Europe's first observatory satellite

The European Space Agency, successor to the European Space Research Organization, is happily collecting data from its first satellite, a gamma-ray astronomical observatory called COS-B. Launched for ESA last Friday by the National Aeronautics and Space Administration from Vandenberg Air Force Base in California, the drum-shaped probe is also the first observatory satellite to be built by a consortium of European nations, in contrast to such as the Netherlands Astronomy Satellite.

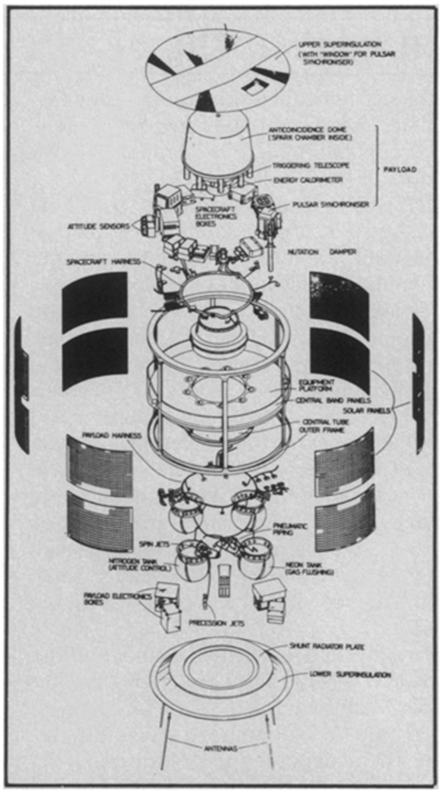
In typical consortium fashion, seven countries contributed components to the probe itself, while four provided experiments for the payload. The prime contractor was German. Project management is by the European Space Research and Technology Center in the Netherlands.

The satellite's basic mission is to study extraterrestrial gamma radiation with energies from 30 million electron-volts to above 3 billion electron-volts, as an aid to understanding matter and energy distribution in the universe, as well as the sources and mechanisms of cosmic rays. Besides measuring the average overall intensity of the gamma ray flux, the COS-B researchers plan to examine large-scale variations in gamma radiation from angular regions known to correspond with specific galactic features.

They will also be looking for smaller sources such as supernova remnants, quasars and other radio and X-ray sources, measuring their energy spectra and seeking out possible correlations between different energy bands. Time variations, both long (as in some X-ray sources) and short (characteristic of many pulsars) will be sought and compared, while an additional quest is conducted for lower-energy gamma-ray bursts in the 100-to-800 KeV range.

Although Germany, France, the Netherlands and Italy have all contributed instruments to the probe's payload, the devices are interdependent in such a way that ESA officials consider them to comprise a single, elaborate scientific experiment.

The heart of the complex device is a German-made spark chamber, contributed by the Max Planck Institute, which measures the precise arrival direction of gamma quanta throughout the experiment's energy range. Desirable gamma-ray candidates for the spark chamber are selected by a "triggering telescope," which makes a more general direction measurement as well as noting the type and energy of particles that pass through; it then sends an activating signal to the spark chamber whenever an eligible event has been detected. Further insurance comes from a so-called "anticoincidence dome," mounted at the very top of the instrument stack, which weeds out charged particles that might falsely be interpreted as gamma rays and send a "veto" signal to the spark chamber-telescope assembly. At the bottom of the stack, another device measures the energies of the gamma quanta after they have been converted into electron-positron pairs by the spark chamber.



ESA

Sensor array tops COS-B *satellite cutaway.*

Timing is an important part of gamma-ray explorations, in order to find not only how much radiation comes in bursts versus general background, but also whether there are episodes of greater and lesser activity and whether there are regular patterns as well as correlations with other energy levels and types of emission. There are two basic timing devices aboard COS-B, one of which merely times the gamma-ray bursts not vetoed by the anticoincidence dome. The other, intriguingly known as a "pulsar synchronizer" ("Sounds like a galactic stopwatch," says a NASA official. "Synchronize your pulsars, men!"), contains a small X-ray detector to enable the timing of the strikingly regular X-ray emissions from pulsars to be matched with gamma-ray timings to see if there is any correlation between the patterns. ESA researchers hope to get two full years of life from the satellite, so that two dozen gamma-ray sources can be studied for as long as a month each. □

The Aug. 23 and Aug. 30 issues of SCIENCE NEWS *will be combined into one double-sized issue emphasizing research in astronomy. It will be mailed Aug. 29.*

Rural smog: Tighter controls ahead?

When Environmental Protection Agency administrator Russell E. Train last week announced that rural concentrations of photochemical oxidants—smog—were larger than previously expected, possibly warranting tougher pollution controls, his timing couldn't have been better to assure an attentive audience: The Washington metropolitan area had just suffered through its worst air quality period on record, with the air quality index reaching an all-time high of 180 (pollution alerts are issued when readings hit 100). All along the Eastern Seaboard a stagnant layer of foul air was plaguing rural and urban areas alike, and few present would have doubted the administrator's new revelations.

Rural smog can be as bad as urban smog, Train said, because of delayed photochemical reactions involving pollutants carried by winds away from the urban centers where most of them still originate. Photochemical oxidants are formed when sunlight acts on hydrocarbons and nitrogen oxides, sometimes after considerable delay when the pollutants have drifted as much as 50 miles downwind. These are added to natural sources of oxidants (such as ozone descending from the stratosphere), which contribute about one-third of the smog in rural areas and about one-tenth in cities. "As a result," Train concluded, "it may be necessary to expand to an area-wide basis some of the pollution control measures now in effect only in urban areas."

Train's announcement coincided with publication of an EPA study, started in 1970, of rural pollution, which revealed several new insights about contaminant production and distribution. For example, little attention has been paid in the past to the less reactive organic compounds, but the new evidence indicates that, though these are changed to photochemical oxidants more slowly than such well-known reactive compounds as nitrogen oxide, over a long period they may contribute substantially to pollution. Also, though most oxidants come from man-made sources, natural sources are very substantial—creating oxidant concentrations as much as 0.05 parts per million (the ambient air quality standard is only 0.08 ppm).

Just what actions will eventually have to be taken to counter this widespread pollution remains to be seen, but Train outlined several possibilities. Since the automobile is still implicated as the chief villain, new emission standards and restrictions on use may be necessary. Such controls may have to be applied over wide geographic areas, as will regulations affecting stationary sources. Finally, emphasis must be placed on controlling *all* reactive pollutants. □