broadcasting without barriers

by
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foreword

Radio broadcasting is by virtue of its speed and range an almost unrivalled instrument for communication between peoples. Through radio, the listener in Tokyo can follow a conference of world leaders in Geneva, a sports enthusiast in Paris may share in his team's success at the Olympic Games in Melbourne and an opera lover in Buenos Aires may enjoy a performance at La Scala in Milan.

In all the long history of man's effort to communicate with his neighbour, radio marks a unique advance. The size and composition of the audience that can be reached by a single broadcast stagger the imagination. Radio enables the educator, journalist, political leader or social reformer to be heard simultaneously by industrialist and farm-worker, professor and illiterate, child and adult. Broadcasting is also an intimate companion, entering freely into the normal round of daily life in the home or at the office, factory or sports club. No matter where man goes he is potentially within reach of broadcasting.

But the vast possibilities offered by radio are far from being realized. Inability to reach agreement on the allocation of radio frequencies between the broadcasting services of different countries has limited the use of the medium for international communication. Lack of receivers deprives many millions of people in underprivileged areas of access to the ideas and entertainment which a radio dial would place at their command. Radio programmes sometimes tend not so much to link people as to spread discord between them. To these present problems of radio must also be added the challenge which the rise of television has posed for the future.

Unesco, dedicated by its Constitution to promoting the free flow of ideas by word and image, is necessarily concerned with assisting radio broadcasting to play its part in the accomplishment of that objective. Uncertainty within governments and among radio broadcasters themselves as to the medium's present task and future prospects prompted the conclusion that a study of the subject on an international scale would be of help to those concerned.

To carry out this study, Unesco commissioned George A. Codding Jr., formerly a member of the secretariat of the International Telecommunication Union (ITU) and at present assistant professor of political science at the University of Pennsylvania (U.S.A.). It is as a survey by an independent expert that Mr. Codding has conducted, and Unesco has published, the study.

Many of the technical problems discussed in this study are within the purview of the International Telecommunication Union, with which Unesco co-operates closely. It is hoped that the study will contribute to the efforts of the ITU, of individual governments and of radio broadcasters to enhance the use of radio as a means of communication and of understanding between peoples.

author's preface

The task undertaken in this study is threefold: to determine the extent to which broadcasting has been made available to the world's peoples; to define the obstacles—political, economic and technical—which impede its full and proper use as a medium of communication; and to examine possible ways and means of extending its benefits more widely.

The broad scope of the survey has obliged me to impose certain limits on the elements to be considered. Broadcasting has many fascinating aspects which cannot, for reasons of time and space, be treated in detail. For example, an analysis of the programme content of the world's broadcasting services would make an absorbing line of inquiry, as would the use of broadcasting in schools as an aid to the educator. The first possibility is ruled out because of the paucity of accurate information and the difficulties in collecting it, and the second because much valuable work in this field has already been done by various institutions, including Unesco itself. Further, since this study is primarily concerned with sound broadcasting, it cannot be broadened to include a detailed analysis of the development and techniques of television. The chapter on television is, therefore, confined mainly to the impact of this new medium on broadcasting.

It has been necessary to impose certain other limitations which are indicated in the relevant parts of the study.

I wish to express my gratitude to the numerous broadcasting organizations and individuals for their kindness and patience in answering questions and placing documents at my disposal. In particular, I would like to thank my two good friends, Mr. Reginald Smith and Mr. Cedric Hennis, and Mrs. Jacobi, librarian at the International Telecommunication Union, and her assistant, Mrs. Stoessel.

I would like to express my deepest appreciation to the Division of Free Flow of Information of Unesco which arranged to commission me for the writing of this study. The members of this division have also been most generous in giving me help and advice.

GEORGE A. CODDING JR.

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the rise of radio

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To obtain a perspective of the problems and opportunities now confronting broadcasting, it may be useful to review, even if briefly, the rise of radio communication as a whole. The manner in which radio was developed has an important bearing on the ability of broadcasting to fulfil its task as a mass communication medium. In addition, the time sequence of the discovery of radio and its adaptation to various uses has had a marked effect on the interrelation of broadcasting and the other media of communication.

Broadcasting is but one of the many services of radio. It was born after radio had been successfully adapted to other important uses and did not, therefore, have any priority in the use of air waves. Furthermore, from the standpoint of technical discovery, broadcasting was dependent to a large extent upon the advances that had already been achieved in the general field of radio. It was an adaptation of radio to a particular service, rather than an invention in its own right.

Nor can radio be isolated from the general trend of technological advance in the nineteenth and twentieth centuries. In the development of rapid communication, the electromagnetic telegraph had preceeded radio by almost fifty years. By the time radio was offered to the service of mankind, most of the world's major cities were already connected by telegraph lines and the continents by telegraph cables. Although radio gained an almost immediate foothold by providing the first means of communication between ships at sea and between ships and the shore, its progress was affected by its position as the junior of the two services.

In the field of mass communication, broadcasting is also linked to two other media, one older and one younger. When broadcasting was born, the press was the recognized instrument of mass communication. Newspapers were not only effectively covering a great portion of the world's inhabited areas, but had also gained in speed and immediacy by the introduction of the electromagnetic telegraph as an aid to the gathering of news. Even as radio was proving its right to be considered a major medium of mass communication, it was confronted by a younger rival, television, which added sight to sound. Although the results of this new rivalry will not be known for many years, the future of these two services is irrevocably linked.

The present chapter is divided into three parts, corresponding to the three major phases in the development of broadcasting. The first part deals with the birth of radio as a communication medium and with its early uses. The second

describes the emergence of broadcasting as an independent branch of radio. The third is concerned with advances in communication made possible by the use of radio for long distance international broadcasting. The advent of television and its challenge to radio broadcasting are considered in a later chapter.

origins and early uses

Marconi's demonstration in 1896 that an electromagnetic signal could be sent through space is a convenient point at which to begin a review of the rise of radio. Such an over-simplification, however, would not do justice to the legion of scientists of many nations whose half-century of experimentation in the field of electricity and electromagnetism laid the groundwork for Marconi's successful experiment. Such pioneers as Michael Faraday, Charles Wheatstone, William F. Cooke, and Samuel F. B. Morse all contributed to the study of electromagnetism and the propagation of electromagnetic waves. There were also many less well-known men who facilitated the great discovery. An example is James B. Lindsay, who suggested that since water was a conductor of electricity, it might be possible to span the Atlantic Ocean without the use of a cable by establishing retransmitting stations on the ocean at 20-mile intervals!

Of more immediate importance to Marconi's experiments was the work of such men as James C. Maxwell, Heinrich Hertz, and Edouard Branly. In his study of electricity and electromagnetism, Maxwell arrived at the theory that electromagnetic waves could be radiated through space with the speed of light. It was Hertz who discovered these waves, and was able to measure their length and velocity correctly. Their velocity, as Maxwell had believed, was that of light (186,000 miles per second). The third man of this group, Edouard Branly, set the stage for the discovery of radio when he devised a workable apparatus which would detect the presence of Hertz's electric waves.

It is almost certain that if Marconi had not succeeded in fitting together the pieces of the communication puzzle when he did, someone else would have won renown as the father of radio. The results of the work of Maxwell, Hertz, Branly and many other pioneers in the field were known to the scientific world and researchers of many nations were seeking a key to the secret of radio. During 1895 and 1896 at least three scientists in addition to Marconi—Sir Henry Jackson, Sir Oliver Lodge and Aleksander Popov—were sending signals over distances of a few feet. Popov, using a modified Branly decoder, demonstrated before the St. Petersburg Physical Society in 1895 that it was possible to detect and register the discharges of electrical storms at some distance. In January 1896 Popov also predicted in a scientific journal that, if man could reproduce an electrical disturbance of the type emitted by electrical storms, he might be able to communicate across space.

It was Marconi, however, who took out the first patent for a system of radio communication. His experiments had begun several years before in the vegetable garden of his father's farm in Italy. After unsuccessfully attempting to interest the Italian Government in his discovery, Marconi went to England where he felt that he had a better chance to enlist the support of influential groups. Before approaching the authorities, however, he registered his invention: British patent No. 12039, dated June 1896.

Marconi was received with great interest in England, and it was there that he went on to perfect his invention. In July 1896, before Sir William Preece, chief electrical engineer of the General Post Office, Marconi's 'wireless' apparatus successfully sent and received a signal over a distance of 100 yards. Preece was so impressed with Marconi's achievement that he arranged for a further series of demonstrations before other Post Office representatives.

