cometary phenomena and has a sufficiently predictable orbit," wrote a NASA study group in 1977. And Halley, the group concluded, "is by far the best target for a first comet mission." The group's recommendation was to aim a spacecraft to spend months moving along next to Halley, but budgetary and technological constraints kept delaying the start of the mission until the critical time was past. As a result, the space agency is pursuing a different sort of mission, in which Halley gets only a brief look — plus direct composition measurements from the diving probe — while a second (and very different) comet, nearly three years later in the flight, gets the full going over.

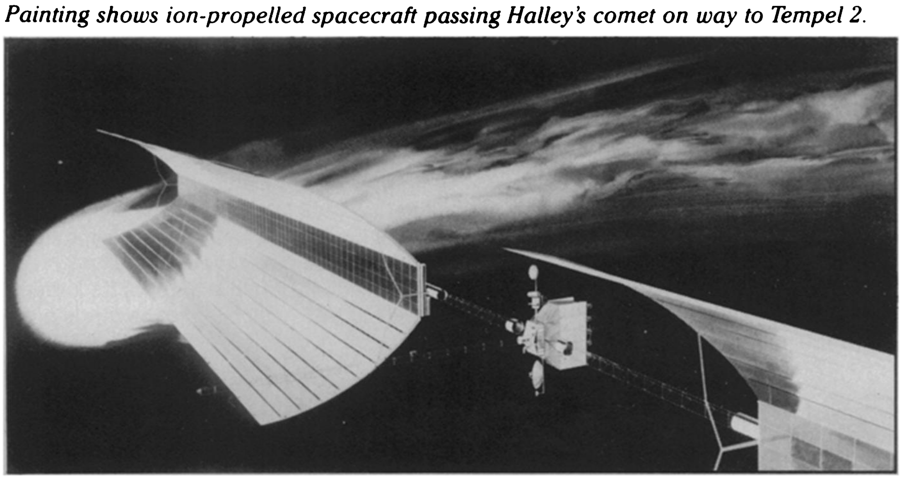
In the mission, NASA calculates that the spacecraft and probe could be launched together from the space shuttle on July 23, 1985. On Nov. 28, about 120 million kilometers from earth, the probe would separate from the larger craft and pass through Halley's gaseous "coma," about 1,500 km from the nucleus, sending compositional and other data back, with the spacecraft serving as a relay station. The spacecraft would then continue on toward its Tempel 2 rendezvous, which would not take place until July of 1988. Matching speeds and directions with the comet, the craft would first fly close to the comet's head, then head farther out, then swoop back again, possibly going into orbit around the comet for a while and perhaps even ending with a final impact on the comet's presumably icy nucleus. By journey's end, the craft would have been in space for about four years, covering more than 2.5 billion kilometers.

But time and money are tighter than ever. The project must get its start in the fiscal 1982 budget, NASA says, and there's a still tighter constraint: All the maneuvering required for the mission would require a prohibitively heavy amount of fuel for a conventional spacecraft motor. So NASA has been studying an extremely low-thrust (less than half a kilogram) but highly efficient device called a solar-electric propulsion system, which would produce its thrust by expelling a stream of ionized mercury vapor, capable of fulfilling the mission's needs with just 1,000 kg of fuel. On such a scale, however, the device is a major new technology, and NASA feels that it must start production with the FY 1981 budget, now at the Office of Management and Budget being readied for submission to Congress. It is also being envisioned for several subsequent missions, such as an orbiter and double atmosphere probe of Saturn, a multiple asteroid rendezvous and others.

The proposed spacecraft would carry a camera based on the sensitive charge-coupled-device instrument now being prepared for the Galileo orbiter and probe of Jupiter. With it, says NASA, it should be possible to photograph objects as small as a baseball on a comet's nucleus. In addition, a radar altimeter would help measure the size and shape of the nucleus to within a claimed accuracy of 23 meters, also providing data for close-in navigation. The scientists responding to NASA's request for experiment ideas are expected to propose such instruments as mass spectrometers and X-ray fluorescence spectrometers for composition studies, dust-collecting equipment for a variety of purposes and infrared instruments for temperature studies.

Jet Propulsion Laboratory in California, which serves as NASA's chief center for planetary missions, would build the main spacecraft if the project is approved, and the European Space Agency is considering building the Halley probe. If the chance is missed, Halley will return, of course — in the year 2061. □

Painting shows ion-propelled spacecraft passing Halley's comet on way to Tempel 2.



NASA

Predictors of a heart attack

A hard-driving, time-urgent personality is a well-documented heart attack risk factor, particularly when such a personality is faced with especially stressful life events. Psychological stress is also known to bring about certain physiological conditions that constitute heart attack risk factors, such as high levels of cholesterol in the bloodstream or blood clots. And now it looks as if the way heart attack patients' bodies react under mental stress can predict whether or not they have a second heart attack, according to a study conducted by Wesley E. Sime and his colleagues at the University of Nebraska at Lincoln and Omaha. They reported their findings last week at the annual meeting of the American Heart Association.

Thirty male heart attack victims were classified as either hard-driving, time-urgent, heart attack-prone personalities, or as more relaxed, non heart attack-prone personalities. Sime and his colleagues gave each subject three different mental stress tests and measured his blood pressure, heart rate, breathing rate and muscle tension before and after each test. One test was an ego-threatening quiz involving 35 questions that any college graduate should know. A second test had a subject first read words designating various colors. Then he was told to read the same words but this time the words were printed in colors other than those that they designated. The third test had a subject recall emotionally charged events in his life.

Sime and his co-workers compared the physiological reactions of their subjects during the three stress tests to their normal readings. They then tried to correlate physiological changes that subjects experienced during the stress tests with whether the subjects were heart attack-prone personalities or not. They expected that those subjects who had had the most elevated blood pressure, heart rate, breathing rate and muscle tension while under stress would most likely be heart attack-prone personalities (aggressive, competitive, time urgent, etc.). However, this expectation was not confirmed, perhaps because the sample size of the study was too small. In any event, the researchers continued to follow their subjects to see whether any of them had a second heart attack and whether their physiological reactions under stress might have predicted their second heart attacks. This finding was confirmed. Eight of the 30 subjects subsequently had a second heart attack, and seven out of the eight had shown an excessive heart rate, excessive blood pressure or an excessive breathing rate and muscle tension. Only 11 out of 20 patients who did not have a second heart attack had such reactions. □