organizations as varied as the national census, the Board of Trade, various city corporations and even the organizers of the Channel Tunnel project, bringing its total earned income to £2.4 million, the Ordnance Survey cost the taxpayer £4.8 million, or two-thirds of its budget. Outsiders will continue to ask whether the Ordnance Survey is making the best of its natural advantages.

RESEARCH SPENDING

US Budget Contracts

EXPENDITURE on research and development in the United States is expected to reach £25,700 million in 1970, according to the latest estimates from the Battelle Memorial Institute. This would represent an increase of less than one per cent over the total estimated for 1969. Taking account of increases in the cost of research and development, this could mean that the real level of expenditure would decrease by as much as seven per cent. The institute forecasts, moreover, that on past trends, industry's share of the research and development bill will increase, while that of the federal government may fall by about \$200 million. In 1964, the federal government funded about 65 per cent of the total research and development in the United States, but this share has been falling gradually, while that of industry has been rising slowly from its 1964 level of 31 per cent. The institute forecasts that in 1970 the federal government and industry will be responsible for 58 per cent and 36 per cent respectively, the rest coming from the universities and non-profit-making institutions (such as the Battelle Memorial Institute itself).

The institute's forecast that £15,000 million will be spent by the federal government on research and development conflicts with the official budget figure of £16,700 million, which represents an increase of about \$300 million over the official estimate for 1969. The Battelle Institute feels, however, that economic pressures will tend to keep down expenditure on research and development, because the Administration and Congress identify such appropriations as "controllable" budget items which can be used to restrain budget increases. It also forecasts that the growth of federal expenditure on research and development will not exceed four per cent a year, without correction for higher costs. Although federal expenditures on research and development, adjusted to 1968 dollar prices, seem to have risen every year since 1953, the Battelle Institute suggests that if increases in research and development costs are taken into account, the real level of expenditure in these fields reached its peak in 1967, then fell by 1.6 per cent in 1967-68 and by 5.6 per cent in 1968-69.

HYDRAULIC ENGINEERING

Disturbances on the Angara

from our Soviet Correspondent

It is reported from Irkutsk (*Priroda*, 12, 97; 1969) that the construction of reservoirs at Irkutsk and Bratsk on the lower Angara—the chief outlet of lake Baikal—has resulted not only in the expected changes in the water level of the river, but also in certain completely unpredicted geological processes in the

banks. Formerly, the banks of the Angara exhibited fully developed slip and karst processes. As the reservoirs filled, the higher water level and greater humidity of the banks caused new regions of slip to be formed and old slips to be reactivated, leading in certain cases to intensive subsidence. In the case of karst processes, especially widely developed in deposits of the lower Cambrian, with frequent subterranean cavities, ground level subsidence became frequent as the water level rose, resulting in potholes often as much as 8-10 m deep and 4-6 m in diameter.

These phenomena seem to be peculiar to the specific geology of the lower Angara region, and have not, apparently, been observed on other "exploited" rivers in the Soviet Union. In view, however, of the current construction of the giant hydroelectric station and reservoir at Ust'-Il'msk on the lower Angara (see *Nature*, 223, 1091; 1969), a thorough study of the geology of this river and the effect on it of these "triumphs of engineering" would appear to be pressing.

ATMOSPHERE

Meteorology at a Distance

by our Astronomy Correspondent

A NEW study of methods for the remote probing of the atmosphere—as distinct from *in situ* observations from balloons and sounding rockets, for example—has been published by the US National Academy of Sciences—National Research Council, which recommends the establishment of what the report calls an atmospheric test range at Wallops Island, Virginia. This is the NASA base which already boasts an enviable collection of five sensitive radars operated by NASA and the Air Force as well as the rocket range. The argument is that there is a need of a place where different remote methods of probing the atmosphere can be compared with each other as well as with rocket measurements. This means that the range must have sensitive radars which are able to measure winds, turbulence and structure in the atmosphere—radars which already exist at Wallops Island. At the same time, the panel responsible for the report, under the chairmanship of Professor David Atlas of the University of Chicago, named other radars which could be pressed into use for atmospheric probing. The Haystack and Millstone Hill radars of the MIT Lincoln Laboratory, for example, are more sensitive than the array at Wallops Island and ought to be available to atmospheric scientists. According to the report, the Haystack equipment in particular, with a 120-foot diameter antenna, is more sensitive by a factor of about thirty-two than the corresponding radar at Wallops Island. It is the Haystack facility which may yet be transferred to the North East Radio Observatory Corporation to become part of the civilian equipment for astronomy.

The report is limited to a review of remote probing of the non-ionized components of the atmosphere below 100 km and might well be subtitled "atmospheric exploration without rockets, balloons and aircraft". The panel contends that it is neither technically nor economically sound to rely on direct observations and that good coverage of the atmosphere must depend on ground-based (and satellite-based) probing. In particular, the report cites the Global Atmosphere Research Program, the chief aim of which is to forecast gross features of the atmospheric

circulation, as an example of a project which, to begin with, requires a global coverage of observations.