The range between transmitter and receiver expanded dramatically in Mar-

coni's demonstrations during 1896 and 1897. In July 1896, the distance was 100 yards; later the same year, one and a third miles; March 1897, four miles; May 1897, eight miles; July 1897, 10 miles; and, in August 1897, a signal was clearly heard at a distance of 34 miles.

Public interest in this new invention increased as the range of transmission increased. Most of the earlier experiments were made before officials of government departments. In 1898, however, radio was demonstrated in a way that really caught the imagination of the public. In that year the Dublin *Daily Express* commissioned Marconi to help report the Kingstown Regatta. A land station was erected in the harbour master's grounds at Kingstown and a ship equipped with a radio set was chartered to follow the races. Progress reports on the races were sent by Morse code from the ship to the shore station and from the shore station by telephone to the *Daily Express* offices. Readers of the evening papers thus received a daily account of events at Kingstown.

Maritime uses

The significance of Marconi's demonstrations was not lost on those who had an interest in maritime affairs. While radio had a formidable competitor on land in the form of the telegraph, it had no competitor at sea. Before the advent of radio, a ship on losing sight of land was completely out of contact with the outside world except for the occasional sighting of other users of the shipping lanes. Consequently, events occurring at sea were not known for weeks or months and, if the ship involved were lost, might never be reported. Months later an 'overdue' notice would appear in the press, to be followed by the announcement 'missing at sea'.

One of the first private investors in maritime radio was Lloyd's of London. Marconi established a radio connexion between two lighthouses on the north-east coast of Ireland so that Lloyd's could receive immediate reports of the sighting of ships bound for Britain. So great was the value of early reports on ship arrivals that 14 of Lloyd's coast signal stations were converted to radio in 1901. With the increase in range, radio was found to have the added advantage that messages could be sent to ships at sea instructing them to change their destination and appeals for aid could be received and answered immediately in case of disaster off the coast. The resultant savings to insurance companies were considerable.

Nevertheless, a dramatic incident was needed to convince the sceptical that radio was all that its advocates claimed it to be. Not one, but several such incidents occurred in a very short period. The first took place early in 1899. One of the early Marconi installations was made on the East Goodwin lightship, operating in the Straits of Dover, to enable the vessel to keep in contact with the shore. Only one month after its installation, the transmitter was used to report severe storm damage to the lightship itself, and help was quickly dispatched. Three months later a freighter rammed the lightship in a dense fog, and again radio was used to summon help. The ability of the lightship transmitter to help save lives and property on these and numerous other occasions convinced the shipping world of the value of radio. Soon ships under many flags were sailing with Marconi sets aboard. In 1901 alone, the British opened six new shore radio stations for communication with ships at sea.

Further proof was provided by the use of radio in the disasters that befell the passenger liners *Republic* in 1909 and *Titanic* in 1912. In a dense fog, some 175 miles out from New York, the Italian vessel *Florida* collided with the British ship *Republic*. Distress calls were immediately sent out, picked up by a shore station in the United States, and retransmitted to ships in the area. All of the passengers and crew of the *Republic* were taken off before she sank, and the

passengers of the badly damaged *Florida* were transferred to another vessel. Not only had radio been used between a ship and the shore, but the transmitter on the *Republic* had also been used to guide rescue vessels alongside at night, despite the presence of a heavy fog and the fact that the *Republic* had been deprived of lights as a result of the collision.

The way radio was used to bring aid to the *Titanic* is well known. But for radio and two conscientious radio offcers, a further 700 names might have been added to the list of 1,500 who died off Cape Race, Newfoundland, on that tragic day in April 1912. It is interesting to note that, in the three-year interval between the sinking of the *Republic* and the *Titanic*, radio was used over forty times to aid in the saving of life at sea.[1]

The early days of radio also have their commercial aspect. One year after Marconi's first demonstration before Sir William Preece, and only 18 months after he took out the first patent for radio, the Wireless Telegraph and Signal Company Ltd. was incorporated with a capital of £100,000 to take out Marconi patents in various countries. Marconi was engaged as chief engineer of the new company and its name before long was changed to Marconi's Wireless Telegraph Company Ltd. In 1900 another firm, the Marconi International Marine Communication Company, was incorporated to exploit the maritime uses of Marconi radio. And, almost simultaneously with the visit of Marconi to the United States in 1899, the Marconi Wireless Telegraph Company of America was founded. Other Marconi companies sprang up in rapid succession in Belgium, France, Italy, Canada, Argentina and Russia. By 1903, Marconi had personally directed the installation of 48 coast stations throughout the world, stations on warships for Italy, United Kingdom, France and United States of America, and stations on ships of the principal shipping companies, including Norddeutscher Lloyd, Hamburg–Amerika Line, Compagnie Générale Transatlantique, Cunard Line and American Line.

In the early years of radio the Marconi company and its subsidiaries were almost alone in the field of communication between ships and between ships and the shore. In 1903, however, two competitors, the De Forest Wireless Telegraph Company of America and the German company Drahtlose Elektricitäts-Gesellschaft, came on the scene.

In an effort to maintain its supremacy, the Marconi Company resorted to methods which were to have a marked impact on radio communication. For example, in an agreement with the Italian Government and in a contract with the British Lloyd Company, the Marconi Company was permitted not only to install radio apparatus on ships and to provide company operators, but also to refuse to communicate with any other radio station that was not equipped with Marconi radio.[2] At a time when Marconi sets were installed on a very large number of ships, such a restrictive clause had a profound effect on competitors. If a ship at sea found itself cut off from the benefits of radio merely because it did not have a Marconi set, what was the alternative except to change to Marconi?

The following three instances, all of which occurred shortly after 1900, demonstrate how the lack of international regulation affected the early development of radio. In 1903 the French Ministry of Posts, Telegraphs and Telephones reported that a large number of French coastal stations in the maritime service were being rendered inactive because of the refusal of the Marconi Company to accept correspondence. In 1906 a report from the United States cited an incident where an American ship, under orders to search for a dangerous derelict, was refused information by another ship because the radio transmitters

1. U.S. Department of Commerce, *Important Events in Wireless Telegraphy*, Washington D.C., 1916, pp. 13–17.
2. *Conférence préliminaire concernant la télégraphie sans fil, Berlin*, 4–13 August 1903, p. 15.

were not of the same make.[1] Previously, in 1902, Prince Heinrich of Prussia had attempted to send President Theodore Roosevelt a courtesy message while crossing the Atlantic after a visit to the United States. He was refused service because the apparatus on his ship was not of the same make as that of the shore station with which the ship was in contact.[2] The additional consideration that by 1903 competition with the Marconi Company had appeared in the United States and Germany showed that the time was ripe for an international conference to regulate communication and provide for freedom of correspondence.

Freedom of Communication

The first international conference on radio communication met in Berlin in 1903 at the invitation of the German Government. The nine countries participating (Austria, France, Germany, Hungary, Italy, Russia, Spain, United Kingdom and United States) includes most of those where radio had been well established. The German Government's aim in calling the conference was clear from the beginning. The head of the German delegation, who presided at the conference, stated in his opening remarks that the development of radio, which was still in its infancy, would be unduly hampered by any attempt to monopolize facilities; consequently, rules should be adopted to block any attempt to impose one system in preference to others. Otherwise a radio 'war' would develop.[3]

It was not until the third international radio conference in 1912 that the United Kingdom and Italy agreed to free maritime communication 'without regard to the system employed'. Both these countries were major users of maritime radio and employed only the Marconi system. Just before the conference closed, the Marconi Company sent to the meeting a message which read as follows: 'In view of the decisions of the conference, and without awaiting the entry into force of the new convention, the Marconi Company has given the order to all ships equipped with its apparatus to communicate with all other ships, regardless of the system adopted by the latter.[4]

It should also be noted that the early years of the century brought governments directly into the field of domestic radio regulation. The first law specifically devoted to radio entered into force in the United Kingdom in 1903, and in 1910 the first Wireless Act was passed in the United States. These laws, which dealt primarily with maritime radio, had a profound effect on the problem of 'freedom of communication'. The United States act provided that 'it shall be unlawful for any ocean-going steamer of the United States, *or of any foreign country*' carrying 50 or more persons to leave any port of the United States 'unless such steamer shall be equipped with an efficient apparatus for radio communication', in good working order and handled by a competent operator, capable of sending and receiving messages over a distance of 100 miles. With a view to hastening the end of restrictive communication practices, the United States Wireless Ship Act of 1912 added that for the purpose of the act 'apparatus for radio communication shall not be deemed to be efficient unless the company installing it shall contract in writing to exchange, and shall, in fact, exchange messages with shore or ship stations using other systems of radio communication'.

