

Battelle Memorial Institute in Columbus, Ohio, paints the gloomy picture of a growth rate in research and development actually lagging behind the anticipated inflation in the cost of performing scientific work.

The estimate for 1969 of \$25,900 million exceeds the figure for 1968 by \$900 million or 3.6 per cent. This compares with increases of 5 per cent from 1967 to 1968 and 7.1 per cent from 1966 to 1967, and is, according to the Battelle Institute, easily the slowest rate of growth for any year since figures were first compiled in 1953. Current rates of inflation in research and development are estimated at between 5 and 8 per cent.

The Battelle report offers little cheer to those who look to the end of the Vietnam conflict for a reversal of this sad trend. The momentum of the drive for social action programmes directed against poverty, crime and unemployment is thought likely to dominate the demands for those funds which would become available after a cease fire, and the sums involved are not expected to be large in the immediate future anyway.

The Federal Government is expected to foot about 60 per cent of the research and development bill for 1969, with industry bearing 35 per cent and the colleges and universities 3.6 per cent. The declining growth rate of Federal expenditure in this field is reflected in the reduction of an average compound growth rate of 9 per cent during the past ten years to one of about 6 per cent for the past four years. The Battelle economists expected that the next ten years would see growth rates of between 4 and 8 per cent, although the value of this forecast must clearly be diluted by the many implied assumptions.

It is an interesting feature of the present structure of American research and development that although the Federal Government is the dominant source of funds, about 70 per cent of all research and development work is carried out by industry. The share of the cost of industrial research and development actually borne by industry is expected to rise from 44 per cent in 1964 to 50 per cent in 1969, which is said to reflect the increased awareness of businessmen of the relevance of research to increased corporate growth.

## EDUCATION

### Physics at Sydney

Few physics departments can be as assiduously watched over as the School of Physics at the University of Sydney, which is cared for by an association with the unwieldy title of Science Foundation for Physics within the University of Sydney, sensibly abbreviated to Science Foundation. Set up nearly fifteen years ago, at the start of the university boom in Australia, which has seen the number of Australian universities more than doubled since 1945, the Science Foundation is an association of public and private organizations to promote the work of the School of Physics and to encourage scientific education in Australia generally. It is the brainchild of Professor Harry Messel, head of the school of physics.

The proudest feather in the cap of the Science Foundation is its International Science School for high school students, which is to become an annual event in August and September at the University of Sydney. Previous schools have been mainly for Australian school-children, but this year Britain and Japan each sent

five students and the United States was able to send ten. Professor Messel hopes to extend the international scope of the school in future. He should have no difficulty in attracting students, although money is a problem. Past lecturers include Professors G. Gamow, T. Gold, H. Bondi, R. N. Bracewell, R. Hanbury Brown and J. D. Watson.

## TRANSPORT

### Cheaper in Bulk

NEXT summer, the first full-blooded attempt to make a hovercraft service work effectively across the English Channel will be undertaken by Hoverlloyd, a company backed by the Swedish shipping firm of Swedish Lloyd and the Swedish America Line. Hoverlloyd announced this week its timetable for 1969, and it sounded very much more professional than British Rail's attempt to run a service in the summer of 1968 with only one hovercraft. The British Rail service, like many pioneer ventures, ran into a multitude of snags, but the experience was valuable. More than 400 modifications have been made to the design of the hovercraft, and Hoverlloyd is confident that it can run a reliable service. It has invested more than £5 million in the venture, which is designed to make all other methods of crossing the Channel (including the tunnel) look hopelessly out of date.

The company will be operating two Mountbatten hovercraft—better known as the SRN 4—between Ramsgate and Calais. On the Ramsgate side, the terminal has been built at Pegwell Bay (after a long wrangle over planning permission), and the terminal at Calais has been built by the Calais Chamber of Commerce. The route will take the hovercraft across the notorious Goodwin Sands, some parts of which dry out at low tide, and within half a mile of the North Eastern Victory, an American ship wrecked on the Goodwins in 1947. In bad weather, the plan is to use the Goodwins to provide a measure of shelter for the hovercraft. The company believes that weather conditions will be suitable for operation whenever the wind is no more than force 7 on the Beaufort scale, which is a near gale. Throughout the year this means that the service should be able to operate 94 per cent of the time; in the busy summer season, 99 per cent reliability should be achieved.

The trip will take 40 minutes, and the turn-round time at each end will take only 20 min. This gives the hovercraft an astonishingly large carrying capacity—indeed, according to Hoverlloyd's estimates, the entire channel passenger traffic could be handled by eight hovercraft. With the two hovercraft, Hoverlloyd will have the capacity to carry 25 per cent of the passenger traffic and 17 per cent of the car traffic across the Channel, although if it achieved one-third of this in the first year it would probably be delighted.

