Big machines make big science

Britain's problem, whether to pull out of high-energy physics, would be solved if there were a moratorium on machine-building. Astronomy is in the same case.

Two or three months from now, the British research enterprise will have gone through its biggest upheaval since the Second World War. Then four successive governments (two Attlee, one Churchill and one Eden) allowed that the great wartime successes (radar, jet engines and even nuclear fission — not, in the end, very British) should be followed by deliberate support for research laboratories on a scale and in a manner different from the casual arrangements of the 1930s, when penicillin was discovered by accident and, by a similar kind of accident, almost let slip. There is much in the view that what is happening in Britain now is peculiarly British. But there is also something to be learned elsewhere from the present dilemma.

Most civil research, certainly most academic research, in Britain is paid for by the government, through the medium of four supposedly autonomous research councils. (There is a fifth, responsible for the social sciences.) Forty years ago, however, there was no mechanism for the support of academic research in general. The agricultural and medical research councils existed to encourage the application of science in their special fields, the natural environment research council had not been invented, the notion that university laboratories were an important source of innovation was acknowledged but not thought to require special intervention and the sole source of financial support for untied research was the Department of Scientific and Industrial Research, whose terms of reference were to make Britain prosperous.

For many years after 1945, the chief sources of support for science were agencies not very different from those still supporting science in other places. The British Ministry of Supply, an early version of a defence procurement agency, founded both the post-war aircraft industry in Britain and also the atomic energy industry, creating in the process the nucleus of what has now become the high-energy physics community. In those days, the Royal Greenwich Observatory was supported by the Admiralty.

In a curious way, the question now for decision by the research councils reopens the questions decided without much thought forty years ago. Now, the Science and Engineering Research Council, having been told firmly by the Treasury that it can look for no help this year in paying its subscription to CERN (the European Organization for Nuclear Research), is being forced to ask whether Britain can continue spending some £70 million a year on high-energy physics. By the spring a decision whether or not to pull out at the end of this year will have had to be made.

What should it be? Everybody agrees that this would be a rotten time for a country such as Britain, with such traditions, to pull out of high-energy physics. For is it not exciting that the predictions of the electro-weak theory should have been confirmed in the past year or so and that the prospect of further adventure in fields such as super-symmetry should have been opened? That Britain, in whose universities the whole field of nuclear physics was invented (principally by Rutherford, at Manchester and then Cambridge), should have to decide to have no more to do with it would be acutely galling. Even physicists who are not nuclear physicists, or scientists in general, agree that such an outcome would be a misfortune. Some, however, hold that following the line dictated by the affection would rob more orthodox fields of science of the support they need, and would reluctantly cut adrift from what sentiment dictates.

It is less often remarked that there are other fields of scientific work in which much the same conditions apply. Britain has become an important contributor to international research in astronomy not because of natural advantages but for the opposite reason, by a kind of perverse insistence on doing well in spite of natural disadvantages. To be sure there is again a strong tradition, going back to Newton and Herschel, but more recently represented by theoreticians such as Eddington and Hoyle, of people who have been able to construct imaginative glimpses of what the Universe is like. Only in the late 1950s did British astronomy seek to compete observationally with, say the Californians. Only in the past few years, in Australia, Hawaii and, in due course, on Tenerife, has the competition showed signs of being successful.

The two fields, high-energy physics and obervational astronomy, have much in common. In each of them, purpose-built instruments can be powerful stimulants of people's curiosity. Indeed, an expensive instrument may create an economic need that futher resources should be spent, both on ancillary equipment and on training people, so as to win the full benefits of the original investment. This is the spirit, in the late 1960s, in which the British high-energy physics community kept urging on anybody prepared to listen the need for further investments beyond the cost of particle accelerators (at CERN but also domestically). More recently, the astronomers have made the same case, more quietly but as successfully; more than a third of British universities now teach astronomy to graduate students, the others would give their eye-teeth to afford to do so. The government which ultimately pays the bill regrets that more effort is not being spent on research to make industry competitive.

In high-energy physics, it is often said that after the next machine is built, the time will have come to put high-energy physics on an international basis, with interested governments clubbing together to build a machine that none of them could separately afford. That way, the argument goes, it will be possible to maintain the momentum of discovery in spite of the gigantic cost. But in this field, as in astronomy, there is no compelling reason why the next discovery should be made tomorrow rather than, say, the day after tomorrow. Or, more accurately, the urgency of the need to know precisely what symmetry groups govern the relationships between elementary particles, or whether the distance-scale of the Universe corresponds to an age of 10,000 million years or twice as much, is academic compared with the need somehow to ensure that academics have the resources with which to answer questions of that kind.

A few morals follow simply. First, it will of course be tragic for many people, but also a break with honourable tradition, if British science has to retreat from high-energy physics, astronomy, either or both, But it may be necessary. And it should not be astronomers or high-energy physicists who decide. Second, since there is already a sense in which these enterprises are international, may it not be worthwhile negotiating not an international agreement for the common building of machines, but international agreements to limit investment in fields where curiosity can be kept waiting? The trouble is that building machines, however expensive, has become too simple. The Large Space Telescope (see p. 337) will settle the issue of the distance-scale in a few days' observation, and will then for twenty years consume the efforts of an army of astronomers, many not yet created. A moratorium on building other telescopes would be in the public interest.

John Maddox