Radio was also being employed for military purposes before World War I, particularly by naval forces. In the British Navy, radio communication began in

1. International Radiotelegraph Union, *Documents de la Conférence radiotélégraphique internationale de Berlin 1906*, Berne, 1907, pp. 95–6.
2. IRE-RTMA Joint Technical Advisory Committee, *Radio Spectrum Conservation*, New York, McGraw-Hill, 1952, p. 5.
3. *Conférence préliminaire concernant la télégraphie sans fil, Berlin*, 4–13 August 1903, pp. 15–16.
4. International Radiotelegraph Union, *Documents de la Conférence radiotélégraphique internationale de Londres, 1912*, Berne, 1913, p. 438.

1897 with the installation of an experimental transmitter and receiver by Captain H. B. Jackson. Following a successful demonstration of Marconi radio on two British cruisers in 1899, a contract was made with the Admiralty for the installation of Marconi equipment on 26 naval ships and in six Admiralty coast stations. The British example was soon followed by other maritime powers, and naval radio was used with great effectiveness in the Russo-Japanese war and the Turkish-Italian war. Radio soon became an essential part of the equipment of warships and profoundly modified naval tactics.

By 1914, the importance of radio had been demonstrated in many fields. Commercial development of the radio industry was well advanced and the usefulness of radio to merchant ships and warships had been widely recognized. Moreover, radio had already become the subject of both national and international regulation. It had staked an indisputable claim as a vital means of communication between ships at sea and between ships and the land.

the emergence of broadcasting

As a medium of mass communication, broadcasting is a specialized development of radio-telephony, rather than a technical phenomenon in its own right. As in the case of radio-telegraphy, radio-telephony was first used in the maritime service. Since it did not necessitate the use of the Morse code, relatively untrained operators could be engaged for the service. The one great handicap in radio-telephony was that it lacked the element of secrecy; radio-telephone messages were public property open to anyone equipped with a receiving set. Broadcasting was born when it was decided to exploit this lack of secrecy.

In the early days of radio-telegraphy, the technical methods employed were relatively crude. Radio waves were produced from a circuit in which a spark discharge was created. These irregular and damped emissions produced a primitive harsh signal. By means of a telegraph key, the length of the electrical impulse was varied to produce the Morse code. Even with the installation of a microphone in place of the telegraph key, the nature of the early radio wave made it impossible to reproduce the delicate variations in sound of the human voice or of musical instruments.

Two basic innovations in the early 1900s made radio-telephony a reality. The first was the creation of a transmitter which sent out a smooth and continuous wave. Two major contributors to this invention were Reginald A. Fessenden and Ernest F. W. Alexanderson, who in 1906 installed a high-frequency alternator at a station near New York. On Christmas Eve 1906, radio-telephony was publicly demonstrated from this station in the form of two speeches, a song, and a violin solo. The programme was clearly heard by a scattered group of persons who had been provided with receivers, and by several wireless operators on ships off the Atlantic coast. The voices and music produced vibrations in the standard telegraph headsets in the same manner as the sound of Morse code. While this was an important development, its results were far from perfect. Although many of the spoken words were easily understood, the musical items were so distorted that it was difficult to distinguish one instrument from another or a musical instrument from the human voice. Transmitters and receivers were unable to reproduce sounds with any great degree of fidelity, and the distortion and accompanying static were almost unbearable. Fessenden and Alexanderson continued to experiment with steadily increasing range of signal, but the quality of the signal remained poor.

The second innovation was the development of the electric valve, or radio tube, which faithfully reproduced the delicate variations in sound made by the human voice or by musical instruments. The invention of the valve resulted from the experiments of Thomas Edison, Sir Ambrose Fleming, and Lee de

Kite used for aerial at Signal Hill, Newfoundland, for reception of the first trans-Atlantic signal, 12 December 1901. Marconi is at the extreme left.
[Marconi International Marine Communication Co. Ltd.]

Dame Nellie Melba sings from the Marconi factory, London, on 15 June 1920 in the first broadcast of public entertainment in the United Kingdom.
[Marconi International Marine Communication Co. Ltd.]

Forest. Fleming, basing his work on observations made by Thomas Edison in the 1880s, constructed a valve of primitive design. It was not until de Forest, dissatisfied with the performance of the Fleming device, improved it by adding a tiny grid between the plate and the filament that a workable radio tube came into being. The radio tube became an essential part of both the transmitter and the receiver, performing two important functions: it built up the strength of the signal before transmission and after reception; and it generated the high frequency radio waves necessary for broadcasting speech and music.

Early Transmissions

Using the new tube, de Forest began a series of public demonstrations which aroused widespread interest in radio-telephony and in the newly formed de Forest Radio Telephone Company. In 1908, de Forest staged a broadcast from the Eiffel Tower in Paris. Antennae were hung from the tower and a generator was installed at its base. The broadcast was heard by all of the French military stations in the area which were taking part in the experiment, and an unsolicited acknowledgement was received from an engineer in Marseille. De Forest again attracted attention a year later when he arranged a broadcast from the Metropolitan Opera House in New York, with Caruso in the leading role. Well aware of the interest he was stimulating in radio-telephony, de Forest continued his public demonstrations until 1917, when the United States became actively involved in World War I. In 1916, for example, he erected an experimental broadcasting station in the Bronx, New York, from which he transmitted talks, songs and recorded music. Later in the same year he broadcast news bulletins on the dramatic presidential election.

De Forest was not alone in the development of broadcasting. In 1913, radio amateurs in the United States heard music broadcast from the Prince of Monaco's yacht while it was cruising in United States waters. In 1914, a station at the Wannamaker department store in New York broadcast music from phonograph records to stations in government departments, and to commercial radio companies and amateurs. In 1915, a voice broadcast from the United States Navy station at Arlington, Virginia, was picked up in San Francisco and Hawaii.

Relatively few people had been able to listen in during these early broadcasts. For a long time, most of the existing receivers were in the hands of government agencies or commercial companies which were experimenting with them. There was, however, a growing group of radio enthusiasts who were making their own sets, not for profit, but for pleasure. For example, several thousand amateurs in the New York area listened to the news broadcasts on the 1916 presidential election by the de Forest station in the Bronx. The members of this group, which was to expand enormously after World War I, were the most influential promotors of broadcasting.

The development of public radio broadcasting suffered a temporary set-back as a result of the war. In most belligerent countries the governments took control of all commercial wireless stations and ordered amateur stations to dismantle their equipment. Progress made during this period resulted almost entirely from operations carried out under contract to governments as part of the war effort. With the cutting of telegraph cables, radio-telegraphy became a necessity, and radio-telephony played an important part in the war at sea, on land, and in the air.

Organized Development

When the war ended, the stage was set for the organized development of broadcasting. The pre-war experiments, the wartime uses of radio, and the

technical training which many young men had received in the services, all combined to produce an army of amateurs eager to conquer the ether. As sales of 'ham' radios and parts increased, the companies engaged in the manufacture of equipment decided to provide amateurs with transmissions of special interest to them.

In Europe, one of the most notable experiments was organized in 1920 by the Marconi Company and the London *Daily Mail*, which arranged a radio-telephone concert, featuring Dame Melba. It was hoped that the concert would be heard at least throughout the British Isles. The programme was in fact clearly heard and recorded in Paris, and received by stations in Norway and Italy, and by ships in the North Atlantic. The Marconi station which staged the Melba concert had been broadcasting regularly on an experimental basis since February 1920, but had to discontinue operations before the end of the year because the British Post Office considered that such transmissions were interfering with the more serious work of maritime and point-to-point radio-telegraphy. A broadcasting transmitter was constructed in the U.S.S.R. in 1919, and experimental broadcasts were begun in Moscow in 1920. To advertise the new medium, a widely publicized concert was transmitted on 17 September 1922 and was successfully received at distances over one thousand miles from the capital.

