THE BRITISH SPACE DEVELOPMENT CO., LTD.

THE British Space Development Co., Ltd., has been formed in order to bring together a representative cross-section of that part of industry which is interested in the development and exploitation of space for commercial purposes and which believes that the use of space will, in the next two decades, become a major key to the continued prosperity of the United Kingdom and Commonwealth, politically and industrially. It is considered that a successful and economic entry into the new medium of space demands a unified effort on the part of British industry.

Briefly, the initial aims of the Company are as follows:

(*a*) To provide an organization to discuss with the Government and co-operate in any proposals that the Government may make in regard to a United Kingdom and Commonwealth space programme, which is either independent of European participation or which includes European participation.

(*b*) To provide the Government with an indication of the faith that British industry has in the exploitation of space and to show its readiness to play its part and to take its share of the risks as well as its share of the future benefits.

(*c*) To offer the Government an industrial body broadly based to act as an authority or agency to conduct research and development and to implement and operate a space programme and to consider and develop all the possible areas of exploitation of space.

(*d*) To provide those industries concerned with an organization to negotiate with other countries or foreign industrial organizations or consortia any matters concerning the commercial uses of space which are likely to have global implications, that is, communications, broadcasting, television, meteorological forecasting and navigational aids.

(*e*) To provide the greatest economy in the use of the limited number of technical personnel available in the country, particularly in the field of astrophysics and astronautical engineering, and to ensure that duplication of effort, which has been so prevalent in the United States and which has contributed to wasteful use of resources, is avoided in the United Kingdom.

(*f*) To encourage the provision of and to provide directly, in due course, facilities for the training of an adequate number of technical personnel in all those sciences associated with space research and the exploitation of space.

(*g*) To preserve for British industry a place in space and a proper share of the national and international benefits deriving from the development and use of space.

It is possible that the Company may develop into an international company, particularly as no enterprise in the world has as yet been envisaged where such a wide cross-section of industry has come together to pool its resources and effort in order to compete in this demanding, expensive but ultimately most lucrative new technical field with its limitless possibilities.

The British Space Development Co. now being formed will have an initial capital of £20,000. The following Companies will be the initial participants: Associated Electrical Industries, Associated Tele-Vision, British Insulated Callender's Cables, Decca Radar, Hawker Siddeley Aviation, Ltd., Pye, Rank Organization, Rolls-Royce, Plessey, Elliott Automation.

As one of its first major projects, the Technical Committee of the Company is now examining the technical and economic problems of the United Kingdom and Commonwealth satellite communications system which allows for integration with an American system.

Sir Bernard Lovell, professor of radio astronomy in the University of Manchester and director of the Nuffield Radio Astronomy Laboratories, Jodrell Bank, has been appointed scientific adviser to this newly formed Company, though he will retain his present position at Manchester and Jodrell Bank.

THE DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

THE report of the Council for Scientific and Industrial Research for the year 1960* records gross expenditure for the year ended March 31, 1960, of £12,008,536, compared with £10,059,376 in the previous year, and reduced to £10,342,691 by various receipts from industry and other sources for services rendered. Of the latter, £722,241 was from other Government Departments and £723,601 from industry, £613,592 in all being received by the National Physical Laboratory: the net increase on 1959 was £1,447,871. Grants to students amounted to £870,289, the number of research students in training being 2,377, of whom 942 (including 88 NATO awards) were new; advanced course studentships numbered 315 (of which 274 were new), first-year studentships 77, and research fellowships 75, of which 30 were held overseas and 45 in Great Britain, and 39 (including 21 NATO fellowships) were new.

Of the research students, 290 were in biology and biochemistry, 176 in chemical engineering, 747 in chemistry, 77 in electrical and 162 in other engineering, 143 in geology, 43 in the human sciences, 236 in mathematics and 503 in physics. Of the advanced-course students, 67 were in physics, 62 in mathematics, 20 in electrical and 42 in other engineering, 39 in geology, 28 in biology and biochemistry, 27 in chemical engineering and metallurgy, 25 in the human sciences and 5 in chemistry. All 77 first-year studentships were in chemistry, and chemistry (22), physics (21) and biology and biochemistry (18) claimed most of the research fellowships.

Grants for special researches totalled 525, of which 293 were new, amounting to £5,591,270; of these, 75

* Department of Scientific and Industrial Research. Report of the Research Council for the year 1960. Pp. 65. (Cmnd. 1365.) (London: H.M. Stationery Office, 1961.) 4*s*. net.

were in biology, 102 in chemistry, 37 in geology and geophysics, 3 in mathematics, 19 in astronomy, 65 in low-temperature work and investigations on the solid state, 60 (totalling £2,221,896) in nuclear physics, 90 in technology, 23 in the human sciences, and 24 (totalling £297,543) in space research. The report does not include the list of individual grants exceeding £1,000 or more, nor is the analysis of the research effort of the Department's research stations given in last year's report repeated.

