from the point of view of feasibility and of high priority. It equally involves the United States remaining in scientific readiness over a long period of years, with the utmost effort to strengthen its scientific progress and maintain that strength at the highest possible level.

It is at this point that the programme of basic research to be supported by the National Science Foundation can be most effective, and the report then details the questions to be answered in developing and formulating a national science policy. Much of this ground has been covered in recent years by the Steelman report, "Science and Public Policy", and the earlier Vannevar Bush report, "Science—the Endless Frontier". Among its first tasks the National Science Foundation plans to make a thorough review of the present national pattern of research and development. It will seek current answers to such questions as what is the total financial support now being provided for scientific research and its distribution among government projects, industry and educational institutions: what financial support can and should be provided, and what is the most desirable distribution. It will also be necessary to determine the division of research effort among the various natural sciences, and also the areas which need greater or less emphasis.

Estimates quoted in the report indicate that the United States is at present spending about 2,500 million dollars a year on research and development, of which 60–70 per cent comes from the Federal Government and 5 per cent from the universities. While industry supplies between 25 and 35 per cent of the funds, nearly two-thirds of the expenditure goes into industrial laboratories and facilities, slightly more than 10 per cent being in the universities. About one-fifth of the university research effort is in physics, and nearly one-half in the three areas of chemistry, physics and electronics. Another 25 per cent of the defence research work is in aeronautical and electrical engineering, mathematics and the terrestrial sciences. Continued pressure upon the universities for defence research without compensating support for basic research could, in the opinion of the Engineering College Research Council, which has examined the situation, easily upset the present balance.

The Foundation proposes to support basic research upon as broad a geographical and institutional basis as possible, as well as to examine the effect of Federal research programmes on the financial stability of universities. It is giving attention to the need for accurate current information on scientific man-power both for sound planning and for mobilization purposes. At present, it is estimated that about 130,000 engineers and scientific men in the United States are engaged in research and development, about 55 per cent being in industrial laboratories, 25 per cent in universities and non-profit-making institutions and the remaining 20 per cent in Federal and State institutions. The military research budget alone requires the services of 54,000 research scientists and engineers, or 47 per cent of the total in the United States. The projected plans for 1952 of the Defense Department, the Atomic Energy Commission and the National Advisory Committee for Aeronautics may take up to 70 per cent of the research man-power.

Such a position emphasizes the importance of the training programme in science which the National Science Foundation proposes to plan, as well as the necessity of securing the wisest and most effective use of the available supply of trained personnel. It is apparent that the Foundation is being led to engage on numerous activities which in Great Britain have for some time come within the purview of the Lord President of the Council or the Advisory Council on Scientific Policy, including the question of the dissemination of scientific information by existing means or by new techniques. Its future reports should be useful as well as interesting to those in other countries who have to confront similar problems, and may well contribute something to that mutual understanding and to the formulation of a common policy in matters of mutual interest for which Dr. Conant pleaded so eloquently and cogently during his recent visit to London. Meanwhile, this first report seems well fitted for winning fuller support in the United States, both from the general public and from scientific workers themselves, for a larger measure of central government endowment of research.

CENTIMETRE-WAVE RADIO LINKS

AT a meeting of the Radio Section of the Institution of Electrical Engineers on April 9, three papers were presented describing the theory, design and development of radio links which are now in general use for multi-channel telephony and television. The work described was carried out by a large group of engineers in the Telecommunication Laboratories of Standard Telephones and Cables, Ltd.

The first paper, by Dr. A. T. Starr and T. H. Walker, entitled "Microwave Radio Links", dealt with the general theory and design of such links as transmission systems. Following provisional allocation made at an international convention, the frequencies selected for study and development are about 4,000 Mc./s. (wave-length 7·5 cm.) for fixed links, and 5,000–6,000 Mc./s. (5–6 cm.) for mobile radio links. The paper deals with questions of propagation and atmospheric phenomena in so far as they affect the design, and with the conditions it is necessary to meet in order to reduce thermal and intermodulation noise to a minimum. The special problems of a television link are discussed.

The second paper, on "Circuit Technique in Frequency-modulated Microwave Links", by H. Grayson, T. S. McLeod and R. A. G. Dunkley, describes in more detail the circuit problems involved in wide-band communication links, and the principles of design of the amplifying, modulating and demodulating circuits involved. Special attention is given to the need for automatic frequency-control throughout the system. In the third paper, entitled "Microwave Techniques for Communication Links", G. King, L. Lewin, J. Lipinski and J. B. Setchfield describe theoretical and practical work involved in the development of radio links to work in the frequency range 3,600–4,200 Mc./s. (7·15–8·33 cm.). Special attention has been given to the problem of matching components of the system over the broad frequency band used, and this included the matching of waveguide sections as well as the feeding arrangements to the parabolic mirror type of antenna system used in this work. This paper contains a section on the measuring technique involved, with a description of a precision signal-generator developed for use at the frequencies mentioned.