It was also during 1920 that broadcasting as a regular daily service was born in the United States. In Pittsburg, Pennsylvania, Frank Conrad, an engineer with the Westinghouse Company, re-opened an amateur wireless-telegraph station which he had built in 1916 and converted it to wireless-telephony. His transmissions aroused so much interest among neighbouring amateurs that he began a regular two-hour broadcast of speech and recorded music on Wednesday and Saturday nights. The success of Conrad's station, and the increase in sales of receivers and parts, convinced a vice-president of the Westinghouse Company that broadcasting should become a permanent activity of his organization. On 2 November 1920, the Westinghouse station KDKA was opened under Conrad's direction, the initial broadcast being timed to coincide with the Harding-Cox presidential election. Through an arrangement with the *Pittsburg Post*, election returns were telephoned to the station and immediately broadcast. Before they retired that night, KDKA's listeners knew that Warren G. Harding had been elected President of the United States. The KDKA broadcasts caused a sensation in the American press.

Following its successful inaugural broadcast, KDKA began a regular daily schedule which continued until 9.30 p.m. Within the next two years, the station made a number of innovations such as the provision of a regular studio orchestra, coverage of sports events, and arranging for well-known people to speak directly from its studio. To ensure an audience for its early broadcasts, Westinghouse had a number of simple receivers manufactured and distributed free to friends and officers of the company.

By 1921, four licensed stations were operating in the United States; by May 1922 there were 129 and by December the figure had soared to 382. By early 1927, when the United States Government was finally empowered to regulate installation of broadcasting stations, the number had risen to 733. Most of these early stations were low-power transmitters owned by manufacturing companies, stores, churches, chambers of commerce, and similar organizations attempting to capitalize on the novelty of radio. The number of receivers in use in the United States had correspondingly increased and by the end of 1927 had risen to some 6.5 million.

Other countries quickly followed the United States in introducing regular public broadcasting services. French broadcasting began in 1922 with regular programmes from the Eiffel Tower station in Paris. In the United Kingdom, the Post Office yielded to pressure from amateur listening groups and authorized regular public broadcasts in 1922. During the next three years broadcasting was

established in Argentina, Australia, Austria, Belgium, Canada, Czechoslovakia, Denmark, Finland, Germany, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, Union of South Africa, and the Union of Soviet Socialist Republics. By 1927, broadcasting had been accepted as a mass communication medium throughout Europe, and had achieved a foothold in Africa, Asia, the Pacific, and Latin America.

Problems of Interference

The rapid increase in the number of American broadcasting stations gave rise to serious problems of interference, which resulted in the government's obtaining a greater degree of control over radio communications. While the first Wireless Act of 1910 had been devoted exclusively to regulating maritime radio, the second act of 1912 gave the executive branch, through the Department of Commerce, the right to require licences from all who wished to use a transmitter. As the frequency spectrum became more and more crowded, the Department of Commerce, under Secretary Herbert Hoover, began to assign specific frequencies to stations. It refused to grant licences to those stations which were not considered qualified, and in some cases specified the times during which a station could operate. Because of the continued competition to get on the air, stations were sometimes given frequencies, or hours of operation, which they did not consider adequate, and protests against regulation increased.

The blow fell in 1924, when the power of the Department of Commerce was challenged in the courts. The courts decided that the department, lacking specific legislative authority, had no power to determine or restrict the frequency, power or hours of operation of any station. Despite the pleas of Secretary Hoover that the stations themselves should assume the obligations which the law failed to impose, an almost complete breakdown in American broadcasting resulted. From the date of the court decision until 23 February 1927, when Congress finally took action, nearly two hundred new stations went on the air and at least a hundred others changed their frequency assignments. Interference between stations became the rule rather then the exception. Everyone suffered—stations, equipment manufacturers and, most of all, the listening public.

The Radio Act of 1927 established a Federal Radio Commission (later renamed the Federal Communications Commission) and conferred upon it all the powers that had been denied the Department of Commerce. Without going further into this act, which laid the foundation for American governmental regulation of radio, it should be noted that there was no prohibition against using the stations for advertising and no attempt was made to nationalize the service.

Europe did not long escape the problem of interference either. Some countries on the periphery of Europe were able to develop broadcasting services for many years without worrying about interference from neighbours. In the case of most European countries, however, the borders were so close that broadcasting stations soon began interfering with each other. While America turned to federal control and regulation, Europe was forced to seek international control.

International regulation of European broadcasting was introduced through the medium of the International Broadcasting Union (UIR), established in 1925 to deal with the problem of mutual interference. Within a short time, governments agreed that it would be necessary to assign a specific frequency to each broadcasting station in Europe, set a limitation on the power used by stations, and adopt technical measures to assure the most efficient use of frequencies. A plan for the distribution of frequencies between member nations was drawn up by the union's technical commission and came into effect on 14 November 1926. This plan, called the 'Geneva Plan', was the first of many attempts, both

intra-European and international, to prevent interference between the radio services of different countries.

While broadcasting was expanding throughout the world as a domestic radio service, another development which was to add to the international problems of broadcasting occurred: the discovery of the suitability of short waves for long-distance communication.

long-distance communication

One more innovation was necessary to complete the picture of radio's achievements; the introduction of long-distance communication. Early radio communication, for all practical purposes, was fairly limited. Even by 1900, the operating distance had been extended to but 150 miles, and that at sea. Beyond this range, reception was unreliable and of poor quality. Good quality long-distance communication only became possible when the value of shorter waves was discovered.

In addition to the natural inclination of scientists to carry their work to its logical conclusion, three important forces stimulated experiments in long-distance radio. The first was a matter of competition. Although by the turn of the century messages could be sent rapidly across most of the world by means of land-line or cable, many radio pioneers, including Marconi, believed that wireless-telegraphy could compete effectively over lines of communication served by low capacity, highly expensive submarine cables. The second force was one of national self-interest. Cables were vulnerable to enemy action. In time of war it was of great interest to have an alternative means of rapid long-distance communication. The third force at work was the simple one of man's inquisitive, gregarious nature. People enjoy talking to other people, friends or strangers, whose daily life differs from their own. Combining this trait with scientific curiosity, radio amateurs opened the way to long-distance communication.

The fact should not be overlooked that, by using higher antennae and greater power, some degree of long-distance communication had already been achieved on the longer waves. On 12 December 1901 Marconi spanned the Atlantic. This achievement was made possible by erecting 200-ft transmitting antennae at Poldhu, Cornwall, and launching a 400-ft receiving antenna attached to the tail of a kite over St. John's, Newfoundland. The message received was the letter 'S' in Morse code. Although this was a notable advance, it did not warrant the Anglo-American Telegraph Company's immediate claim to the effect that it had a monopoly of all telegraphic communications in Newfoundland, and its request to Marconi to cease his operations.

Marconi had some limited success with new stations in Glace Bay, Canada, and Cape Cod in the United States. In 1903, President Theodore Roosevelt sent a transatlantic message to King Edward VII via Cape Cod and Poldhu. In the same year, transatlantic communication between the Glace Bay station and Poldhu was used to carry out a limited press service for the London *Times*. This service proved only moderately successful, however, and in 1904 the Glace Bay station was transferred to the Cunard Lines for the maritime service.

Marconi remained convinced that the secret of long-distance communication lay in high antennae and high power on long waves. In 1908 he presented a plan to the United Kingdom Government for the establishment of a chain of long-wave stations which would provide a radio-telegraph link between all countries of the British Empire. The cost of the system, doubts as to its reliability, and the advent of World War I, all combined to defeat the plan. R. N. Vyvyan, who had worked closely with Marconi on the project, commented: 'The 16 years delay in establishing an Imperial Wireless Chain had however been a blessing in disguise, not only to the Empire but also to the Marconi Company. The

procrastinations, criticisms, opposition and political considerations, responsible for the delay, which were many times most irritating and disheartening, continued until a day arrived when a new method became available, profoundly changing the whole technique of long-distance wireless communication.'[1]

Use of Short Waves

The new method was the use of short waves. Two elements were necessary to make long-distance short-wave communication a reality: (a) instruments capable of sending and receiving a short-wave signal, and (b) the discovery of short waves themselves. The first element, the development of improved apparatus, was accomplished while technical advances were being made in maritime radio and short-range broadcasting; i.e., the vacuum tube, and an improved antenna.

