

Engineering innovation

Improved engineering education is the key to the new industrial revolution.

OPTIMISM, a rare commodity during the long recession of the past ten years, seems to be taking hold again among the governments of the industrialized world, and in a way that promises that the economic doldrums may in due course end for good. For after decades of lip-service to the belief that science and technology are necessary (but not sufficient) conditions for prosperity, governments seem now to be behaving as if the truth were self-evident. What else can explain the unexpected decision last week of the ten members of the European Community that funds would be found to launch the Esprit programme of collaborative research in information technology? Or the renewed commitment of the United States Government to federal support for basic research, reaffirmed by the 14 per cent increase asked for in the budget for the coming financial year, beginning on 1 October? In these cheerful circumstances, the outstanding problem is how to translate good intentions into practice.

Two problems stand out, how to spend public money on the support of industrial innovation and how to find people who will use it imaginatively but wisely. It is important that governments now setting out to bring about another industrial revolution should first learn what can be learned from the often depressing experience of recent years of which there is, unfortunately, a surfeit.

Pride of place should go to education and to engineering education. Circumstances are much changed since the heyday of the nineteenth century's industrial revolution. The engineers on whom the burden of that upheaval fell, people like Watt (a few decades earlier) and the Stephensons in Britain and Edison in the United States, were in no sense academic but, rather, practical men whose ingenuity centred on the intuitive development of new machines. Tempting though it may now be to hope that people (women as well as men) of the same temperament might conjure endless prosperity from technical innovation, that is no longer possible. Wider access to higher education in most industrialized societies has ensured that all but a tiny fraction of creative engineers are launched on their careers from academic institutions. There is, however, good reason to suppose that the old hankering after empirical ways persists among academic engineers. Research in the standard academic pattern is less common and less successful than in basic science, but academic engineers (faculty members and students alike) have traditionally made important contributions to the solution of practical industrial problems.

This is one reason why, in the United States, the National Science Foundation deserves applause and support for its plan to create industrial centres in conjunction with university engineering departments, looking to industry not merely for equipment normally beyond the reach of academic institutions but for practical problems to solve. For what it is worth, institutions of this kind are not new; in Britain in the past fifteen years, a private foundation (the Wolfson Foundation) has made grants to support more than a hundred academically based but industrially oriented centres of this kind, many of which have been remarkably successful. The National Science Foundation seems to be planning to build industrially oriented centres that will be individually larger, and whose role in the education of engineering students will be more deliberate. This could yet be the best way of meeting the crying need that engineering graduates should acquire further skills before going out into the cruel world — and perhaps even of tempting their teachers to stay longer in an academic setting. Certainly the experiment, to be mounted later this year, deserves a fair wind.

Elsewhere, as in Britain, there are more serious problems to tackle. The Engineering Council (see p.103) seems to share with others who have taken a view of engineering education the view that universities have failed the industrial community, forgetting that at least in the British environment the failure until recently

has been that of the industrial companies which consistently undervalued the engineers whom they have employed. Even if the Engineering Council now has grounds for thinking that attitudes have changed, no useful purpose would be served by having the University Grants Committee prescribe the proportions of university budgets to be spent on engineering education. A more legitimate demand would be that universities should so organize their affairs, in the years ahead, that they can respond flexibly if, as seems likely, the demand for engineering education should increase; as things are, too many British universities have responded to the troubles of the past few years by making over-rigid arrangements to preserve the present balance of student numbers in different fields. And the Engineering Council should not forget that, in present circumstances, engineering education is not the only fruitful source of industrial innovators.

The question of how to spend money on innovation, not innovators, is more difficult. Unhappy experience suggests only one firm rule — that neither politicians nor their civil servants can be trusted with decisions of this kind, for they are prone to use public funds for the rescue of dying industries, not for the creation of the new. Similarly, but less certainly, there are dangers in the attractive device of collaborative research designed to provide a common basis of knowledge and skill on which commercial companies can then build new machines. The popular legend that much of the Japanese success in recent years stems from such programmes is overstated, and takes too little account of the meagre financial contribution of the central government. Elsewhere, the most common difficulty is that of devising a programme of collaborative research that is neither so exclusively concerned with general principles as to seem academic nor so pointed that it benefits chiefly those who happen to carry to work. Could this be part of the reason why Admiral Bobby Inman's collaborative venture on behalf of the United States computer industry is so slow off the ground (see p.99)? It will be interesting to see whether the managers of the Esprit programme launched last week in Brussels are more successful. □

Space station trouble

NASA in the United States has only itself to blame that its plan to build a space station is in trouble.

REPORTS that the United States is about to build a space station are, so to speak, exaggerated. That seems to be the burden of the intelligent criticism by the congressional Office of Technology Assessment of the plan being canvassed by NASA on behalf of the US administration to design a habitable platform somewhere in orbit about the Earth (page 101).

The issue is quite simple. NASA considers that there should be a space station, but is for the time being unable to say exactly (or even roughly) what it would be for, except perhaps as a kind of talisman. The hope that two years of further work will clarify the issue is almost certain to be disappointed, for what will by then have emerged is that there are several possible uses for a space station, each of which would predicate a different kind of platform in a different kind of orbit.

As things are, however, some proven needs stand out. One is that there should be means of recovering satellites from geosynchronous orbits about the Earth. Such satellites may each cost several hundreds of millions of dollars and their lifetimes could with great economic advantage be extended by the replacement of relatively minor components. Another is a durable space platform which would be a splendid base from which to mount scientific observations. For the time being, there is no economic use for in orbit materials processing.

Putting a space station in a geosynchronous orbit would however be exceedingly expensive, and would not even be the most economic way of recovering satellites in the same orbit. It follows that the practical obstacle to efficient use for a space station is uncertainty about the kind of vehicle that would make the journey from what would presumably be an orbit nearer the Earth. So why not develop that first. □