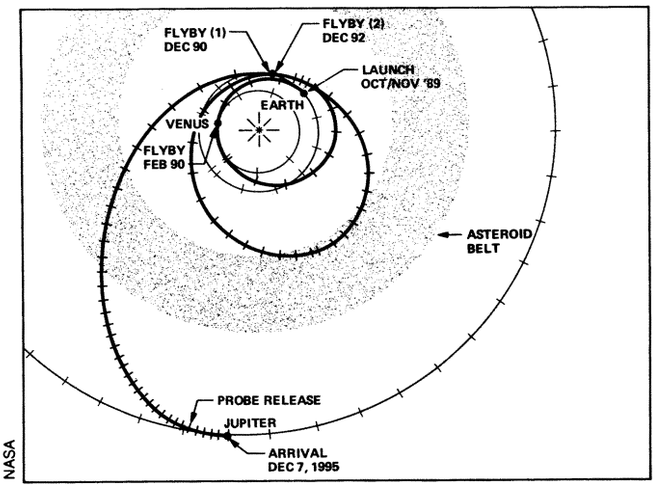
Jupiter orbiter to launch in 1989

When the unmanned mission to Jupiter was scheduled to begin in 1982, NASA officials planned to deploy the Galileo orbiter and probe from the space shuttle. The direct voyage was expected to take about 18 months.

Five delays later – due mainly to rocket propulsion problems and the setback in the shuttle program – Galileo is now set for a 1989 launch date during the revamped shuttle program's ninth mission. The setbacks, however, have changed how Galileo will reach the fifth planet from the sun, lengthening the journey to six years.



The Galileo program, which will cost more than $1.3 billion, is a joint effort between the U.S. and West German governments. The West Germans designed the spacecraft's propulsion system and several of the 16 instruments that the orbiter and probe will carry on its unorthodox route.

To avoid possible damage to the shuttle, NASA officials have decided not to launch Galileo with a high-energy, liquid-fueled Centaur rocket. Instead, they will use a smaller launch vehicle and a route that will take advantage of the gravitational fields of Venus and earth.

After Galileo is launched from an apparatus set adrift from the shuttle Discovery during October 1989, it will fly around Venus and then twice around earth before being hurled toward Jupiter, each time changing its trajectory slightly and gaining momentum. The craft will provide the first direct sampling of Jupiter's atmosphere and the first extended observations of the planet and its moons.

Because of Galileo's longer and more complex route, NASA scientists say they will be able to obtain more science from the mission, such as inner-planet observations and the first asteroid flybys. And they are confident the new course will work perfectly.

"There will be no miscues in this billiard game we're playing," said Galileo project manager John Casani last week at a NASA news conference in Washington, D.C., announcing the mission, which was named after the Italian scientist who discovered Jupiter's four large moons in 1610.

During February 1990, the 5,870-pound Galileo will fly within 9,300 miles of Venus and will search for evidence of lightning storms that were suggested during the Pioneer 12 flight. It also will measure the planet's atmospheric composition and distribution.

During the first return to earth 10 months later, Galileo will fly by at an altitude of about 620 miles. Then, during October 1991, it will pass within 620 miles of the asteroid Gaspra, located in the asteroid belt between Mars and Jupiter. Galileo will take pictures of the 10-mile-wide asteroid to correct its flight path, and will also observe Gaspra's composition.

After a 200-mile-altitude flyby of earth during December 1992, Galileo will pass the asteroid Ida, which also is located in the asteroid belt and which is twice as wide as Gaspra. Here the craft will make observations similar to those made during the Gaspra flyby, thus allowing scientists to directly observe asteroids for the first time.

In addition, during both earth flybys, Galileo will examine the moon's dark side, enabling scientists for the first time to map this section of the lunar surface using infrared.

In July 1995, almost five months before Galileo reaches Jupiter, its probe will be released. Shortly after entering the planet's atmosphere, the 737-pound probe will deploy a parachute, and for 75 minutes the probe will relay information to Galileo, which will have just entered Jupiter's orbit.

For the next 22 months, Galileo will make 10 orbits of Jupiter, each time coming within about 125 miles of Jupiter's four largest moons, which range in size between earth's moon and Mercury. During this part of the voyage, Galileo will take pictures of the moons that will have 20 to 100 times better resolution than those taken by Voyager 2 in 1979. After Galileo's instruments begin to wear out and stop functioning, the orbiter will continue in permanent orbit of Jupiter.