The second element, the discovery of short waves and their propagation characteristics, should be attributed, not to the commercial radio companies or government scientists, but to the radio amateur. The term radio amateur, as used subsequently in this study, refers to the individual who for pleasure rather than profit maintains a transmitter for conversation with his fellow amateurs. These enthusiasts were rapidly increasing in number by the turn of the century and their activity closely followed advances in radio communication. In many countries, amateurs were regarded with some misgivings. Commercial radio companies considered that many of the messages exchanged by amateurs might otherwise have been sent through their facilities. Governments disliked the idea that amateurs might be able to 'listen in' to official business and that, in Europe at least, they could engage in unregulated communication with persons in other countries. In the end, however, it was these amateurs who opened up new horizons in radio communication to the benefit both of governments and commercial enterprises.

Between 1900 and 1912, the number of amateur stations rapidly increased, especially in the United States. Friction soon developed between the United States Government and commercial and amateur stations in the long-wave band. The Navy complained that amateur interference at times rendered its wireless system useless. Commercial operators voiced similar protests. In 1906, for instance, while President Roosevelt was visiting the fleet at sea, it proved impossible, because of amateur interference, to transmit messages from the shore to the President. A destroyer had to be used to carry his dispatches. Furthermore, some amateurs engaged in highly unethical practices. In his book, *Old Wires and New Waves*, Alvan F. Harlow states that in their unbridled enthusiasm and quest for excitement, certain amateurs went so far as to send false orders to naval vessels, and, more seriously, to transmit false distress messages purporting to come from ships at sea. Although the number of amateurs who engaged in such activities was small, their action, not surprisingly, had widespread repercussions for the whole group.

In the Wireless Ship Act of 1912 the United States Government dealt what was then regarded as a staggering blow to the amateurs. Since there were not enough frequencies in the long-wave band to provide for satisfactory communication by commercial and government services and to provide for planned expansion, some action had to be taken. As the amateurs were not considered 'essential', they were moved completely out of the long-wave band. Instead, they were permitted to operate on wavelengths below 200 metres, which were considered almost unusable. To quote the act of 1912, 'no private or commercial station not engaged in the transaction of *bona fide* commercial business by radio communication or in experimentation in connexion with the development

1 R. N. Vyvyan, *Wireless over Thirty Years*, London, 1933, pp. 76–7.

and manufacture of radio apparatus for commercial purpose shall use a transmitting wavelength exceeding 200 metres...'.

Exploring possibilities in the short-wave field, the amateurs soon discovered that relatively long-range communication could be effected. The advent of World War I, with the consequent ban on amateur activities, delayed further progress in the use of short waves. However, when wartime restrictions were raised in 1919, the amateurs returned enthusiastically to their experimentation. In 1921 and 1922, amateur transmissions in the 200-metre band from the United States were heard in Europe, and European transmissions were heard in the United States. Not content with the quality of 200-metre communication, the amateurs decided to try shorter and shorter wavelengths. Finally, in November 1923, American and French amateur operators achieved two-way transatlantic communication on 100 metres. Using even shorter wavelengths, other amateurs found that they could easily conduct two-way communication across the Atlantic.

As soon as the amateurs had demonstrated the value of shorter frequencies, commercial and government services invaded the field. For the first time reliable long-distance point-to-point communication was possible. The concept of rapid long-distance communication, which had so alarmed the Anglo-American Telegraph Company that it forced Marconi out of Newfoundland some twenty years before, was at last a reality. Although the amateurs were not permitted to monopolize this vast new range of frequencies, their achievement helped them to defend their right to a place in the radio spectrum.

International Broadcasting

Long-distance broadcasting on short waves soon followed the initial success of the amateurs. Even before 1923, however, the technique of broadcasting had been used for international communication. In 1915, for example, Germany provided daily news reports by radio-telegraphy on wartime events to interested parties. Many newspapers in Europe and abroad relayed the information carried in these broadcasts. The Russian revolutionaries, who were also early users of the international broadcast technique, used radio to expound their war policy and to exert pressure on the Germans during the negotiations for the Brest-Litovsk Treaty. They likewise used radio to explain to the world the meaning of communism and the communist revolution in Russia.

In the present sense of the term, general international broadcasting—a regular transmission of voice or musical instruments over a long distance for reception by a general group of people—did not reach its peak until World War II. The four phases of its development were: (a) exchange of programmes between broadcasting services of different countries; (b) broadcasts from colonial powers to distant colonies; (c) broadcasting from one country to its nationals, or former nationals, in another country; and (d) broadcasting from one country directly to the nationals of another.

The first phase, the long-range exchange of programmes, began in 1923 on the initiative of the American station KDKA, which had pioneered the first regular broadcasting service. On New Year's Eve 1923, KDKA transmitted a special holiday programme by short wave to the United Kingdom. This programme was picked up and rebroadcast to British listeners by a station operated in Manchester by the Metropolitan Vickers Company. KDKA conducted similar experiments with South Africa in 1924 and Australia in 1925. This type of programme exchange soon became common among broadcasting organizations and was supplemented by the exchange of recorded programmes when speed or novelty was not essential.

The second, or colonial service phase, opened a few years later. In 1929, the Netherlands began a regular service in Dutch to the Netherlands East Indies

and in 1932 the United Kingdom started a regular Empire service in English. France, which opened its colonial service in 1931, added a new element. The French Empire was divided into zones and broadcasts were made in both French and the language most frequently used by the people of the area concerned. Another major colonial power, Belgium, began a daily service to the Belgian Congo in 1934. This service, which at first ran for an hour and a half, consisted of 15 minutes of news in Flemish, 15 minutes of news in French, and one hour of music. In 1935 the Belgian programme had about eight hundred and fifty listeners.[1]

The third phase opened when some countries without overseas territories, but with numerous nationals and former nationals living abroad, began overseas short-wave broadcasting services to reach these persons. Notable among such countries were Switzerland and Czechoslovakia. The Swiss service, which commenced in September 1935, was an immediate success with Swiss and former Swiss residents in Argentina and North America. The programmes, which went out in the three official Swiss languages, French, German, and Italian, were described by the Swiss Broadcasting Service as a method of cultural propaganda by which the ties of distant nationals to their motherland could be reinforced.[2] It may be noted in passing that in 1932 the League of Nations began short-wave broadcasts from Geneva in English, French and Spanish. The League's purpose was to send communications and information to Member States and to keep in contact with certain League organs, such as the Lytton Commission, during the Manchurian affair.

The fourth phase of international broadcasting, and the one which assumed great volume during and after World War II, was the use of short waves to reach an audience in a country other than that which originated the broadcast. Until 1930, the U.S.S.R. was the only country to recognize the political potentiality of international broadcasting. In that year, Radio Centre Moscow was beaming programmes to foreign listeners in some fifty languages and dialects.[3]

Germany, the next country to start an international short-wave service, began a programme in English and German to North America in 1933. Italy followed in 1935 with a service in Arabic to Africa and the Middle East, and Japan began broadcasts in Japanese and English to Hawaii and the west coast of the Americas.

When war broke out in 1939, over twenty-five nations were broadcasting to audiences abroad. They included Albania, Australia, Belgium, Bulgaria, China, Denmark, Finland, France, Germany, Hungary, Italy, Japan, Netherlands, Norway, Poland, Portugal, Rumania, Spain, Sweden, Switzerland, Turkey, U.S.S.R., United Kingdom, United States, Vatican, and Yugoslavia. By the end of the war, the number of countries engaged in international broadcasting had reached 55, and the total hours of broadcasting per week had risen to 4,275.

International short-wave broadcasting diminished immediately after the war. By 1950, however, the number of countries conducting services, and the total number of hours broadcast, far exceeded those at the height of the conflict. In that year 62 countries were transmitting programmes totalling over 6,500 hours a week in all of the major languages and a number of others. Although the largest output came from four countries, the U.S.S.R., the United Kingdom,

1. Belgium, Institut National de Radiodiffusion, *Rapport annuel de l'INR, exercice 1935*, Brussels, 1936, p. 22.
2. Société Suisse de Radiodiffusion, *Cinquième rapport annuel sur l'exercice 1935*, Berne, 1936, pp. 22–3; and Service de la Radiodiffusion Suisse, *Les dix ans de la Radiodiffusion suisse: Rapport annuel du Service de la Radiodiffusion suisse pour l'exercice 1940–41*, Berne, 1941, p. 23.
3. Charles J. Rolo, *Radio goes to War*, London, 1934, p. 36.

the United States and France, short-wave broadcasting by smaller countries notably increased. Countries newly accepted into the society of nations gave a high priority to international foreign-language broadcasting. The establishment of short-wave services was to become a matter of national prestige, as well as a highly valued instrument in the promotion of national policies at home and abroad.

the world's domestic broadcasting systems

2

Anyone who has ever sat turning the selector button on a sensitive receiver in search of a particular programme will have realized the tremendous number of stations there are on the air, crowded into every available niche in the frequency bands reserved for domestic broadcasting, and sometimes outside them as well. The listener would be wrong, however, to conclude that the mere profusion of programmes automatically provides ample intellectual fare for all of those who desire it. Whether any given individual can actually benefit from the free flow of information and culture which radio is so well fitted to serve depends on a number of other considerations, including the accessibility of a good receiver and the use to which the broadcasting facilities are put by the competent broadcasting authorities.

