



Scarp runs 185 miles across surface.

sun side of Mercury. If, as it appears at first glance, the planet's influence is present there, it may show up in the magnetic field as well. The main goal of the second encounter, however, was the pictures. Next March, the third and

final pass, on the planet's darkside again, will be largely devoted to the infrared, ultraviolet and other instruments, looking from as close as 2,360 kilometers. There is some concern about whether Mariner's reserve of control gas is adequate for the journey—"I think it'll

have some of the element of 'the Perils of Pauline,'" says Project Manager Gene Giberson—but officials are cautiously optimistic. "As far as I'm concerned," says Program Manager William Cunningham, "we're on our way to 'Mercury 3' right now." □

'Jupiter effect': Mixed reaction

The planets of the solar system are moving surely and inevitably toward a configuration that happens only once in 179 years. In 1982 there will come a moment when all the planets are in line with each other on the same side of the sun.

A newly published book, *The Jupiter Effect* by John Gribbin and Stephen Plagemann (New York: Walker and Co., 1974), foresees disastrous effects for that planetary imbalance. Gribbin and Plagemann predict increased seismic activity in the years around 1982 and specifically a major earthquake for the Los Angeles area.

Due to stories about it in the past

two weeks by United Press International and Newsweek, the Jupiter effect theory is getting considerable public attention, including a formal query from a U.S. Senator. But the theory is receiving, at best, mixed reviews by scientists.

The two authors propose this chain of events: The planets exert tidal forces on the sun, and with all planets lined up on the same side of the sun such forces reach a maximum. The maximum force triggers an overabundance of sunspots. More sunspots mean more solar particles reaching the earth's upper atmosphere. The particles trigger unusual movements of large air masses. These movements affect the earth's rate

The Colombo Connection: How Mariner was brought back

"Looking back on things like this, you kind of kick yourself," says Joseph G. Beerer, "but sometimes you just can't see the forest for the trees." He wasn't the only one. In 1970, Beerer was the trajectory analyst helping to plan Mariner 10's flight past Venus and Mercury. His gentle self-chastisement is for his failure to realize the significance of a number buried in a computer printout on his desk, showing that Mariner could easily be aimed to pass close to Mercury two, three, and a virtually infinite number of times. And almost for free.

The math was easy. It would almost inevitably have occurred to someone sooner or later. As it happened the brainstorm was that of Italian astrophysicist Giuseppe Colombo, whose work in 1966 had helped to explain the newly discovered 3:2 ratio between Mercury's rotational and orbital periods.

Early in February of 1970, a group of scientists met at the California Institute of Technology to discuss Mercury, including the upcoming flyby. The launch date had already been chosen to minimize the energy required for the flight, and an arrival date had been picked to give a proper lighting angle for photography on the single visit that was then planned. Mission officials had also decided because of some of the experiments to aim for the planet's "dual-occultation zone," a region where Mercury would block both the earth and the sun from the spacecraft's view. Even with these stipulations, however, there was a range of available aiming points, each of which would take Mariner 10 into a different solar orbit after leaving Mercury.

It was at this meeting that Colombo tugged on the jacket of Caltech's Bruce Murray, who would be Mariner's chief picture analyst, and exclaimed, "The spacecraft will return! The spacecraft will return!" Queried by Murray, Colombo pointed out that among the range of possible post-Mercury solar orbits there

seemed to be one with a period of 176 days, exactly twice the 88-day period of the planet. Couldn't this orbit be fine-tuned so that every two trips around the sun Mercury would find the spacecraft waiting for it?

Murray asked Beerer to find out. Sure enough, already on Beerer's desk was a computer listing of alternatives including one in which Mariner would move around the sun an average of 2.04 degrees per day. Divided into the number of days in a year, it came out just right for repeated encounters—extra flybys for free.

Well, not quite. A few changes had to be made in the spacecraft design, and time was short since the contracts with the builder (Boeing) had to be signed that autumn. Valves were adapted from Apollo so that Mariner's engine could be restarted the required number of times. Pioneer contributed a larger tank to hold an increased amount of control gas. Solar panels had to be made movable for better cooling, and an antenna was pivoted so that it could aim at earth while the spacecraft was behind the sun between encounters.

And it all had to be done while adding neither cost nor weight. Fortunately (and atypically), Mariner 10 came in about \$750,000 under budget, thanks largely to its NASA project, program and spacecraft managers, respectively, Gene Giberson, William Cunningham and John Casani, and the spacecraft program manager at Boeing, Edward Czarnecki. The weight miraculously took care of itself: The conservatively rated Atlas-Centaur rocket turned out to be able to handle the load.

The cost of keeping data analysts and others around for the second encounter had added only about two percent to Mariner 10's \$98 million budget, with another 1.7 percent for "Mercury 3" next March 16, but that comes out of more recent budgets. Altogether, the Colombo Connection, with Beerer, Giberson, Cunningham and colleagues, has been one of the better investments in NASA's planetary research program. □

of spin. Finally changes in the rate of spin trigger earthquakes.

We must carefully state what we have here. As seismologist Lynn R. Sykes of the Lamont-Doherty Geological Observatory takes pains to point out, such a chain of events cannot *cause* earthquakes. Earthquakes are caused by stresses and strains within the earth. Nobody argues otherwise including Gribbin and Plagemann. They are saying that the chain of events they lay out could serve as a trigger, releasing an already overstrained portion of the earth's crust, and this is an idea that Sykes says cannot be dismissed out of hand.

