

College authorities at those places. The Canadian authorities have installed new stations at Fort Chimo, Resolute Bay and Baker Lake; and South Africa has assisted the Belgian Congo authorities to build a station at Leopoldville. The Australian Radio Research Board responded very actively to the recommendation that a chain of ionospheric observatories should be operated in the vicinity of longitude 150° E. by setting up recorders at Hobart, Canberra, Brisbane and Townsville. Furthermore, a station has been set up at Macquarie Island which should be of great assistance in the study of ionospheric conditions in antarctic regions. In India, ionospheric recorders of various types have been installed at Delhi, Calcutta, Ahmadabad and Kodaikanal.

Research on the absorption of radio waves traveling through the ionosphere is being actively pursued in the United Kingdom and in Australia, Canada and India; and the results are used, with other ionospheric information, in a comparison of radio transmission forecasts with practical results. Investigations are also in progress in most Commonwealth countries with the view of improving the forecasting of ionospheric storms, which on occasions cause serious interruption of practical radio services, including communication and broadcasting.

For several years past, measurements of the atmospheric radio noise-level prevailing at frequencies of 2–20 Mc./s. have been made by a subjective method at some twelve stations in various countries; and development work is in hand to extend this investigation to frequencies of 15–500 kc./s. in order to provide more direct information on the performance of low-frequency radio aids to navigation. Fundamental investigations on atmospheric disturbances, including in some cases a detailed study of waveforms, are in progress in the United Kingdom, India and South Africa. A recommendation was made at the Sydney meeting that the high-frequency noise-measuring equipments in Australia and New Zealand should be put into operation again as soon as possible, since continuity of the study of atmospheric noise for several years all over the world is essential for the ultimate improvement of the efficiency of operation of all radio services.

Following a recommendation made at the London meeting in 1948, the New Zealand authorities have been able to initiate in the southern hemisphere the study of meteors by radio methods, as a field of research complementary to that pursued in the United Kingdom. The collaboration between the two countries has been very effective, and it is now recommended that the work in New Zealand should be continued and extended so far as practicable.

The extremely short-wave portion of the radio spectrum is likely to be of very great importance to the future of radio services of all types. With this in mind, a strong recommendation was made at the Sydney meeting that research on tropospheric wave propagation should be vigorously pursued in all countries in order to improve our knowledge of the influence of different climatic conditions on the possible correlation between radio propagation and meteorological conditions. A considerable amount of investigation work in this field has been conducted during recent years in New Zealand, and in the United Kingdom; but there is a need for a continued study of the effects experienced under different conditions and at various frequencies in order to assist those responsible for planning future radio systems and services.

The extensive research work on solar and cosmic noise, which is now embraced under the general title of 'radio astronomy' and which has been pursued in several countries, notably in Australia and the United Kingdom, is too well known to need any detailed reference here. It may be remarked, however, that the meeting in Australia of the International Scientific Radio Union provided an excellent opportunity for some of the workers in this field to meet and discuss matters of mutual interest, and particularly to compare the results of experience in the northern and southern hemispheres.

In February 1950 the United Kingdom established a limited regular service of standard-frequency transmissions from the Rugby radio station of the General Post Office, using the call-sign *MSP*. The service provides transmissions for short periods daily on frequencies of 60 kc./s. and on 5 and 10 Mc./s. These transmitted frequencies are monitored by the National Physical Laboratory, and the latter's observations show that over a period of a day the frequency remains constant to about 1 part in 10⁸, a slow drift of frequency over longer periods being corrected whenever the deviation from the nominal value approaches 2 parts in 10⁸. Apart from this service, the Union Observatory in South Africa radiates time signals, and a standard frequency transmission is made on low power from Johannesburg. The Australian authorities are also exploring the possibilities of establishing a standard-frequency service to meet local requirements in that continent.

With regard to the measurement of the electrical characteristics of the ground at radio frequencies, in Canada, South Africa and South-West Africa, surveys of conductivity by radio methods have been in progress for some years; and the All-India Radio organization is starting systematic measurements of the electrical properties of the ground throughout India. It is realized that this type of investigation should be pursued in close association with a study of the effects of the contours of the terrain on ground-wave propagation at various frequencies. It is considered, however, that the original recommendation should be retained with the view of encouraging Commonwealth radio organizations to collect all appropriate information on measurements made in their own countries, to facilitate the preparation by the United Kingdom of a survey of existing knowledge of the electrical constants of the ground at radio frequencies.

HUMAN FACTORS IN INDUSTRY

TWO committees to work on human problems in industry have been set up jointly by the Department of Scientific and Industrial Research and the Medical Research Council, one being concerned with human factors in individual efficiency, and the other with human relations. The division of interest between the committees is broadly that the first will study the individual worker and his job, and the second such things as the relation between the manager and the worker, between the worker and his mates and between the foreman and the technical specialist.

The subjects to be considered can be listed under four headings, the first three of which are, in general, the responsibility of the committee on industrial efficiency, and the fourth is that of the committee on

human relations: fitting the job to the man—work on the design of tools and working equipment to suit the man who uses them (which is getting more important as machines become more complicated), time and motion study, and the effect of factory lighting, heating and noise, etc., on performance; selection and training; assessing the job—work measurement, job appraisal, time and motion study as a means of assessing a fair day's work, etc.; human behaviour and human relations—joint consultation, attitudes to work and the structure of informal groups in the factory. For research on matters relating to occupational health, the Medical Research Council will continue to be responsible, advised by its own special committees. However, in order to secure co-operation on technical aspects, the Department of Scientific and Industrial Research will be asked to appoint assessors to these committees where appropriate; for example, the elimination of dust from factories, although primarily a medical problem, may bring in the Department or the research associations to develop means of combating dust.