– S. Eisenberg

Link between earthquakes and El Niños?

The periodic, massive climatic upheavals known as El Niño-Southern Oscillations (ENSOs) may be triggered by intense tectonic activity in the seafloor near Easter Island in the East Pacific, a seismologist reported this week at the fall meeting of the American Geophysical Union in San Francisco.

Daniel A. Walker, from the Hawaii Institute of Geophysics in Honolulu, found that all five ENSOs occurring between 1964 and 1987 were preceded by spells of numerous earthquakes along the East Pacific Rise – one of a worldwide set of seafloor spreading centers that produce new oceanic crust.

"Since 1964 the track record on that correlation is, as far as I'm concerned, five for five," Walker told SCIENCE NEWS. "If you pick out the five most intense periods of tectonic activity that have occurred since 1964, you'll see that they coincide – within about six months – with all these five El Niños."

The ENSOs – a reorganization in Pacific climate patterns – bring torrential rains to normally arid parts of South America, while Australia and Indonesia suffer from abnormal droughts for up to a year and a half. On average, ENSOs recur every four to five years, but the timing and severity of the cycle are highly irregular.

Since the turn of the century, scientists have attempted to develop theories that explain the El Niño (an East Pacific warming trend) and the southern oscillations (abnormal shifts in air pressures over the Pacific), which were originally thought to be separate phenomena. In the last two decades they have learned that ENSOs result from an interaction between the ocean and the atmosphere. Without completely understanding how ENSOs begin, meteorologists have discovered that the ocean and atmosphere combine forces as an amplifier, generating a full-blown event out of some subtle initiating factor.

According to Walker, this factor may be tectonic activity. When he analyzed the seismic history of a long stretch of the East Pacific Rise around Easter Island, he found that the ridge tends to stay relatively quiet for a period of five to seven years, averaging only 1.8 earthquakes a month. Punctuating these quiescent times are periods of intense activity, which last only one or two months. During one active period, 21 earthquakes shook the ridge.

While the correlation between earthquakes and the onset of ENSO events may be coincidental, Walker suggests that the

periods of seismic activity result from episodes of seafloor spreading along the East Pacific Rise. This kind of tectonic activity is known to generate hydrothermal fluids that contain many dissolved gases and minerals.

Walker proposes that the heat of these fluids could raise the temperature of the surface water near Easter Island, thereby lowering the air pressure over this part of the Pacific. Both these characteristics are hallmarks of an ENSO event. Another possibility is that the dissolved nutrients in the fluids indirectly affect the temperature and pressure of the air by stimulating biological activity.

Meteorologists, however, have not warmed to such unorthodox ideas about the climate. "It doesn't impress me," says Stephen E. Zebiak at the Lamont-Doherty Geological Observatory in Palisades, N.Y. "Over the past few years, various people have correlated everything in the world with ENSOs. You can take a really short period like this and find correlations with almost anything imaginable."

Moreover, says Zebiak, the latest theories about ENSOs downplay the role of a triggering factor. Instead, he says, it seems that wave and wind patterns might "precondition" the Pacific, making it sensitive to any number of secondary effects that could trigger the start of an ENSO. If this is true, says Zebiak, then the preconditioning factors are more critical than any specific trigger.

But seismologist Don L. Anderson of the California Institute of Technology in Pasadena says that Walker's findings – if they can be confirmed – may help in understanding ENSOs. "It is a phenomenon that involves oceanography, meteorology and probably the influence of the sun. But nobody has ever really thought about there being some coupling with the inside of the earth.... We might not have discovered the explanation of the ENSO because we haven't looked broadly enough." – *R. Monastersky*

Emphysema drug approved

The Food and Drug Administration this week approved the sale of a purified human protein that can slow the progression of emphysema in patients who fail to produce enough of a critical lung-protecting protein. Up to 40,000 people in the United States have a genetic deficiency of the protein, alpha-1 proteinase inhibitor, also known as alpha-1 antitrypsin (SN: 5/2/87, p.277). Of these, perhaps 2,000 suffer noticeable lung damage and would be considered candidates for treatment with the newly approved drug. The protein will not help the vast majority of emphysema patients who have developed the disease from environmental factors such as cigarette smoking. □

SSC: An iffy proposition in Congress

Big science is now very big politics. The Superconducting Super Collider (SSC), a 40-trillion-electron-volt proton accelerator, will be the largest physics laboratory ever built – if construction is authorized. By the time it is completed it is likely to cost $5 billion or $6 billion. And it is enmeshed in politics as no physics laboratory ever was before.

