Europe's Choice: Where Next in Space?

By JONATHAN EBERHART

European Space Agency officials are struggling to make a difficult choice. In March, they are due to select one from among five competing proposals for a start as the multi-nation organization's next scientific satellite project (four others are already in the works), for launch in 1988 or 1989. All have their advocates, and the planners must also consider costs, scientific merit, available capabilities of the member countries, and perhaps possible overlaps with envisioned U.S. programs. But making the decision difficult even apart from such factors is the candidate missions' sheer diversity:

• **Kepler:** Sent to orbit Mars, it would be only the second ESA space probe to leave earth's gravity (the first will be the 1985-86 Giotto flyby of comet Halley). Its carefully chosen scientific objectives underscore the gaps in the existing Mars data bank and the limitations of studying the red planet from earth. A radar altimeter, for example, would map the ups and downs of the topography, while neutral and ion mass spectrometers measure the composition of the upper atmosphere (sampled only briefly by the Viking landing craft during their descents to the surface in 1976). A magnetometer would try to find out once and for all whether the planet has an intrinsic magnetic field, a 15-year controversy, as various sensors study other aspects of Mars's interaction with the solar wind. An ultraviolet mapper and an infrared sounder would profile the atmosphere, as the craft's orbit carries it as low as 150 kilometers from the ground.

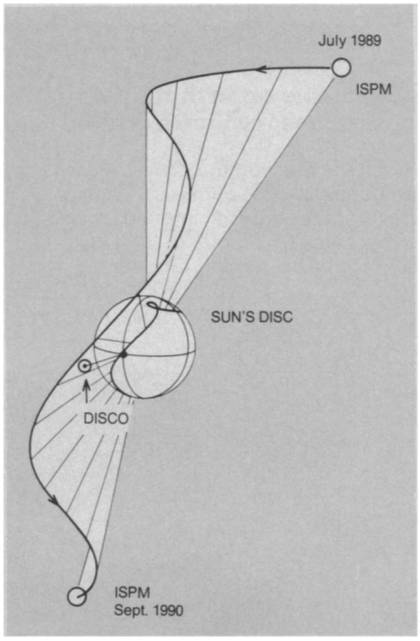
• **Disco:** Working in the strange-sounding field of "helio-seismology," Disco would measure oscillations of the sun's surface, plotting the speed of the pulsations to within 1 millimeter per second. It would be positioned about one percent of the way from the earth to the sun, orbiting the L1 Lagrangian point where the gravitational attraction of the two bodies is "balanced." (The ISEE-3 satellite occupied the same spot, monitoring the solar wind, until late last year, when its engine was fired to send it down earth's magnetic tail and thereafter toward a 1985 rendezvous with comet Giacobini-Zinner.) Disco, operating in the plane of the ecliptic, would be timed to be on duty at the same time that ESA's International Solar Polar Mission spacecraft is flying over the sun's poles, allowing a host of particles-and-fields sensors aboard both probes to study the structure of the solar wind and heliosphere in three dimensions.

• **ISO:** The Infrared Space Observatory would have much in common with the U.S./Dutch/British IRAS satellite (see p. 85) — a 60-centimeter, cryogenically cooled telescope, and spectrometers and photometers covering similar wavelength bands. But IRAS, launched Jan. 25, is just the pathfinder, the first satellite designed to survey the entire infrared sky, and is expected to operate for no longer than about seven months. If ISO flies, it will have the IRAS experience to build on, including maps of what are expected to be vast numbers of currently unknown infrared sources such as stars aborning and dying, toward which ISO can promptly turn its gaze during a planned lifetime of at least a year and a half. (In the works at NASA is the Shuttle Infrared Telescope Facility, which should have resolution and sensitivity at least as good as ISO's but only the short operating spans of typical space shuttle missions.)

• **Magellan:** The far end of the ultraviolet spectrum, at wavelengths below about 1,100 angstroms, includes such phenomena as the energy peaks of extremely hot stars and the key spectral lines of many astrophysically important atoms and ions, relevant to subjects ranging from galactic evolution to the ionized torus of Jupiter's moon Io. Yet this UV region has so far been explored only in a preliminary way, by limited observations from the Copernicus satellite (bright objects only), a few sounding-rocket experiments and low-resolution studies from Voyager. The International Ultraviolet Explorer satellite, still at work after five years in orbit, gets down only to about 1,130 Å. Magellan, however, would be able to see from 1,400 down to 500 Å, providing high-resolution spectra as well as a low-resolution mode capable of studying sources as faint as magnitude 18.5, such as certain galactic and extragalactic objects. (One proposed NASA satellite, the Far Ultraviolet Spectroscopy Explorer, would operate from about 1,200 to 900 Å.)

• **X-80:** As early as this summer (or next year if launch-vehicle problems force a postponement), ESA hopes to launch an X-ray astronomy satellite called Exosat. X-80, say its advocates, would be that mission's logical successor. A wide range of instruments would gather spectra with high spectral and spatial resolution, and provide precise timing measurements for variable and transient phenomena. The goal would be to gather detailed data on sources already cataloged by Exosat and previous X-ray satellites, "without recourse to the large, powerful, imaging telescopes and necessarily more costly missions envisaged for the 1990s."

Choosing among the five candidate projects will be anything but easy. In recent days, detailed presentations on behalf of each have been made before ESA's Science Program Directorate, which is working toward the March selection.



ESA

Proposed "Disco" satellite would monitor the sun from the ecliptic plane, while ISPM flies over the solar poles.

And meanwhile, five more candidates are waiting in the wings, undergoing preliminary study on the way to a 1984-85 selection process in hopes of a launching in the early 1990s. Narrowed down last December from a group of 20, they include: AGORA, a radar-and-camera-equipped flyby of three main-belt asteroids; Cluster, a four-spacecraft (one big and three small) study of earth's magnetic field; SOHO, an earth-orbiting satellite to study the dynamics and mass-loss of the sun's outer atmosphere; XMM, a multi-mirror telescope for X-ray studies; and FIRST, a far-infrared and submillimeter astronomy satellite whose instruments would include a superheterodyne, very-high-resolution spectrometer for extremely precise spectra of faint IR sources. A long-sought Polar-Orbiting Lunar Observatory (POLO) may also join the group, if West Germany commits itself to building the communications satellite required for relaying data while POLO is on the moon's far side.

ESA has successfully conducted a number of significant scientific projects in space over the years, but there has been a tendency for observers on the NASA side of the Atlantic to look on the Europeans as strictly minor participants. Now the tight budgets constraining NASA's science plans, as well as the growing activity of the European space science community, have U.S. researchers looking more carefully than ever at what ESA may do next. □