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