In order to provide the basis for a judgement as to whether domestic broadcasting is playing its proper role as an instrument of mass communication, this chapter will inquire into the physical facilities for broadcasting throughout the world, the interests administering this powerful instrument, the audiences it serves and the controls exerted on its use. A discussion of problems of domestic broadcasting especially applicable to the underdeveloped areas of the world, and an inquiry into the situation of broadcasting between countries will be undertaken in later chapters.

facilities

The total number of transmitters throughout the world in 1957 approached 9,000, and was still increasing. This figure is, however, only a very approximate guide to the influence of radio in particular areas and communities. The power of stations may differ widely, from 1,000 kW down to 0.05 kW or less, with corresponding variations in range. Many low-powered transmitters are mere 'repeater' stations, consisting only of an unmanned installation operating automatically to 'boost' the signal in an area of poor reception. In addition, many stations, particularly in countries where broadcasting is organized as a national service, relay almost identical programmes. In the United Kingdom, for example, more than forty transmitters relay the British Broadcasting Corporation's Home Service programme alone, and this case is not extreme. The number of transmitters used to provide broadcasting coverage depends upon the topographical peculiarities of the country, the amount of interference

from industrial installations and from other stations, the scarcity of frequencies, and so on.

Transmitters

A few general trends can be discerned. In countries with a privately owned broadcasting service many persons seek to use radio for various purposes, educational as well as commercial. As a result, such countries have a comparatively large number of separate stations, which, though often organized in 'networks' for technical and economic reasons, are nevertheless bound to some extent to adjust their programmes to suit a local or regional audience. It is arguable that these countries possess the most varied radio fare; on the other hand, this very profusion of broadcasting requires that the power of most transmitters must be kept fairly low, or conditions in the ether would become chaotic. In the United States for example, there were no less than 3,762 private stations in August 1957, but fewer than 100 were operating with 50 kW.

Similar conditions exist in most of the South American countries, where the commercial system also prevails. Brazil, for instance, had 447 stations in 1955 and has since built a number of others. Colombia possesses more than one hundred and seventy transmitters, and Venezuela has a total of 139. In all these countries the great majority of stations are privately managed.

Operating and financing methods affect the number of transmitters. The rates for advertising, from which a commercial station normally derives its revenue, naturally vary with the station's effectiveness as a publicity medium, i.e., the size of the audience it can reach and interest. Commercial stations, therefore, tend to compete for listeners in the largest population centres at the expense of more sparsely inhabited areas. Thus, on the one hand, we find vast regions dependent on a few transmitters and, on the other, cities crowded with rival stations; Mexico City, for example, has about thirty-seven, Montevideo about forty-two and Havana even more.[1]

In countries where broadcasting is regarded as a public service, and especially in those where it is considered an instrument for social unification or political propaganda, the basic objective is quite different. The authorities seek to enable everyone to listen to the one, two or three national programmes. In bringing radio to every citizen, they tend to establish a very close network of coverage throughout their territories, even if some of the stations would be 'uneconomic' by commercial standards. Thus instead of the multiplicity of stations which characterizes broadcasting in the Americas, the practice in most European countries (where broadcasting is most widely organized as a national service) has been to install a relatively small number of powerful stations to carry transmissions to all areas. In addition, relay stations of low power are used to provide reception for remote communities where ordinary transmissions cannot be picked up; the villages in the Swiss Alps are a typical example.

Current figures on amplitude modulation (AM) transmitters used for home audiences show that France has 13 transmitters of 100 kW or more (including one of 500 kW), one medium-sized installation of 60 kW, 18 smaller area transmitters of between 10 and 20 kW, and 19 local relays of less than 2 kW. Czechoslovakia operates seven large transmitters of between 100 and 200 kW., two 30-kW and three 3-kW stations. In mountainous Austria, a large number of low-power relay stations, some 60 in all, are required. The postal administration operates many of these to relay the two national programmes radiated by three 100-kW stations and six medium-sized transmitters of 10 to 25 kW each, together with two small transmitters of 5 and 1 kW respectively.[2]

At the other geographical extreme, the Netherlands, an almost flat country,

1. Cf. Arno Huth, *Radio Today, The Present State of Broadcasting*, Geneva, 1942.
2. A third programme is radiated exclusively by the frequency modulation networks.

can provide a complete AM service with two 120-kW transmitters, assisted by three relays of a combined power of 5 kW. Rumania's AM network for the home service comprises two 150-kW stations, one 50-kW transmitter and three with a power of between 20 and 30 kW, which are supplemented by one 5-kW and two 1-kW installations. In the Federal Republic of Germany, the regional, domestically managed, public corporations use for AM broadcasts to their national audience five 100-kW stations and 31 local relays of 2 kW or less (together with five short-wave installations).

In European AM broadcasting, the only significant development for many years was the introduction of even more powerful transmitters, which caused additional interference with stations on adjoining frequencies. The latter, in turn, 'boosted' their own power, thus creating a vicious circle. As a result, the medium-wave band in the European broadcasting region became seriously overcrowded, with a consequent increase in interference and a decline in the quality of reception. One of the countries most handicapped was the Federal Republic of Germany, which had been allocated few conventional broadcasting frequencies at the European Broadcasting Conference of 1948. The Federal Republic accordingly concentrated on building frequency modulation (FM) stations. Other European countries have also begun to introduce FM broadcasting, either from necessity or because it gives improved reception (and doubtless also to satisfy listeners with sets capable of receiving FM). Since an FM station provides an essentially local service, a large number of stations are required to cover an area adequately. This had led to a substantial, though uneven, increase in the total number of transmitters in use; the Federal Republic of Germany, for example, now has over 360 transmitters of all types, and the United Kingdom operates about 200.[1]

It is apparent that an immense amount of effort has been expended throughout the world to bring information and entertainment to the public. Physical facilities for transmission by radio now girdle the globe; but transmission is only half the problem. To gauge the effectiveness of broadcasting, the facilities for reception must also be examined.

Receivers

The world total of receiving-sets is estimated at somewhere over 315 million. These sets are unevenly distributed, however. Over half of them are located on the North American continent alone. Another third are distributed throughout Europe, with the greatest concentration in the West, and the remaining sixth are scattered over Asia, Africa and the Near East. The United States is in first place both from the point of view of total receivers (150 million) and density (88 per 100 inhabitants). Second place in total number of receivers belongs to the U.S.S.R. (33,121,000), although second place in density goes to Canada with 58 receivers per 100 population. At the other end of the scale we find Ethiopia and Eritrea with only 16,000 receivers for a population of some 20 million or an average of 0.1 per 100 people. Even India with over a million receivers has an average of only 0.3 per 100 people.[2]

There are several reasons why the number of receivers alone, as in the case of transmitters, does not accurately indicate the size of the radio audience or the potentialities of broadcasting. Radio's influence must largely depend on a subjective factor, which might be described as the intensity of listening. In some of the advanced countries, where broadcasting has penetrated into every home, it may sometimes have become little more than an agreeable background to everyday activities, to be heard without being listened to. In the less advanced countries, on the other hand, where the sole transmitter may be on the air for

1. For a further discussion of FM broadcasting, see Chapter 9.
2. See appendix, page 147, for a listing by country of the world distribution of receivers.

only an hour or two daily, the broadcaster can often count on an attentive audience.

In these countries widespread illiteracy denies a large portion of the population access to the written word. It is perhaps fortunate that the immediacy of speech should give more potency to the radio message in less advanced areas, since it is precisely the evils accompanying backwardness and poverty—ignorance, superstition, social injustice and hostility to new ideas—that broadcasting can most effectively combat. But there is, after all, a physical limit to the number of people who can use one receiver.

