confined almost exclusively to revenue expenditure". The objective has been to work out a kind of yardstick for relating the annual expenditure of technical colleges to the amount of teaching which they undertake. Much of the report is devoted to a somewhat puzzled inquiry into the reasons why expenditure at many technical colleges differs by as much as thirty per cent from what would be calculated from the formula. What the committee has to say about the procedures which should be used for handling the finances of technical colleges will probably be valuable for the more enlightened local authorities. For many, however, the new yardsticks will quickly become a straitjacket. There is a real danger that the development of the technical colleges will be unreasonably restrained precisely when there is a need for them to be able to try out new ideas.

This part of the educational system is, in other words, in danger of becoming a second-class system. One obvious difficulty is that when this truth is widely appreciated, the difficulties of recruiting people to the technical colleges, already considerable, will be increased enormously. The result will be the further neglect of close on 1·5 million students. Another is that the division between the technical colleges and the universities will be sharpened, and already there is too much snobbery in the universities and inverted snobbery in the colleges. In the long run, these problems are every bit as important for higher education in Britain as the issues which seem to university academics to be the most pressing—the public insults of the Prices and Incomes Board, for example. In the circumstances, it is not unreasonable to ask that the universities should divert some of the energy they have recently been spending on public debate towards the problems of relationships with the technical colleges. The present separation of the two types of institution is unstable as well as inequitable, and the ideal is that there should be some means by which a technical college can hope to promote itself to a higher status by diligence and flair. This implies a spectrum of institutions, not a binary separation.

NUCLEAR POWER

Keeping it Natural

AUSTRALIA is continuing to devote the greater part of its nuclear development expenditure to one system—natural uranium reactors fuelled and moderated by heavy water. This, the Australian Atomic Energy Commission believes, is the system most likely to be applicable to Australian conditions. The latest annual report of the AEC appears to narrow the choice even further, by suggesting that one "particularly attractive" system is the type moderated by heavy water and cooled by ordinary water. Essentially, there are two such systems. The best developed is the Canadian CANDU boiling light water system being installed as a 250 MW prototype at Gentilly. This seems to command a great deal of confidence. The alternative is the British steam generating heavy water reactor, modified for use with natural uranium. A third possibility, the Italian CIRENE system, is less fully developed.

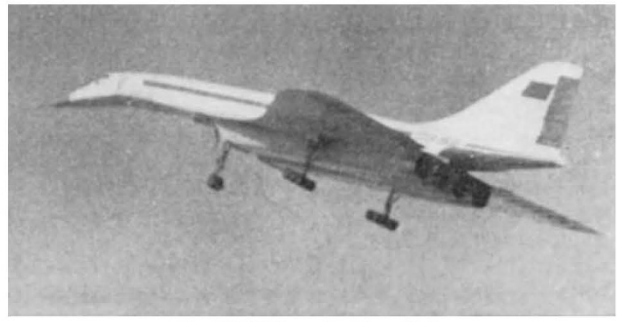
At the moment, AEC personnel are participating in both the British and Canadian development programmes in order to get experience of both systems at first hand. The AEC disavows any intention of developing a system of its own, which it says would be far too expensive. It also points out that modifying the SGHWR to run on natural uranium is far from easy. To achieve a reasonable burn-up with natural uranium, it is necessary to remove all neutron absorbing material from the core. This means thinner pressure tubes, thinner fuel cladding and more closely spaced fuel pins, and problems of safety and control become harder. Solutions to these problems, though they exist, all militate against the economics of the system. Softening this pill, the report suggests that the UKAEA has been unable to do as much work on the system as it intended, because of other more urgent commitments.

During the year, the AEC also continued basic work on reactor physics and isotope and radiation programmes. But the second largest sum of money—about one-eighth of the research budget—was spent on a programme rather confusingly described in the annual report as Aborigine Primus. In fact this represents the amount of work which is still directed towards high-temperature gas-cooled reactors. Until the recent preoccupation with natural uranium reactors took over, the AEC was interested in a gas-cooled reactor using pebble-bed technology and enriched fuel; Aborigine Primus ("somewhat fancifully named", as an AEC man in London admitted) represents an attempt to apply this technology to a very small reactor suitable for remote country regions. But while Australia, a producer of uranium, remains doubtful about the prospects of enriching it cheaply, natural uranium reactors are certain to dominate. Aborigines will have to remain content with traditional methods.

SUPERSONIC FLIGHT

Hazards of Flying High

WITH the advent of supersonic aircraft such as Concorde and the Russian Tupolev 144, which can fly at altitudes of 20 km, increasing attention is being given to the danger to passengers of high doses of radiation (see *Nature*, **217**, 5; 1968). Last week[1] Dr J. F. Loutit, director of the Radiobiological Research Unit at Harwell, drew attention to the danger when he quoted the suggestion of the Space Radiation Space Panel and the Task Group of Committee 1 of the International Commission on Radiological Protection that "the vast majority of visible solar disturbances do not result in significant radiation near the Earth; those that do, and notably those that result in potentially dangerous



The TU 144 on its first flight.

giant flares, are not distinguishable from the others". He went on to say that the likely warning period may be as little as 10 min.