The scientific study of the human factors in industry is not, of course, a new venture: notable contributions have come in the past from the researches of the Medical Research Council's Industrial Health Research Board on, for example, how hours of work affect output and health, the influence of environmental factors such as lighting and heating, and the effects of incentives; and the Panel on Human Factors of the post-war Committee on Industrial Productivity has also done important work, including an investigation of the foreman in British industry. However, the need for much more of this kind of research is realized, and the aim of the two new committees will be to develop knowledge which can be used to make definite recommendations, the underlying object being to improve industrial production in Great Britain. For this reason, the committees include persons from industry, trades unions and universities.

Committee on Individual Efficiency in Industry. The terms of reference of this committee are: "(1) To keep under review the progress of knowledge bearing on the technical efficiency of the individual in industry. (2) To advise on general policy in research, including applied research and field study. (3) To call attention to gaps, and make recommendations for filling them. (4) To consider and report from time to time on the requirements for the training of research workers and technologists in this field". Its members are as follows: Sir Frederic Bartlett (*chairman*) (formerly professor of experimental psychology, University of Cambridge), W. V. Beard (general secretary, United Patternmakers' Association), J. O. Blair-Cunynghame (chief personnel officer, British Overseas Airways Corporation), Prof. J. V. Connolly (Department of Aircraft Economics and Production, College of Aeronautics, Cranfield, Beds), J. Crawford (general president, National Union of Boot and Shoe Operatives; member of the Advisory Council, Department of Scientific and Industrial Research), Prof. J. Drever (Department of Psychology, University of Edinburgh), Dr. C. B. Frisby (director, National Institute of Industrial Psychology, London), L. V. Green (head of the Personnel Research Department, Dunlop Rubber Co., Ltd.), Prof. Esther M. Killick (Department of Physiology, Royal Free Hospital School of Medicine, London), Prof. W. E. Le Gros Clark (Department of Human Anatomy, University of Oxford), N. G. McCulloch (deputy

chairman, Calico Printers' Association, Ltd.; chairman, Council of the British Cotton Industry Research Association), Prof. R. W. Russell (Department of Psychology, University College, London), Miss Nora Wynne (director, Carr's Biscuits, Ltd.), and an assessor from the Ministry of Labour and National Service. The joint secretaries are Dr. B. S. Lush (for the Medical Research Council) and Winston Rodgers (for the Department of Scientific and Industrial Research).

Committee on Human Relations in Industry. The terms of reference of the committee are: "To examine current activities concerning the study of human relations in industry and to call attention to problems of special timeliness or promise on which research, including applied research and field study, might be undertaken or supported by the Department of Scientific and Industrial Research, the Medical Research Council, or other bodies". Its members are as follows: A. B. Waring (*chairman*) (chairman and managing director, Joseph Lucas Industries, Ltd.), J. Foster Beaver (chairman, Beaver and Company (Bingley), Ltd.), J. O. Blair-Cunynghame (chief personnel officer, British Overseas Airways Corporation), A. D. Bonham-Carter (head of the Personnel Division, Unilever, Ltd.), Prof. T. Ferguson (Department of Public Health, University of Glasgow), E. Fletcher (member of the Advisory Council, Department of Scientific and Industrial Research; head of the Productivity Department, Trades Union Congress), Miss Beryl Foyle (joint managing director, Boxfoldia, Ltd.), Prof. A. J. Lewis (Institute of Psychiatry, University of London; and member of Medical Research Council), Prof. R. W. Russell (Department of Psychology, University College, London), Miss B. N. Scarar (Department of Social Science, London School of Economics), Prof. T. S. Simey (Department of Social Science, University of Liverpool), W. R. Verdon Smith (managing director, Bristol Aeroplane Co., Ltd.), T. Williamson (General Council, Trades Union Congress), Dr. A. T. M. Wilson (director, Tavistock Institute of Human Relations), and an assessor from the Ministry of Labour and National Service. The joint secretaries are J. R. Gass (for the Department of Scientific and Industrial Research) and Dr. B. S. Lush (for the Medical Research Council).

TEACHING OF NATURAL SCIENCE IN SECONDARY SCHOOLS

IN view of the pressing needs for a more thorough and efficient teaching of science, a comparison and free flow of ideas between teachers, of all nations, of this subject would be useful. A number of accounts of different aspects of comparative education have been published by the United Nations Educational, Scientific and Cultural Organization, and a recent volume, "The Teaching of Natural Science in Secondary Schools"* is compiled from information supplied to the International Bureau of Education, Geneva, by the ministries of education of all countries, apart from the U.S.S.R. and its satellite States. This is a valuable piece of work, and such efforts are to be encouraged; but it suffers from undue compression, as well as vagueness and scrappiness of

* Unesco: International Bureau of Education. Publication No. 139: XVth International Conference on Public Education, convened by Unesco and the I.B.E., Geneva, 1952. Teaching of Natural Science in Secondary Schools. Pp. 216. (Paris: Unesco, Geneva: I.B.E. London: H.M.S.O., 1952.) 5 Swiss francs or 8s. 6d.