Don L. Anderson, director of the Seismological Laboratory at the California Institute of Technology says the idea is "on its face not as ridiculous as it seems," but it does have serious weaknesses. There is a connection between the triggering of earthquakes and changes in the earth's rotation rate, but it is not yet clear which is cause and which effect. Gribbin and Plagemann have to assume that changes in the spin rate are the cause and earthquake triggering the effect. The weather does affect the spin rate, Anderson continues, and the sun does affect the weather.

The weakest link in the chain of reasoning, in Anderson's opinion, is the notion that the planets trigger sunspot activity. This is "not generally accepted by solar physicists," he says. "There is nothing to the planetary theory of sunspots." Anderson also points out that in 1803, the last time this planetary lineup occurred, no great increase in seismicity was recorded.

"I wouldn't dismiss it and say 'baloney,'" says Robert Hamilton, who is chief of the Office of Earthquake Studies of the U.S. Geological Survey. He too agrees that there is some connection between earthquakes and changes in the earth's spin rate, but he is unsure of planet-sun-atmosphere connections. He can neither pooh-pooh nor confirm Gribbin's and Plagemann's reasoning. Their picking of Los Angeles for a 1982 quake is "a leap" in Hamilton's view. They say they do it because the southern part of the San Andreas fault has gone longest (since 1857) without a major quake.

Meanwhile there is a countersuggestion that much of the San Andreas is safe from a major quake for a number of years to come, possibly as many as 25. It is by Max Wyss of the University of Colorado and appears in the Sept. 13 NATURE. Wyss's conclusion comes from a study of the velocity of P or pressure waves in the rock around the San Andreas. It has been noted that the velocity of such waves increases years before a major earthquake. Wyss finds no increases near the San Andreas and concludes that an earthquake of

Richter magnitude seven is unlikely for seven years and one of magnitude eight for 25 years in the region between San Francisco and Parkfield.

The Gribbin-Plagemann prediction has stirred governmental interest. In a letter Sept. 18 to NASA Administrator James C. Fletcher, Sen. Frank E. Moss (D-Utah) asked NASA to look into it to see how plausible it is and what its impact may be. Moss, chairman of the Senate Aeronautical and Space Sciences Committee, believes the committee may want to consider possible funding and research authorization. A member of the committee staff, Gilbert Keyes, who has been asking astronomers about the Jupiter effect, says most of them feel that the chain of events has a low probability of occurrence, but none

would positively declare it impossible.

NASA's immediate response was that none of its astronomers thought much of the idea. It is too early to tell who in NASA will be assigned to answer Moss's questions, spokesmen say. The question is likely to prove a hot potato for NASA. Although Gribbin and Plagemann are reputable scientists—Gribbin is geophysics editor of NATURE, and Plagemann is an astronomer who does contract and consulting work—the idea is the sort of thing cultists like to take in their teeth and run with, and NASA already has trouble enough with cultists. On the other hand if the proposed scenario is acted out, NASA would not want to be caught with its expertise down on that great gettin'-up morning in 1982. □

Right to treatment: A legal dilemma

In 1957 Kenneth Donaldson was diagnosed as paranoid schizophrenic and confined to the Florida State Hospital. During the next 14 years Donaldson brought 15 different legal petitions before state and Federal courts to request release. In the petitions, some of which went to the Supreme Court, the patient protested the conditions of his confinement and the lack of treatment—even though, as a Christian Scientist, he had refused the drug treatment that hospital authorities considered appropriate for his condition.

All of Donaldson's petitions were either denied or refused by the courts so he started a class action suit on behalf of the patients on his ward in the hospital. The thrust of the suit was an attack on Florida's civil commitment laws. It asked that the state provide adequate treatment for those committed to its hospitals against their will. Shortly after the right-to-treatment suit was initiated, Donaldson was discharged from the hospital. But this did not end the legal action. The class action suit was dropped and Donaldson's lawyers initiated a personal action suit against two doctors who had been in charge of the case at various times. They were charged with knowingly, intentionally and maliciously confining the patient against his will without adequate treatment. Even though the psychiatrists were following the rulings of 15 different court decisions to keep the patient in the institution, Donaldson was awarded \$38,500. His suit was upheld last spring by the U.S. Court of Appeals.

The American Psychiatric Association disagrees with the decision. APA President John P. Spiegel announced this week that the association will ask the Supreme Court to review the case next month. The APA does not argue that Donaldson got adequate treatment.

In fact, it admits that most large state institutions are not funded, equipped or staffed to provide good treatment. Alan Stone of Harvard Law School is the chairman of the APA Judiciary Committee. He and Spiegel both say that conditions in the Florida hospital were deplorable and horrible. The institution was so overcrowded that staff psychiatrists could afford to spend only three minutes per day with each patient.

In such situations should individual psychiatrists be held responsible? The APA feels that the institution and ultimately the state has the legal obligation to supply treatment for involuntarily committed patients. And this is what the APA wants the Supreme Court to rule on. State institutions would then be forced to go to the legislature for funds to ensure adequate treatment. In this way psychiatrists who have 500 or up to 1,000 patients to treat would not be held responsible for the shortcomings of the system. Psychiatrists would still, Spiegel points out, be responsible for their own clinical decisions and still be open to malpractice suits.

If the Supreme Court hears the case and rules against the APA's position, things can only get worse, Spiegel and Stone warn. Psychiatrists in state institutions will have two options. They could release any patient who complains about treatment or they could protect themselves by going to work somewhere else. If patients are released early, they will still not be getting adequate treatment. Released patients will end up on welfare or in already overcrowded nursing homes, says Stone. And if the few psychiatrists available leave the state institutions, those left behind will only be more overworked and less able to offer adequate treatment.

The APA's attempt to shift the burden