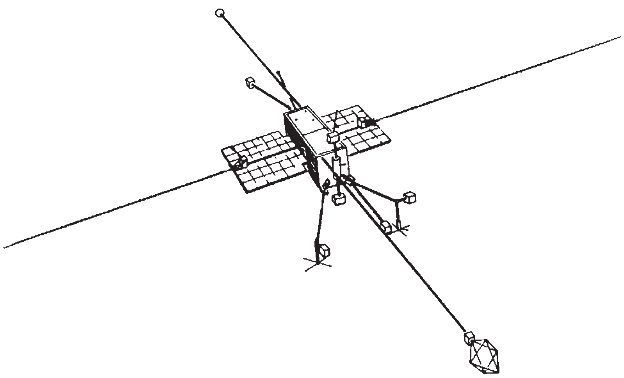
one of them obscuring the horizon sensor. Nevertheless, NASA reports that four and a half years later about half of its twenty experiments are still working and sending back useful measurements. OGO-2, launched in October 1965, was not a complete success either. Although unobscured, its horizon sensor seems to have been too sensitive, so that it continually picked up false horizons and rapidly exhausted its gas supply as it reoriented itself. One explanation is that the sensor was locking on to a mass of cold air over the equator, but even with its attitude control gas used up, most of its experiments worked for two years.

Eventually the spacecraft design was borne out by OGO-3 (June 1966) and its successors. The latest model, classified OGO-F until successfully launched when it will be redesignated OGO-6, is the heaviest so far, weighing 1,393 pounds and containing twenty-five experiments. The observatories are designed to be standardized platforms accommodating large numbers of experiments—OGO-1 had twenty—and one of the problems in addition to that of deploying the booms correctly has been to integrate the payload without causing interference between experiments.



OGO-F spacecraft.

Goddard Space Flight Center is responsible for managing the project, and must take much of the credit for the success of the series, paving the way for the development of large space laboratories. NASA claims several scientific "firsts" among the OGO results—first satellite map of the terrestrial magnetic field, first map of the airglow, first observation of the non-ducted propagation of VLF waves, first measurement of electric fields in the Earth's bow wave.

OGO-1, 3 and 5 were launched into highly elliptical orbits to probe the magnetosphere, but, like its other predecessors, OGO-F is to have a near-Earth orbit to investigate the atmosphere, the ionosphere and the lower levels of the radiation belts at a time of maximum solar activity. The twenty-five experiments are the responsibility of ten American universities, four government laboratories, five private companies and a team led by Professor J. E. Blamont, of the University of Paris. The experiments fall under four headings—atmospheric and ionospheric studies, solar radiation measurements, airglow and auroral studies, and magnetic and electric field studies. The French team will be measuring airglow and auroral emissions at 6300 and 3914 Å, and the sodium airglow. Two thirty-foot aerials attached to the solar paddles are the longest protuberances on this OGO, and are for electric field and VLF measurements.

PHYSICS

Laser follows Bubbles

The Science Research Council has announced an award of £40,473 towards the cost of bringing into full operational use a novel machine known as Sweepnik, which automatically analyses bubble chamber photographs. Sweepnik is the brainchild of Professor O. R. Frisch at the Cavendish Laboratory, Cambridge, and is essentially a laser beam, guided by a small computer, that follows tracks on a photographic film. Most of the money will go towards an extra 8K memory store and magnetic tape for the computer. But plans are under way for the production of a commercial version of Sweepnik which, it is hoped, will sell for considerably less than the £100,000 or so that is the price of rival commercial machines, even without associated computers.

In nuclear physics the analysis of bubble chamber photographs is a well established source of information about elementary particle interactions. Beams of high energy particles are shot into liquid hydrogen in a bubble chamber and the tracks of any charged particles produced show up on photographs as lines of bubbles. The tracks are curved because the chamber is in a strong magnetic field and accurate measurement of the radius of curvature of the tracks gives the momenta of the emitted particles. One bubble chamber experiment may require something like a hundred thousand pictures, and with a manual machine it still takes about fifteen minutes to process a typical event—which explains the need for much faster machines like Sweepnik which will be able to process an event a minute.

The way Sweepnik works is to focus a fine laser beam to a thin line using an astigmatic lens; a spinning prism rotates this line which is then projected by two mirrors on to the film. A condenser lens focuses the transmitted light on to a photomultiplier which registers a sharp dip in intensity when the slit is lined up with the direction of the track. By moving the mirrors the computer can direct the line to different positions along a particular track. The position of the mirrors is controlled by an independent laser interferometric system to an accuracy of 0·1 second of arc and this means that the accuracy of measurement on the film, which is a metre away from the mirrors, is one micron.

The advantage of using a laser beam to follow the tracks is that its intensity and coherence give measurements with a good signal-to-noise ratio compared with conventional machines which use cathode ray tube devices or ordinary light sources. This means that Sweepnik can easily handle poor contrast tracks. A small 18 bit work computer with an 8K store, such as PDP79 or DDP516, is all that is required to direct the mirrors. Sweepnik was built under the direction of Professor Frisch with the help of Dr G. S. B. Street, and Dr S. G. Rushbrooke will be responsible for bringing it into full operational use within the bubble chamber research group.

CHEMISTRY

Union of all Chemists

Two important events are coming up in the calendar of international chemistry. The International Union of