The fare structure is designed to even out two factors which would otherwise reduce the efficiency of the operation. One of these is the fact that people have strong preferences about when they travel; as well as the peak in the summer months, there is also great variation during the day. Hoverlloyd has therefore established a two-level fare structure designed to encourage people to travel at off-peak hours. The other factor is the odd characteristics of the SRN 4; although it can carry 250 passengers, it can take only 30 cars.

The average number of passengers per car on the Channel services is only 2.7, so that Hoverloyd will be faced with a lot of empty seats if it is unable to do better than this. The fare structure is therefore designed so that passengers—as many as seven per car—travel free. This means that families or parties can travel very much more cheaply by Hoverloyd than by any other route. Four people in a medium size family car would pay £14 by boat, and exactly the same by Hoverloyd if they travelled on the peak-period "A" tariff. If they travelled off peak, the hovercraft fare would be only £11. One person in the same car, on the other hand, would still pay £11 on the hovercraft, but only £6.85 on the boat. Each foot passenger will be charged £2 10s on the hovercraft cheap rate, against £2 12s for the boat.

#### MANAGEMENT

### Strategy for Technology

A SPECULATIVE lecture on scientific and technical strategy at the national and major enterprise levels—the seventh talk in a series devoted to management and technological problems—was given at the United States Embassy in London last week by Professor James Quinn of the Amos Tuck School of Business Studies at Dartmouth College, New Hampshire. Enlivened by a series of anecdotes, the lecture revolved around the problem of defining and following a scientific and technological strategy in a large organization, whether public or private.

The immense difficulties in trying to reduce this question to definable terms were reflected in the style of the lecture. Indeed, it would be tempting to surmise from the number of unanswered questions posed by Professor Quinn that the days of intuitive decision-making are not yet over. But, in the long run, the only justification for adopting a strategy at all, according to Professor Quinn, is that either guessing or hoping do generally produce worse results.

Much of the talk was devoted to outlining the concepts needed to relate technology to an industrial or government strategy. The distinction between measured economic growth and the idea of "maximum growth in human well-being" was expressed in terms of quality improvements, which are intimately connected with technology. An example might be the construction of quieter aircraft rather than more economic ones.

Professor Quinn went on to discuss the role of a technological strategy in attaining this goal, and was quick to concede that a large company—by virtue of its well-defined hierarchy and its more limited objectives—could evolve a strategy much more easily than a government. He showed a flow-chart of forecasting and strategy in a typical large company, and referred to Hannibal's planning of his campaign against the Romans to bring out the prime ingredients of a strategy. These consist of evaluating opportunities and threats and committing resources in a unique and selective pattern. Occasional snippets of political affiliation crept into the lecture, such as the acceptance of competition both nationally and internationally as a fundamental of life.

In assessing the benefits to less developed countries of foreign investment and the installation of multinational companies, Professor Quinn stressed that the

managers in the parent country were by no means as free to dictate policy as might appear on the surface, and had to be influenced by the feelings of local labour and social conditions. The importation of technology was also of value to the host country, but the style of Professor Quinn's treatment will have given many in the audience the impression that part of the argument was based on a need to justify the huge overseas investments of the United States.

#### TECHNOLOGY

### European Cooperation

THE deadlock between France and the Netherlands on the question of technological collaboration between the Common Market and other countries was resolved at a meeting of the Council of Ministers of the European Community when a compromise procedure for associating with other countries was hammered out. The deadlock arose after the last French veto on British entry into the Common Market. The Dutch boycotted the Community's Marechal Committee on technological cooperation, saying that it should be allowed to consider collaboration with countries that had applied for community membership. The French position was that only the member countries should be involved.

The way the compromise works is that the Marechal Committee will resume its interrupted study of the possible fields for international cooperation and will report to the council by March of next year. The ministers will consider the report and may at that stage make proposals to other "interested" European countries. The word interested in this context is an attempt to gloss over the question of who exactly should be included. The Dutch would like to see only the four applicants for membership involved, but the French, unwilling to concede this a step on the way to entry into the community, want to make the invitation more general. At the discretion of the council, the next stage would be for experts from the six and outside countries to meet to prepare the ground for discussions between ministers of technology in the countries concerned. A spokesman for the community thought that this meeting might materialize in about a year's time.

The Marechal Committee will initially consider collaboration in seven fields—automatic data processing, telecommunications, development of new forms of transport, oceanography, metallurgy, meteorology and nuisances (including air and water pollution). Whether the fact that none of these areas is politically controversial will make agreement easy and pave the way for more significant cooperation remains to be seen.

#### OPEN UNIVERSITY

### Who will be Paying?

THE proposals for the Open University have now become an issue in the constant battle between the British Government and local government authorities over the levels of local government expenditure. Whitehall can fairly be accused of telling local government authorities to cut their levels of expenditure, while at the same time blithely putting forward projects which saddle local councils with extra expenditure. Last week, the Association of Municipal Corporations