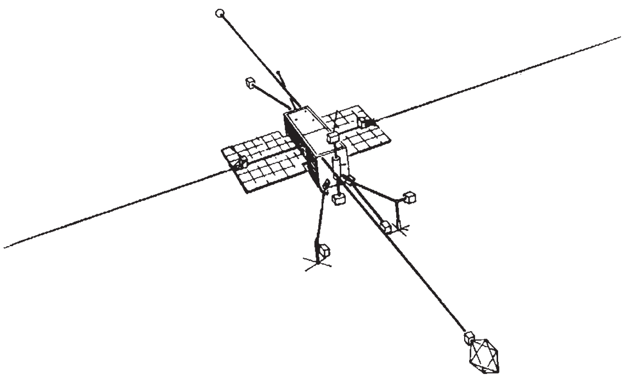
one of them obscuring the horizon sensor. Nevertheless, NASA reports that four and a half years later about half of its twenty experiments are still working and sending back useful measurements. OGO-2, launched in October 1965, was not a complete success either. Although unobscured, its horizon sensor 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

Pure and Applied Chemistry (IUPAC) is holding its twenty-fifth biennial conference at Cortina in Italy, starting on June 30. A fortnight later an IUPAC-sponsored symposium on the chemical control of the human environment opens at the University of Witwatersrand, Johannesburg.

This confluence of events makes it a suitable time to take a look at IUPAC, the self-styled United Nations of Chemistry, though in fact of League of Nations vintage. It was founded in 1918, with a membership open to national organizations of chemistry. Usually it is a country's chemical society which joins, but Britain is represented by a Royal Society committee, the United States by a National Research Council committee, and the nations of eastern Europe by offshoots of their academies of science.

There are now forty-three member countries, and they include all the obvious ones, with the exception of China and East Germany. Hong Kong and Ghana are currently in the process of joining. IUPAC is not itself the top rung of the global scientific hierarchy. With ten other scientific unions (pure and applied physics, biochemistry, geophysics and the rest) it makes up the apex of all, the International Council for Scientific Unions.

IUPAC has four sources of income. All member countries pay annual dues, in six categories ranging from $100 to $25,000, which entitles them to send between one and six delegates to the biennial council meetings. Second, royalties flow in from publications while, third, some money comes from UNESCO through the International Council for Scientific Unions. A fourth source of income is an industrial membership scheme, recently founded, which gives companies preferential access to IUPAC information at a price. These incomes amount to no vast sum, and it was only two years ago that IUPAC first set up a permanent secretariat, which at present has offices in Oxford. IUPAC's only other global focus is the office of Rudolf Morf, the secretary-general, in Zurich.

By acting as a sponsor for meetings within chemistry, IUPAC is able to act as a kind of international standards institution. IUPAC does not grant its sponsorship freely, and meetings so privileged find it much easier to attract travel grants, publication rights and star names. IUPAC's other *raison d'être* resides in its Working Commissions: there are thirty of them at present, busy setting international rules for nomenclature, use of symbols and, increasingly, analytical methods.

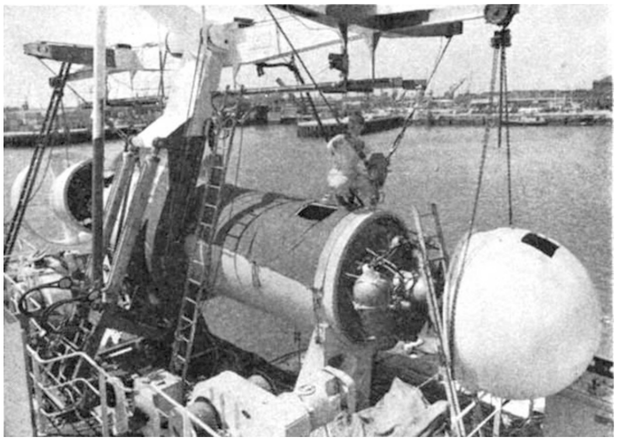
IUPAC thus has plenty to do for the time being, and it will probably continue to have plenty to do, as new compounds and new techniques appear without cease. The union has no ambitions beyond its present brief. It manages to be even less political than the British cricket team, and so far there has been not one voice audibly raised in protest about its sponsorship of a meeting in South Africa next month.

OCEANOGRAPHY

Sic Gloria Transit

THE world's first long range sonar for probing the ocean bottom recently left Southampton aboard the RRS Discovery for two months of sea trials. This sideways looking sonar is capable of viewing the ocean floor 3 miles below and 10 miles away to the side while being towed at a depth of 600 feet behind the mother ship. Such depths are at present beyond the range of researchers. The scan is presented as a continuous profile on a recorder in Discovery. The instrument is expected to be of special value in defining sea-mounts and locating the deep crevasses and holes that characterize the transition from one undersea geological regime to another.

Gloria, as the new tool is called, is 32 feet long, has a mass of about 7,000 kg and cost about £250,000. Gloria (geological long range inclined Asdic) has been under development for five years at the National Institute of Oceanography, where the first short-range side-scanning sonar for shallow seas was developed some eight or nine years ago. It sinks and rises with water ballast like a submarine and all systems are remotely controlled from a console in the ship through a specially produced 2-inch diameter armoured coaxial cable (the work of STC) which also acts as the tow.



"Gloria".

Gloria's recent past has been picturesque. Last autumn, when sea trials should have taken place, the special davit installed in place of one of the ship's lifeboats on the upper deck failed, damaging the instrument and throwing a man into the sea. The week before it was due to leave Southampton in Discovery, it was the subject of a ridiculous spy scandal in a British newspaper. Dr Stuart Rosby, the project scientist in charge says that "this was rather embarrassing. Gloria is entirely unclassified. Purposely we have developed all the special devices—such as the 144 high-power transducers—without drawing on Navy expertise".

All hopes are now focused on the operational trials going off without further incident. If all goes well, the first worthwhile pictures of the deep ocean bed will be obtained by the end of June. The first two weeks out (ending weekend of June 7) are being spent in the sheltered waters of Loch Fyne, Scotland, principally to practise handling techniques. The loch is deep enough to test the scanning system at the same time. Such a large and costly "fish" could prove quite a handful when towing from a non-specialized ship in open sea conditions. The main part of the trials is expected to take place in the Atlantic over as many contrasted areas as possible.