give the procrastinators among the airport planners more time to decide how the airport should develop. The establishment is also carving out something of a reputation for itself in the field of infrared mapping.

PHOTOGRAPHY

Silent Talkie

THE visit of a group of Russian scientists to a special conference on high speed photography at the National Physical Laboratory on June 20 seems to have been a moderate farce. Not only had they singularly little to report, but the translation facilities provided by the Association of High Speed Photography seem to have created confusion, not enlightenment, and to have diverted the sizable audience from the few points that were of interest.

The conference was organized by the Association for High Speed Photography in conjunction with the Ministry of Technology. The Russian delegation, consisting of twelve specialists in high speed recording, image tube cameras, lasers, holography and flow visualization techniques, is on a fact-finding visit to Britain, and the one-day conference was inserted to give British specialists in these fields the opportunity to learn about recent developments in the Soviet Union. It seems that the organization of the conference was rather hurriedly contrived.

One point which made some impact at the conference was the sheer number of optical and mechanical devices that have been developed in the Soviet Union for recording high speed phenomena. Although no new techniques emerged from the lectures, the scale of work on high speed photographic techniques in the Soviet Union caused some surprise. The most informative paper was that of Professor U. Nesterikin, director of the Institute of Automation and Electrometry in Novosibirsk, who described experiments that have been carried out in the Soviet Union using electronic image tube cameras. One of these involved measurements on plasma flow to give the temperature in different regions of an electron plasma shock wave. The exposure time for the photographs was of the order of a few nanoseconds. Professor Nesterikin also showed some slides of his image converter tubes.

NUCLEAR REACTORS

Dragon Looks Ahead

ON its tenth anniversary, the Dragon reactor project at Winfrith is beginning to show promise of a commercial benefit, although the electricity boards are doing little more than make encouraging noises. Run by the European Nuclear Energy Agency of the OECD, Dragon is a joint project involving twelve European states. It has a noble history, beginning as a feasibility study by the UKAEA which was suggested to the predecessor of the OECD by Sir John Cockcroft as a possible collaborative project. Now, the chief executive of the project, Dr L. R. Shepherd, says that Dragon is at a stage where industrial application is imminent.

The concept of Dragon is that it eliminates the known limitations of gas-cooled reactors by making extensive use of graphite, in particular to replace the metal sheaths around the fuel. With no metal in the reactor, high temperatures can be achieved in a compact reactor core—that of Dragon, producing 20 MW, is 4 feet across—and with a high conversion efficiency. The structure of the core and moderator is also graphite, the fuel is ceramic (uranium oxides or carbides, for example) and the coolant is an inert gas—helium. The project began in March 1959 with twelve countries signatory to the agreement, and the reactor began operation in August 1964.

But the sponsors of Dragon still do not know whether their pioneering work will be taken up commercially in Europe. The chief British utility, the Central Electricity Generating Board, is, for example, satisfied to say that the third generation of reactors (high temperature gas cooled reactors like Dragon) are likely to come into operation in Britain in 1975–76.

Meanwhile Dragon's sponsors have their competitors. One of the twelve signatories, Germany, has its own national effort in this field. Gutehoffnungshütte is building a 25 MW high temperature gas cooled reactor (HTGCR) at Geesthacht, in which the helium cooling gas drives the generating turbines directly, instead of through an intermediate steam-producing cycle. The same company has designs for 300 MW and 1,000 MW stations. Using a similar principle to the Dragon reactor, Brown Boveri has built a 15 MW reactor at Jülich (the "Pebble Bed" reactor) and is said to be about to receive an order for a 300 MW plant. In the United States, there is a 40 MW experimental HTGCR (the "Peach Bottom" reactor) and a 300 MW reactor is planned for Colorado. This work is being done by General Atomic, sponsored by the Gulf Oil Company of America.

What of the future of Dragon, now that the pioneering work has been done? The reactor management is eager to keep at least the nucleus of the design team in existence. Dr Shepherd says that his team are increasingly giving support to industry and the utilities which are concerned with exploiting the system. The experimental facilities seem to be very much in demand. The current agreement expires in March next year when the total investment in Dragon will be £31 million, but Dr Shepherd hoped this could be extended to March 1973, and to an investment of £38 million. A decision will be made in September this year.

Dr Shepherd considers that the ultimate advantage of the HTGCR will be that it sounds the death knell for the intermediate steam cycle. The CEGB has concluded that the third generation of reactors can be expected to produce savings in generating costs of 10 per cent over the second generation reactors, the AGR. But, using the helium to power the turbines, an extra saving variously estimated at from 5 to 25 per cent is possible. At one time, Dr Shepherd said, some organizations tried to persuade the Dragon management to add a small gas turbine, but the feeling was that the information gained would not be worth the trouble.

