

framework of advanced technology, and set out three principles which technological cooperation in Europe should satisfy.

"(1) It would extend to the major subjects of advanced technology such as space, nuclear energy, data-processing and computers, aviation, transport and telecommunications; (2) it would be based on the establishment of industrial consortia which would be granted, on the one hand, the support of research and development contracts and, on the other, that of public orders coordinated among our governments; (3) it would ensure that each country has its fair share in the new jobs, flows of business and stimuli to progress which will result from joint action, this fair share applying to the programmes as a whole and not to each of them in particular, which assumes that our efforts should be established on a continuous and durable basis."

This thoroughly sensible and constructive approach got nowhere in spite of—or perhaps because of—a prompt British welcome. After a day and a half of mumbling, a resolution reintroducing the Lefèvre principles but linked with the specifically ELDO problem was re-introduced by the British delegate, Mr J. P. W. Mallalieu, Minister of State at the Ministry of Technology, but was voted against by France and Germany. A German resolution to do much the same but woollier in its terms was finally adopted with Britain and Australia abstaining.

The result is that there will be another committee of officials representing ELDO government ministers to draw up proposals for a European space programme. It is to take into account work already done, applications satellites for Europe, and available resources—and to report back by November 11. It looks like the Causse Report all over again except that the Causse inquiry drew strength from the ESRO countries as well as the ELDO countries. "The Causse Report minus", some officials were calling it. This seems to be one of the British Government's objections to the terms of the final resolution. It would like to have seen the inquiry opened up to all countries in Western Europe with an interest in space and in collaboration in advanced technology. The national appointments to the new committee (which is to meet in Brussels under a Belgian chairman) must be made by October 12. It is not quite clear yet whether Britain will send a nominee.

PLANETARY ASTRONOMY

The Stay-at-homes

Is it necessary to venture into space to study the planets or can they be observed more comfortably and at leisure by staying at home? The Panel on Planetary Astronomy of the United States National Academy of Sciences' Space Sciences Board argues that ground based measurements are often as effective and are almost always considerably less expensive than measurements made in space and should therefore play an important part in any programme of planetary study. Thus the panel throws its weight behind the stay-at-homes in a report now published (which can be had from the National Academy in Washington). The panel, under the chairmanship of J. S. Hall, the director of Lowell Observatory, was asked to survey

the current state of knowledge in planetary astronomy, to indicate potentially productive fields for ground based research and to survey the available techniques. The fields of research they considered include the dynamics of planetary motion, the study of planetary surfaces and atmospheres and the gathering of information on the interiors of planets and their associated magnetic fields. Ground based instruments have the advantages that they can handle data much faster than space instruments can and they have much longer effective life-times. Their relative design flexibility means that recent technological developments can be incorporated to good effect. Time is an important factor because information from ground based studies is used in planning space programmes and also because the planets can most usefully be observed only for certain periods. The limitations on such instruments are caused largely by the Earth's atmosphere—its opacity to radiation of all but a few wavelength bands and its turbulence. Some of these restrictions are already being overcome by the use of better observing sites, image scanning and image enhancement devices and, most importantly, by the use of radio and radar techniques. Here the limitations are purely instrumental and there is scope for order of magnitude improvements.

The panel makes eight specific recommendations for improving the efficiency of ground based studies. It asks that a 60-inch optical telescope designed for spectroscopy, interferometry, photography and photometry of the planets should be erected as soon as possible in the southern hemisphere. Two reflectors for the infrared would be useful—one with a 120-inch aperture at a site with very low water vapour content and the other with a 36-inch aperture installed in the Convair 990 aircraft operating from the Ames research centre. Existing facilities for planetary radar observations should be more extensively used, the panel says, and a large filled-aperture instrument for use at millimetre wavelengths and a high resolution one for use at 3 cm to millimetre wavelengths should be built. The recommendation of the Whitford Committee for construction of large radio telescope arrays by the National Radio Astronomy Observatory and the California Institute of Technology is endorsed. Fourier interferometers with resolutions of at least 10,000 should be developed and "the importance of technological development should be recognized by ensuring that funds are available to support it". The establishment of a "worldwide photographic planetary patrol" distributed in longitude to ensure adequate coverage for the period from January 1960 to January 1974 was recommended. The panel emphasizes the need for a solution to the thorny problem of how to provide experts who also have a comprehensive knowledge of the field as a whole.

METEOROLOGICAL RESEARCH

Set Fair at Bracknell

THE completion of a series of research projects on the Earth's atmosphere and a noteworthy advance in international cooperation are highlights of the Annual Report of the Meteorological Office for 1967 (HMSO, 11s.). On a budget of £7.5 million, the Meteorological Office seems to have pushed ahead with modernizing

its forecasting and communications networks with a clear sense of purpose.