Studies at the Radio and Space Research Station which are mentioned in the research station's first triennial report, published last week, may cast a more cheerful light on the situation (*Radio and Space Research*, 1965–67; HMSO, 7*s* 6*d*). Solar flares and their effects on radio wave propagation through the ionosphere have long been studied at the research station, but it is only in recent years that the importance of the millimetre-wave content of the Sun's radiation has been followed closely. As this component arises in the chromospheric layers, it is likely not only to give new information on the mechanism of solar flares but may even lead to a means of predicting their occurrence. According to the report, the wavelength of solar radio emissions depends on the depth within the Sun at which they originate, so that it would seem of value to record a number of wavelengths simultaneously. Equipment for 19 GHz and 71 GHz is already in operation, a swept-frequency receiver for the 100–280 MHz band is nearing completion and construction of a 37 GHz radio meter has started. In addition, a swept-frequency polarimeter for the 2–4 GHz band is being operated at the station by a group from University College, London.

Experiments in rockets conducted by the research workers at the station have provided successful measurements of various characteristics of the upper atmosphere. For example, in March 1967, a rocket was launched in cooperation with the Norwegian Defence Research Establishment to measure the energy distribution of electrons in an auroral display. Other experiments have been concerned with the measurement of electron density distribution in the lowest region of the ionosphere and the Sun's ionizing radiation producing these electrons.

With the trend towards increasing exploitation of very short radio waves for both space and terrestrial communications, transmission characteristics at a wavelength of 2·9 mm have been studied over a 300 m path; scintillations arising from variations in atmospheric refraction have been investigated, and measurements have been made of the attenuation caused by rain. In addition, measurements are being made of the absorption by water vapour at wavelengths between 0·783 and 0·793 mm in controlled laboratory conditions.

[1] *British Medical Journal*, 1, 50 (1969).

ENERGY

Uncertain Planners

THE planners of the European Economic Community in Brussels have been having a happy time the last month or so. Before Christmas, the Common Market commission launched an ambitious plan for the reform of agriculture in the EEC during the next ten years. Scarcely had the ink dried than another document, this time on the planning of energy resources, emerged from Brussels. The document is certainly important, possibly influential—but, like so much that goes on in Europe, its success depends not on its own good sense but on the good sense of European governments. That is in much shorter supply.

Like other advanced parts of the world, Europe's energy needs are rising steeply. A consumption that ran at 596 million tons of coal equivalent in 1965 will be up to 743 million tons by 1970 and 1,130 million tons by 1980. The merging of the three communities—Coal and Steel, Euratom and the EEC—eighteen months ago offered a splendid chance of producing a plan for this rapid expansion. The result so far is tentative only because anything else would be tempting the gods. It starts out from the premise that while Europe needs the cheapest energy supplies it can get, it should not be prepared to buy them at the expense of certainty of supply. From this, the plan turns to the problems of the free movement of trade, and, harder still, to the problem of harmonizing the systems used in the six countries for taxing energy supplies. The commission is proposing the uniform application of a value-added tax, combined with a reduction in the taxes imposed for the purpose of protecting other forms of fuel and the harmonization of the taxes on petrol. For coal, the commission suggests a concentration on a few efficient pits; for other fuels, including nuclear fuel, it suggests constructing a plan based on the investment intentions of individual enterprises. A plan like this, it says, could help to ensure that the energy supplies are sufficient to meet demand—if not, the commission is prepared to prepare recommendations for its members suggesting remedies. The commission also suggests annual meetings to discuss the investment plans of the EEC governments, so that it could advise; if it seemed that over-investment was about to take place, it would again produce recommendations to the members.

As for nuclear power, the commission declares a firm interest in the plan to set up a European separation plant for enriching nuclear fuel, and intends to alter the Euratom treaty so that it is in a position to supply nuclear fuel at sensible prices. Enrichment is becoming an increasingly important theme in Brussels, which perhaps sees it as a way of regaining some of the ground lost by the gradual but inexorable decline of Euratom. It seems likely that European countries, possibly within the framework of Euratom, the European nuclear industry association, will be putting forward firmer plans within the next few weeks. But there is a good case for postponing the final decision on the type of enrichment to be used until the agreement between the UK, West Germany and Holland on the development of the ultracentrifuge begins to bear fruit. It should then be much clearer which of the three enrichment methods—diffusion, centrifugation, or the jet nozzle system—is likely to be the best bet.

FALLOUT

The Decline Halted

THE concentration of long-lived radioactive fission products in the air over Britain during the first half of 1968 was roughly equal to that for the same period in 1967, ranging from 0·12 pCi per kilogram in January 1968 to 0·037 pCi per kilogram in September, according to figures published at the end of December by the UK Atomic Energy Authority (*Radioactive Fallout in Air and Rain; Results to the Middle of 1968*, HMSO, 8*s*). But in 1968, for the first time since 1963, the steady reduction in the concentration of long-lived fission products in fallout of about 50 per cent a year was