ROLLS-ROYCE

Engines by Appointment

IF there are legends left in British industry, Rolls-Royce is one of them. For almost as long as there have been internal combustion engines, the company has been selling distinctive automobiles which make up

with technical sophistication for the sobriety of their appearance. Now the company is also one of the largest of all suppliers of aircraft engines. At the company's annual meeting a week ago, this record of continuing success needed very little help in telling. With all its operations, the company turned in a profit of £24·05 million, compared with £18·70 million in the previous year, on a total revenue of £322 million. Aircraft engines continue to provide most of the business—81 per cent in 1968—and something like a third of what the company produces eventually finds its way abroad. Research and development is necessarily a large part of the company's operations, and cost last year £14·08 million compared with £9·57 million in 1967. Rather more than a third of this expenditure is for the development of the RB-211 engine due to be fitted to the Lockheed airbus in the early seventies.

INDUSTRIAL REORGANIZATION

Shot-gun Marriage Broker?

WHEN the Industrial Reorganization Corporation was set up two years ago, the most common fear among its opponents was that it would become a device by means of which the British Government could nationalize a large part of British industry without having to trouble Parliament with legislation. In the event, however, the IRC has emerged as a quite different sort of animal, and its opponents—still numerous—are more alarmed by its piratical methods than by the danger that it will become a kind of nominee shareholder for the British Government. The cheek with which, in July last year, the IRC prevented the Rank Organization from taking over George Kent Ltd, the instrument manufacturers, by the simple expedient of buying enough of the saleable stock of the smaller company to swing the balance in favour of the Cambridge Instrument Company excites the admiration and the fury of many entrepreneurs. This is part of the reason why the annual report of the IRC, published last week and covering for the first time a full year of the corporation's activity, has been read with close attention for signs of how the wind is blowing.

The corporation makes no bones of its intention to throw its weight about. Its justification is the way in which British manufacturing industry seems to be losing its traditional place as the backbone of export industry. A decade ago, imports of manufactured goods were 35 per cent of manufactured exports, but in 1968 the ratio had increased to 72 per cent. The IRC points out that if things go on this way, imports will exceed exports of manufactured goods seven years from now. The corporation says that its aim in seeking to reorganize industry, chiefly in the private sector, has been to make industry internationally more competitive, especially in marketing, product development and in the rate of investment. Although the corporation is best known for its stimulus of mergers such as that of GEC Ltd and the English Electric Company, the annual report says quite explicitly that size as such is not one of its objectives, but merely one of the factors which determine the international competitiveness of a company. The IRC goes on to say that two others now deficient in much of British industry are the quality of management and the character of labour relations.

The range of the IRC's interests is impressive. During the past year, the corporation has set the pattern for the reorganization of the nuclear power industry, helped the British Oxygen Company to buy up Edwards High Vacuum Ltd, helped along the creation of the British Leyland Motor Corporation, dabbled in trawling, film-making and pumps, and has most recently been engaged in fending off a Swedish invasion of the ball-bearing industry. But if the list of activities is a striking testimonial to the energy of the IRC, it also shows that the corporation lacks the Midas touch. Some of the mergers which it has helped along have been successes, but the reorganization of the nuclear power industry is a different story. The moral may well be that the IRC should cherish more its opportunist instincts, intervening in the pattern of industry only when it is sure of being successful, and fighting shy of promises to bring about what government departments would like to see happen. Another pitfall is that the purely commercial successes of the mergers which the IRC creates may provide a framework for continuing technical deficiencies. The great GEC merger, for example, has not chased away all the technical complacency which has in the past made the British company seem a poor cousin of its American namesake. This is probably the direction in which the IRC needs most urgently to develop in the year ahead.

RADIO ASTRONOMY

New Claim on Frequency

RADIO astronomers will have their next chance to make a claim on the available radio frequencies at the special meeting of the International Telecommunications Union which is likely to be held either at the end of 1970 or the beginning of 1971, and the International Union of Radio Science has now published the draft list of frequencies on which its representatives agreed at their meeting in Brussels earlier this year. Although the ITU conference will be concerned both with radio astronomy and with telecommunications in space, it is already clear that commercial if legitimate interests of the common carriers will so dominate the allocation of frequencies for space communication that there is hardly anything that URSI can usefully say. This, no doubt, is why the report of the February meeting is largely concerned with radio astronomy, and there is a long list of recommendations which it is hoped national governments will cherish as their own between now and 1971. On the face of things, however, there is at least a danger that URSI may have undermined its own case by asking for too much.

The best hope is that there will be agreement in the ITU on the allocation of a world-wide band of frequencies between 404 and 410 MHz. So far as Britain is concerned, international agreement on the 136 MHz band would be a boon. This includes the frequency for which radio telescopes such as the two-mile telescope at Cambridge have been designed. There seems to be strong hope that most governments will agree that this band should be reserved for radio astronomy. For the rest, URSI recommends the following reservation of frequency bands: 17–23 MHz (world-wide), 37·75–38·25 MHz (world-wide), 150·05–153·00 MHz (where sharing with other uses would be acceptable), 608–614 MHz (where there is a need for unified stand-