The report gives pride of place to the fact that all 122 members of the World Meteorological Organization voted unanimously to support the World Weather Watch to coordinate the work of the individual meteorological services of member countries. This world-wide project has generated a considerable incentive for each national body to modernize its forecasting, communications and data-processing systems; nobody wants to lag behind in this venture.

The participation of the United Kingdom will be focused on the Central Forecasting Office in Bracknell, Berkshire, and the existing communications establishment will serve as a regional telecommunications hub. There seems little doubt that each country involved will benefit both from more comprehensive analysis of global behaviour of the atmosphere and from the wider range of weather forecasting. It is indeed comforting that nothing should dampen the humour of the communication received from an indignant lady reader by a Sunday newspaper: "What right have the Americans got to forecast OUR weather?"

Perhaps the most significant of the projects discussed in the report is the expansion in the use of computers and new data-processing techniques for forecasting the movement and evolution of major weather systems. Computerized techniques have not yet been extended to local forecasting, the form which most directly affects the man in the street. It is to be hoped that the benefits offered by fast and accurate calculations will not long remain on the side-lines. Research is reported to be encouraging, and a detailed model for the numerical prediction of rainfall is already off the drawing board.

A programme of investigation into the structure and evolution of frontal cloud systems has begun this year. The project, based in the Isles of Scilly, will use a variety of modern techniques, including satellite photographs and radar, to determine the quantity and distribution of rain falling from these clouds. A separate research project, carried out during the past year, was an analysis of the ozone and dust in the upper atmosphere made with the aid of the Ariel 2 satellite. The Ariel 3 satellite has been involved in a successful investigation of the vertical distribution of oxygen at a height of about 100 kilometres.

The Meteorological Office seems to be concerned equally with research and its applications. A more salient achievement on the practical side last year was the promotion of the Principal Forecasting Office at London's Heathrow Airport to the rank of Area Forecast Centre for all westbound Atlantic flights from any airport in Europe. The number of forecasts issued for aviation is reported to have risen by 5 per cent during the year, partly as a result of the new work at London Airport.

Perhaps the problems of weather-sensitive industries have not received the emphasis they deserve in this report. Although general forecasting seems to be making steady progress, and some applications to industrial or commercial problems have been reported—the avoidance of rough seas and the saving of time on transatlantic voyages, for example—it is tempting to ask whether the full potential of this field has been explored as fully or imaginatively as it might be.

One of the more obvious weather-sensitive enter-

prises is air transport, and the improvements that are continually being initiated are indeed welcome. But anyone familiar with flying in densely serviced areas like Europe or the United States needs little perception to sense the need for more accurate correlation of forecasts with the planning of airline schedules. There is still ample room for progress in this and other allied fields, and it is to be hoped that the sense of enterprise which is reflected in the 1967 report will be vigorously maintained in the following year's work.

FLOOD PROTECTION

Dams Across the Thames

SLOWLY but surely, the possibility of a flood barrier across the Thames is becoming more a reality than just wishful thinking. It has now got to the stage when two consultant engineering firms, Rendell Palmer and Tritton, and Sir Bruce White, Wolfe Barry and Partners, are to be asked by the Greater London Council to undertake joint preliminary investigations into plans and estimates for either a movable flood barrier or a fixed barrage across the Thames. They are to look into the possibilities of five sites for one or other of the constructions—Upper Pool, Blackwall Reach near the entrance to the West India Docks, Woolwich Reach, Half-Way Reach near the Ford Factory, and—for a barrier only—Long Reach. It is hoped that the consultants will make a preliminary report in about six months.

Compared with earlier efforts to get flood protection for London, the authorities seem recently to have been moving ahead in leaps and bounds. Professor Bondi's report in February on the feasibility of either a flood barrier or a barrage started the ball rolling (*Nature*, **217**, 800; 1968). For practical reasons, he came down in favour of a movable barrier at one of three sites—just below the Ford Motor Works, just above the Dagenham Dock or at Woolwich Reach. This type of construction would be an immediate solution to the problem. In theory, however, Professor Bondi thought that a fixed barrage in the Woolwich region, though much more expensive, would be the best solution. The Greater London Council has also tended in the past to favour a fixed barrage on amenity grounds. This was certainly the impression given at the one-day conference on the Thames in April organized by the GLC (see *Nature*, **218**, 5; 1968). Obviously, from its recent announcement, the GLC is still viewing both types of construction quite openly, and it will be interesting to see which plan the engineers prefer. It is interesting that one of the sites being studied by the engineers, at Long Reach, was one Professor Bondi thought had little advantage if any over the other ones he suggested, as it would work out very much more expensive, without extra benefit.

Inevitably, the GLC's decision will also depend on the results of the present investigations of the tidal flow in the Thames and of silting in the estuary.

MARINE BIOLOGY

Charting Scottish Seas

THE Scottish Marine Biological Association seems to have had a successful year, to judge from its latest