In determining the actual audience to broadcasting, one must also take into account such things as social organization and the average size of a family, which may fluctuate widely from country to country. Standards of living are also a material factor. In the more prosperous countries a single family may own a number of sets,[1] located in different rooms of the house, or in automobiles, or used as portable receivers.[2] In the case of the United States, it is fairly clear that on the basis of 150 million receivers, the average number of listeners per set cannot be very high, for the corresponding population figure is only about 170 million. This figure includes several classes not likely to be active listeners, such as children in arms and the very deaf. On the other hand, it must be remembered that in countries where receiving-sets are scarce, broadcasting will have the attraction of novelty and people will flock to hear radio programmes, just as the Italians gather to watch television in local cafés.[3] In some areas there may be only one receiver for a whole township; if conveniently located, however, the set may have a regular audience of thirty or forty people. The various forms of collective listening, in factories and workshops, clubs, schools and discussion groups, now promoted in numerous countries also help to swell the audience.

It should also be noted that certain countries maintain licensing systems for receivers and can thus report with reasonable accuracy the total of sets in use; others base their totals on the number of sets produced, imported or sold. Consequently, statistics for all countries are not strictly comparable. Moreover, figures on broadcasting sets in use do not usually indicate the type of set in use. Receivers may include everything from large, expensive, many-wave-band consoles to primitive crystal sets, or merely loudspeakers of a wire broadcasting network. This, however, does not affect the comparison of a total of 150 million sets for the United States with that of some 1,076,000 for India, which has over double the population.

Whatever the size of the potential world audience, the fact remains that at any given time hundreds of millions of persons are listening in. By and large they do so of their own volition, for broadcasting has the peculiarity (or advantage) that it can be banished at the flick of a wrist.

Wired Broadcasting

A survey of broadcasting facilities would be incomplete without a brief

1. In the 4 million Canadian homes there are more than 5 million radio sets in use, or about 1.3 per home. To this must be added sets in cars (almost 1,100,000), and in hotels, restaurants, etc. (*EBU Bulletin*, Vol. VIII, No. 45, September-October 1957).
2. In a recent study for the Ford Motor Company, the J. Walter Thompson Agency states that there was an average of nearly three sets per family in the United States, and that 35 million were installed in motor cars (*Broadcasting-Telecasting*, 13 May 1957). A report prepared by BBDO, another advertising agency, in 1956 stated that the United States has 8 million portable radios (ibid., 1 October 1956).
3. According to Professor Mario Attilio Levi, the television audience for a certain quiz programme represented some 12 million, or a quarter of the entire population of Italy, though there were only 620,000 sets throughout the country (Lecture delivered at Bristol University, 21 October 1957).

discussion of wired broadcasting facilities. Basically, this service consists of picking up broadcast programmes at a central point or exchange, and distributing them by wire to listeners subscribing to the system.[1] Despite the inherent lack of programme choice, wired systems have been extensively used in certain areas where reception conditions are difficult, or the expense of a regular broadcasting service, or receivers, is excessive.

Wired broadcasting has a history almost as old as sound broadcasting itself. Although telephones were used to listen to remote concerts as early as the 1880s, wired broadcasting was really introduced about the same time as sound broadcasting. The reason for this was that the vacuum tube (or valve) is just as necessary for the faithful transmission of sound by wire as for the transmission by radio. The first commercial 'relay exchange' in the United Kingdom, which has long been a leader in the use of this medium, was opened in the village of Hythe, near Southampton, in January 1925. The wired system proved so effective that it was almost immediately a commercial success. The British Broadcasting Investigation Committee of 1935 reported: 'The system appeals specially to those who find wireless reception difficult or who wish to avoid the expense of buying, or the trouble of looking after, a wireless set.'[2]

Maurice Gorham, a former executive of the British Broadcasting Corporation (BBC), considers that wired exchanges were the first real challenge to conventional radio in the United Kingdom and adds that they 'threatened the very basis of broadcasting.'[3] In 1930 there were some sixty exchanges with 14,000 subscribers; by 1935 there were 340 exchanges and subscribers totalled 200,000. The number of regular receivers in use in these two years was 3,411,910 and 7,403,109 respectively. Expansion accelerated during the decade which included World War II. In 1939 there were no more than 284 exchanges with some 270,596 subscribers; by June 1950, the total of 337 exchanges had as many as 935,672 subscribers. Nevertheless, the share of wired broadcasting in total national facilities remained small in relation to the increases in licensed radio broadcasting receivers. The same period saw an increase in radio licences from 8,947,570 to 11,871,312. Recently the number of subscribers in the wired relay systems has passed the 1 million mark, but is still less than one-tenth of the total conventional radio licences. Although the increase in wired broadcasting has been steady, it does not fully indicate the potential audience in the United Kingdom for this system. For various reasons, half of the county boroughs have refused to approve the establishment of wired relay. They include London (certain districts), and Birmingham, Glasgow, Liverpool, Manchester, Sheffield, Edinburgh, Leicester and Stoke-on-Trent.[4] If these towns were included and listener response was equally favourable, wired broadcasting might well achieve 20 per cent of the total listening figure.

Under the terms of the British Post Office contracts, the companies are not permitted to originate programmes themselves. Furthermore, if they provide two channels they must make BBC programmes available on the first channel and for 75 per cent of the time on the second. If they provide three channels, two of the three must always carry BBC programmes. No political, social or religious propaganda in English from a source outside the United Kingdom may be relayed, and no money or other consideration may be accepted by the operator for relaying a programme. The Postmaster-General retains the right to take over a plant and equipment on termination of licences.

Wired broadcasting has developed in a number of other countries in Western Europe and Scandinavia: Austria (11,700 subscribers), Belgium (132,000), Federal Republic of Germany (134,000), Netherlands (526,000), and Switzerland

1. See Chapter 7.
2. *Report of the Broadcasting Committee, 1935*, London, HMSO, 1936, p. 39.
3. Maurice Gorham, *Broadcasting and Television since 1900*, London, 1952, p. 106.
4. *Report of the Broadcasting Committee, 1949*, London, HMSO, 1951.

(309,000).[1] Most of these systems, which are of the primitive type, were introduced between 1920 and 1934. The Swiss system is an exception. Ceylon, China, (People's Republic), Mongolia and several United Kingdom overseas territories also maintain this system.

There is a heavy concentration of wired broadcasting in Eastern Europe. In the U.S.S.R., where the service dates from 1924, 'in the near future... the number of wired broadcasting [sets] is to reach 35 million.'[2] In Poland, for example, some 3,700 centres in 1954 transmitted programmes to 1,600,000 loudspeakers and wired receivers installed in State farms, agricultural co-operatives, factories, hospitals, clubs, households and schools.[3] There are also well over 4 million independent receiving-sets. In Rumania about half of all sets are wired receivers. The pattern is similar in Bulgaria and Hungary. Even Czechoslovakia, which is well equipped with radio sets and manufactures more than it needs, has installed an appreciable number of wired sets. Under its latest five-year plan, Albania is undertaking a broad extension of its wired network.[4]

The great disadvantage of wired broadcasting is that the listener has no say in the selection of programmes and must take what the broadcasting organization chooses to give him. On the other hand, the listener possessing a radio set which can pick up medium- and high-frequency broadcasting has theoretically a greater choice of programmes from his own country or from abroad. He may not make frequent use of this choice, but it still remains available. Moreover, if the listener is unable to roam the ether with his receiver, nations will find it even more difficult to speak directly to each other and a formidable barrier will have been raised against the free flow of information which is becoming increasingly necessary as technical advances bring the world's peoples closer together.

uses of broadcasting

But what of the uses to which these transmitters are put? In countries where broadcasting is organized as a public service or a State-controlled monopoly, a certain number of transmitters will, as we have seen, be needed to meet the minimum requirement, i.e., to provide at least one basic programme for all listeners. It is not always possible, however, to provide a standard national broadcasting service for the whole of a country. Internal language differences are a major reason. A remarkable number of States include substantial linguistic minorities, among them being Austria, Belgium, Canada, Finland, Czechoslovakia, Poland, Switzerland, U.S.S.R., United Kingdom, and Yugoslavia. Although few of the States equal Switzerland, where a full broadcasting service is provided in three different languages (German, French and Italian), most of them schedule a number of regional programmes to maintain cultural traditions and cater for ethnic particularisms. The linguistic problem also affects almost all of the Asian and African countries and some of those in Latin America.