The most urgent of the recommendations, which the report says have been put forward with due regard for the financial situation, are concerned with the availability of the Wallops Island and MIT radars for atmospheric studies and the organization of the small atmospheric test range at Wallops Island by the National Center for Atmospheric Research in cooperation with NASA. The panel also asks for more research on Doppler radar techniques, chiefly because of their potentiality as early warning systems for tornadoes.

A second group of recommendations advocates the development of acoustic techniques for the lower atmosphere, and of optical radars using lasers for the measurement of aerosol pollutants and the vertical profiles of atmospheric gases. Microwave and infrared radiometers are given low priority because their application as satellite-based probes of temperature and water vapour and ozone content is already appreciated. Finally, the report calls for more observations of the way the atmosphere affects the operation of microwave and optical line-of-sight links.

POLYTECHNICS

Unity at the Top

by our Education Correspondent

DIRECTORS of the polytechnics will soon have their own committee, on the lines of the Committee of Vice-Chancellors and Principals. Proposals to set up this new body came at a meeting of directors and directors-elect of nineteen designated and proposed polytechnics, and a working party, under the chairmanship of Mr R. E. Wood of Leicester Polytechnic, has been elected to plan the organization and aims of the committee.

Until the working party puts forward its proposals—probably in February—polytechnic directors are reluctant to comment about the aims of the committee, but it seems that it will consist of the directors of the eight designated polytechnics and directors-elect of those shortly to be established. The new committee has been prompted by the fact that polytechnics have many common problems which are not shared by other institutions. It seems that the committee will meet regularly and will try to speak with a common voice on issues affecting this sector of education. One such problem is finance, and it is here that the analogy with the Committee of Vice-Chancellors breaks down because, unlike the universities, which are largely financed through the University Grants Committee, the polytechnics are financed from local education authorities and therefore have no single body to negotiate with.

If the committee is set up, it will come into being at a crucial stage in the development of the polytechnic system. Eight establishments have so far been officially designated, and a further six—at Manchester, Leeds, North Staffordshire, Kingston, Lanchester (Warwickshire) and Plymouth—are expected to receive the official go-ahead in the near future. The greatest problem facing these institutions is, of course, how they will coexist with the universities, and the proposed Committee of Directors must try to forge close links with the Committee of Vice-Chancellors and Principals to help in alleviating the effects of the binary system.

Miscellaneous Intelligence

No newspaper or magazine can rival the *British Medical Journal* in entertaining its readers over the Christmas holidays. *BMJ* faithfuls spent the holidays answering a Christmas quiz which called for definitions of Homeric laughter syndrome, Job's syndrome, full-moon disease and Lilliputian syndrome. (The last, apparently, consists of "large numbers of gaily dressed and busy small people seen by patients with toxic psychoses".) Extra marks were gained for knowing what to prescribe when asked, in underworld argot, for such nostrums as "black bombers", "charge", "French blues", "blue velvet", "black and white minstrels", "hot and cold", "jolly beans" and "Freddy". For answers see *British Medical Journal*, 4, 753; 1969.

THE longest English word known to the *Guinness Book of Records* (October 1969 edition) is the full chemical description of the alpha chain of *E. coli* tryptophan synthetase whose 267 amino-acid residues, when written out in full, amount to 1,913 letters. Surely the protein chemists can do better than that. A quick glance through the *Atlas of Protein Sequence and Structure 1969* reveals that pig glyceraldehyde-3-dehydrogenase has 332 residues and the same enzyme from lobster possesses 333 residues. Assuming an average of 7.15 letters per amino-acid residue, the full name of the latter enzyme (whose sequence was published in *Nature*, 216, 1181; 1967) requires 2,381 letters.

THE comparative study of protein sequences certainly holds an important key to human evolution, but are the molecular biologists yet prepared to oust the palaeo-anthropologists? A. C. Wilson and V. M. Sarich seem confident enough at least to tweak their tails with the remark that disagreements among students of fossil man are due in part "to the failure of traditional comparative anatomy to develop methods which would lead to agreement, even among anatomists, as to the evolutionary meaning of (their) data. Molecular biology now offers new methods . . . (which help) to circumvent the problems caused by few fossils and uncertain anatomical conclusions" (*Proc. US Nat. Acad. Sci.*, 63, 1088; 1969). The remark will doubtless set palaeo-anthropologists digging hard in their most fruitful sources of new material, Omo and Olduvai, the drug-stores of Hong Kong and the vaults of the British Museum.

A LETTER in the current *Journal of the British Society of Dowsers* (22, 244; 1969) points out that since the geographical incidence of cancer is related to the permeability of the local soils to cosmic rays, and since the Moon has been bombarded with cosmic rays for millions of years, "it is very possible that the 70 pounds of rock samples (brought back by the Apollo 11 astronauts) are many thousands of times more harmful than anything we have got on Earth. . . . I hope the above is of some interest". Another contributor ends his criticism of NASA policies with the remark (*ibid.*, 234): "The sick in mind are troubled by the Moon. The scientists say this is a myth, but scientists do not nurse the sick and I think are excluded from the Moon".