Expenditure on the Warren Spring Laboratory was £402,854 gross, compared with £404,963 in 1959, and on the Torry Research Station, Tropical Products Institute and Government Chemist, which appear in these accounts for the first time, £177,860, £164,051 and £290,237, respectively. Otherwise, there are increases under all the separate heads of expenditure, the largest increases being in headquarters administration (£623,206 from £441,440); the National Physical Laboratory (£1,438,776 from £1,285,018); building research (£656,975 from £599,931); Geological Survey and Museum (£490,014 from £433,550); National Engineering Laboratory (£686,156 from £637,299); and road research (£718,056 from £618,763). Expenditure on fire research amounted to £158,441; on hydraulics research to £175,041; on radio research to £239,174; and on water pollution research to £137,100.

Annual grants to research associations amounted to £1,761,368 (£1,683,195 in 1959) and special grants to £17,823; £1,259,000 was contributed to the European Organization for Nuclear Research and £75,333 to NATO scientific schemes. Expenditure on headquarters overseas liaison increased from £113,929 to £132,684. Further progress is reported with the planned expansion of the staff, which rose by 3 per cent from 5,506 to 5,680 during the year, and it is estimated that, excluding stations transferred to or from the Department, the total staff has increased by just under 20 per cent during the past four years.

THE RADIO RESEARCH STATION, SLOUGH

THE Radio Research Station, Slough, gave visitors the opportunity of seeing some of its work during two open days on May 31 and June 1. Most of the Station's work is concerned with radio-wave propagation and with the fundamental properties of the ionosphere and the troposphere through which the waves travel. About half of the work is devoted to some aspect of experiments made on rockets and artificial satellites.

Among the exhibits concerned with the propagation of very-high-frequency waves through the troposphere was one which showed how the dielectric constant of the air had been measured continuously in an aeroplane. The measurement was made by determining the natural frequency of an open-ended electromagnetically resonant cavity. The measured distributions of dielectric constant were then related to certain aspects of radio wave propagation. Of other exhibits concerned with tropospheric propagation one showed a method for determining the azimuthal angle of arrival of waves propagated by tropospheric scatter from distances beyond the horizon, and another showed how the time-delays in multipath transmission over a distance of about 35 miles were being measured.

Equipment used for recording information about the ionosphere over Slough and over outstations at Falkland Islands, Singapore and Inverness was demonstrated. The results, together with those from other ionosphere observatories all over the world, are available for the use of all bona fide workers in the Station's World Data Centre. This is one of four set up in different countries by international agreement. One of the exhibits showed how the Research Station was making use of these recordings to investigate the nature of the ionosphere over the polar regions. Conditions of strong absorption (blackout) and of sporadic ionization at levels near 100 km. (*Es*) were shown to occur along spiral lines fixed in space relative to the Sun. When, as a result of the Earth's rotation, any given point on the Earth passes beneath one of these spirals, the appropriate phenomenon is observed. The two spirals, one for the blackout and the other for *Es*, curve in opposite senses, due, it is thought, to the fact that they are caused by the arrival in the atmosphere of particles of opposite sign. Another exhibit showed how the ionosphere over Halley Bay in Antarctica had varied throughout the International Geophysical Year.

The ionization produced in the ionosphere by the Sun's radiation varies throughout the day and the season as the angle of the Sun's rays, and possibly also the constitution of the atmosphere, changes. If changes caused by these two varying quantities could be eliminated the density of the ionization might be expected to be a measure of the intensity of the solar radiation. Methods for removing these variations were explained and the way in which the resulting 'ionospheric indices' varied with time were shown. One puzzling result was that the indices both for the *E* and *F* regions appear to have decreased steadily throughout the past 20 years even when the variations of the sunspot cycle have been removed.

The procedure was shown in which a digital computer was used to estimate the main parameters (height and peak electron content) of the *F* region from a knowledge of these quantities at a few key observing stations, and it was explained how this might help in the future for forecasting the nature of the ionosphere all over the world.

Once the world-wide *F* region is known, it is, in principle, possible to calculate the different rays by which waves will travel, on any frequency, from any one point to any other point on the Earth. The results of such calculations were compared with measurements of pulses received over the range of frequencies from senders in Malta and on Ascension Island. It is hoped that this kind of calculation, extended with the help of a digital computer, might lead to a simplified method for planning the frequencies used in point-to-point communications.

Another series of exhibits showed the work of the research station in the field of radio measurements. A resistive film inserted in a waveguide was used in an apparatus for the measurement of microwave power. This device had been compared satisfactorily with other standards from other laboratories and other countries.