As became evident at the National SSC Symposium in Denver last week, a wide coalition of federal, state and local officials and nonofficial citizens is being put together to support the project. Yet, the meeting heard, SSC is in a certain amount of trouble in Congress. Sen. Pete V. Domenici (R-N.M.) gave a rather gloomy assessment of its chances. Energy Secretary John S. Herrington pronounced it "in jeopardy" and urged his audience to mount a campaign of support.

Pending now in Congress are two bills related to the SSC. One is a special authorization bill that would authorize $1.1 billion in expenditures for the SSC over the next three years. According to one of the bill's sponsors, Rep. Manuel Lujan Jr., (R-N.M.), it now has 253 cosponsors. However, as several people at the meeting pointed out, an authorization says you can spend money but does not guarantee that you'll get it. What puts money in the account is an appropriation. The current appropriation for the SSC is for one year. It is now before a Senate-House conference and will amount to either $25 million or $35 million.

With 253 cosponsors, can the SSC be in trouble? Even representatives who are virtually uncategorical in support – for example, Rep. Ralph M. Hall (D-Tex.), who said: "We don't have a choice; we have to build it" – sense problems ahead.

The difficulties arise from budgetary concerns: Where is the money to come from, and how will it affect the rest of the country's scientific program? They also arise in some part from differing perceptions of the project on the part of administration spokesmen and members of Congress. And some difficulty arises from a perception that much of the support is softer than it seems.

"I think much support is parochial," Domenici remarked. And, referring to the 25 states with 36 site proposals still under consideration, he said, "They all can't get it." He suggested that the Department of Energy delay its site-selection procedure (SN: 6/30/84, p.409; 10/17/87, p.247) until after Congress considers the bills. This got a negative reception from the four state governors and one lieutenant governor at the meeting. Govs. Richard F. Celeste (Ohio), James G. Martin (N.C.), George S. Mickelson (S.D.) and Roy Romer (Colo.) and Lt. Gov. Stan Lundine (N.Y.) unanimously condemned the idea. The present administration should complete the site-selection process, they said. Otherwise it could become an issue in the 1988 presidential campaign.

The Reagan administration touts the SSC in nationalistic terms as a boost for American competitiveness, both in technology and in science. Herrington said that many American particle physicists now work abroad. "If we build it," he said, "they'll all come here."

On the other hand, the administration talks of soliciting foreign contributions. Members of Congress who addressed the meeting suggested that Congress would find the deal sweeter if foreign financial commitments were included. Yet at least one commentator wondered how the administration could talk so nationalistically in one breath and solicit foreign participation in the next – especially, as Lundine and Rep. Sherwood Boehlert (R-N.Y.) said, when the United States is cold-shouldering the most interested foreign party, Canada.

New York had proposed two "international sites," one straddling its border with Quebec, the other wholly in the United States. Only the second is still officially in the running, but the Canadians remain interested in it, according to Bernard Margolis of McGill University in Montreal, who represented Canadian organizations at the meeting. Margolis told SCIENCE NEWS of possible support from the Canadian federal government, the provinces of Ontario and Quebec and even the city of Montreal. Canada could offer construction money – up to 10 percent, according to Boehlert – and inexpensive electricity that would substantially lessen operating costs. However, they complain that the Energy Department won't talk to them. As Boehlert put it, "Considering the new free-trade agreement, protons are the only item unable to cross the border without interference."

Money for the SSC has to come from somewhere, and that, as all the members present agreed, will give Congress the painful duty of setting priorities among science programs and other domestic spending. However, Hall presented a suggestion on how to get the money without disturbing the rest of the science budget: Abrogate the Japanese Defense Treaty, under which since 1945 the United States has guaranteed the defense of Japan in return for Japanese demilitarization. Hall thinks it's time the Japanese undertook their own defense. "That would save $10 billion a year, enough to build two SSCs," he said. That particular suggestion may not fly, but there could be similar ones in the offing. – *D. E. Thomsen*