Transmitters are also required to provide a good selection of programmes. In private broadcasting, variety is generally assured through competition between stations, but as the *raison d'être* of this system is to secure the maximum number of listeners, programme content is often decided on the principle of the 'highest common factor'—which may result in an extremely low level of intellectual fare. The desire for popularity is seldom compatible with improvement of public tastes and artistic standards and there are few commercial networks which can afford to sacrifice popularity to less material considerations.

1. See appendix, page 147.
2. International Broadcasting Organization (OIR), *OIR Documentation and Information Bulletin*, No. 4-5(58), September 1956.
3. *World Communications*, Paris, Unesco, 1956.
4. International Broadcasting Organization, op. cit.

It should not be forgotten, however, that in countries where broadcasting is not a public monopoly, commercial stations are not the only ones on the air. Anyone with a licence and the necessary funds can operate a transmitter, and in the United States the universities in particular have seized upon this opportunity to use broadcasting for education. Extra-mural and extension courses are widely transmitted, and in some cases regular courses for which students can obtain academic credits.[1]

In countries with a statutory radio monopoly or similar system, the authorities are morally obliged to use broadcasting to reflect national cultural achievements so as to justify their control of the medium. Although they may be less tempted to lower programme standards by giving only what the majority prefers, there is the disadvantage that programmes may become unduly narrow and nationalistic, or reflect only the tastes of the system's controllers. However, the authorities in these countries likewise appreciate the need to cater for the widest audience, and are aware of the fact that 'highbrow' programmes are not to everyone's liking. Consequently, most countries with a highly developed system provide a second programme, usually lighter in content.

It would obviously be out of place in a study of this kind to attempt a content analysis of the programmes of all countries or any large group of countries engaged in broadcasting, even if the information were readily available. The following two examples, Canada and Czechoslovakia, will however give some indication of the programme emphasis that is found under two systems of control. In view of its special importance to the free flow of information, news will be treated separately and to a greater extent in the following subsection.

In its 1957 study, the Royal Commission on Broadcasting in Canada examined the programme output of various classes of Canadian radio stations.[2] The study revealed that in a typical week in 1957 the programme emphasis of four stations of the Canadian Broadcasting Corporation's Trans-Canada network was as shown in Table 1.[3]

TABLE 1

Programme class	% of total time	Programme class	% of total time
Serious music	16.2	Agriculture, fisheries, etc.	3.8
Light music	10.5	Serious drama	3.1
News and weather	9.5	Variety	2.9
Popular music	8.4	Political and public affairs	2.8
Old-time and western music	5.7	Social and human relations	2.2
Domestic drama	5.5	Family living	2.2
Youth educational	5.3	Sports news	1.5
Fine arts and literature	4.8	Sports events	1.4
Canadian activities and heritage	4.4	Comedy	1.4
Religion	4.4	Other[1]	4.0

1. The remaining 4 per cent included the following classes of programme which took up less than 1 per cent of total air time: Nature and science, foreign lands and peoples, miscellaneous information, 'feedback' programmes, crime or western or action drama, personalities, fairy tales, childrens' variety, childrens' quiz games and contests, other childrens' programmes and programme promotion.

1. There are now about one hundred and sixty-two such stations in the United States as well as a number of stations engaged in religious broadcasting. The size of the audience has also made it feasible for several stations (particularly FM) to broadcast 'good music' programmes and similar forms of entertainment on a partially sponsored basis.
2. For a discussion of the organization of Canadian radio, see page 43.
3. The programme breakdown given below for the Canadian Broadcasting Corporation (CBC) and Canadian private French-language stations exclude advertising messages,

A different emphasis is manifest in the content breakdown for eight private enterprise French-language stations in Canada (see Table 2).

TABLE 2

Programme class	% of total time	Programme class	% of total time
Popular or dance music	53.5	Sports news	2.6
News and weather	9.8	Domestic drama	2.5
Religion	5.8	Quiz, games and contests	1.5
Light music	5.6	Canadian activities and heritage	1.2
Old-time or western music	4.0	Agriculture, fisheries, etc.	1.2
Serious music	3.1	Other[1]	6.5
Family living	2.7		

1. The remaining 6.5 per cent included the following classes of programmes each of which took up less than 1 per cent of total air time: foreign lands and peoples, political and public affairs, social and human relations, miscellaneous information, 'feedback' programmes, fine arts and literature, merchandising, readings with music, serious drama, other drama, variety, personalities, sports events, youth education, children's crime or action or western drama, children's variety, childrens' quiz and games, other childrens' programmes and programme promotion.

Material on Czechoslovakia is less detailed but is still adequate to give a general picture of how radio is used. The Czechoslovak radio broadcasts three main programmes in Czech—Prague I, II and III—and three main programmes in Slovak—Bratislava I, II and III. The structure of the two networks is similar. The Czech system also includes serveral regional stations with a degree of autonomy.

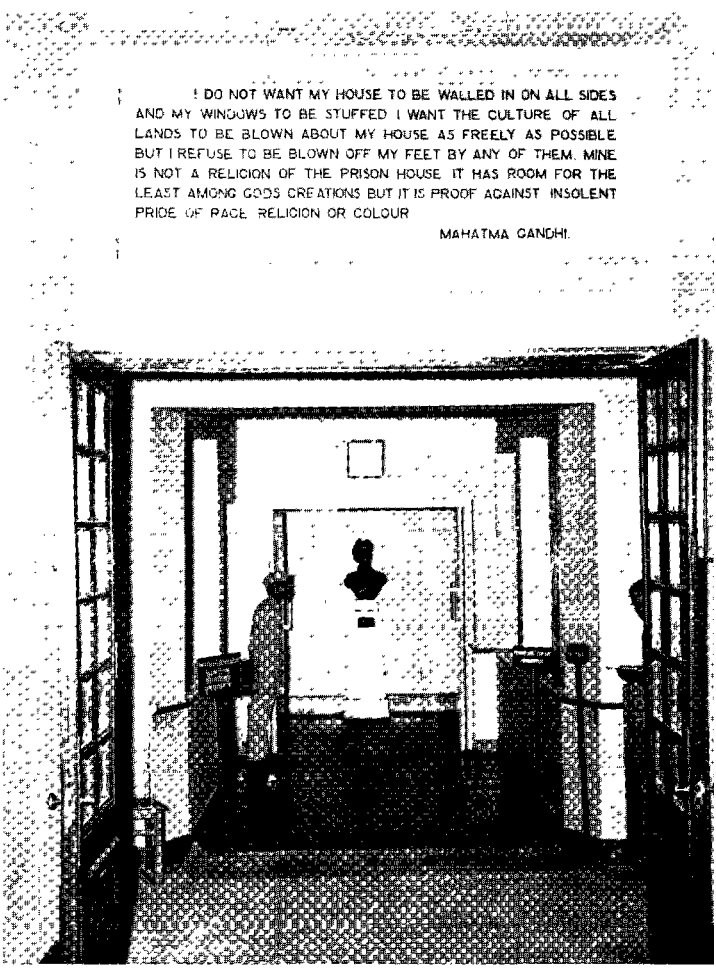
The Prague network is organized in the following manner. Prague I is the principal Czech-language station, being heard throughout Bohemia and Moravia and on it are broadcast the more important programmes. Prague II can be heard throughout Czechoslovakia and its programmes are oriented towards the non-urban population. Seventy per cent are given in Czech and 30 per cent in Slovak. Prague III is the Czech wire-broadcasting service feeding programmes to loudspeakers in public places, restaurants, stores, hotels, hospitals and the like. It produces 38 per cent of its day-time and 58 per cent of its evening programmes. Because of its specialized audience, the programmes of Prague III 'are mostly amusing and recreational'.[1]

Prague I provides a good example of Czech programming. It is on the air from 4.30 to 24.00 hours and its normal broadcast day is divided into seven major sequences. The first takes place from 4.30 to 8.00 hours and is composed of three news bulletins and programmes intended for workers leaving for work and students leaving for school. These programmes include physical culture, light music, reading of editorials from *Rudé Pravo* and a language course. The second sequence occurs from 8.00 to 11.30 hours and is intended principally for workers on the afternoon shift, farmers, children who go to school only in the afternoon and housewives. These broadcasts include news, light and popular classical music and special programmes for women and children.

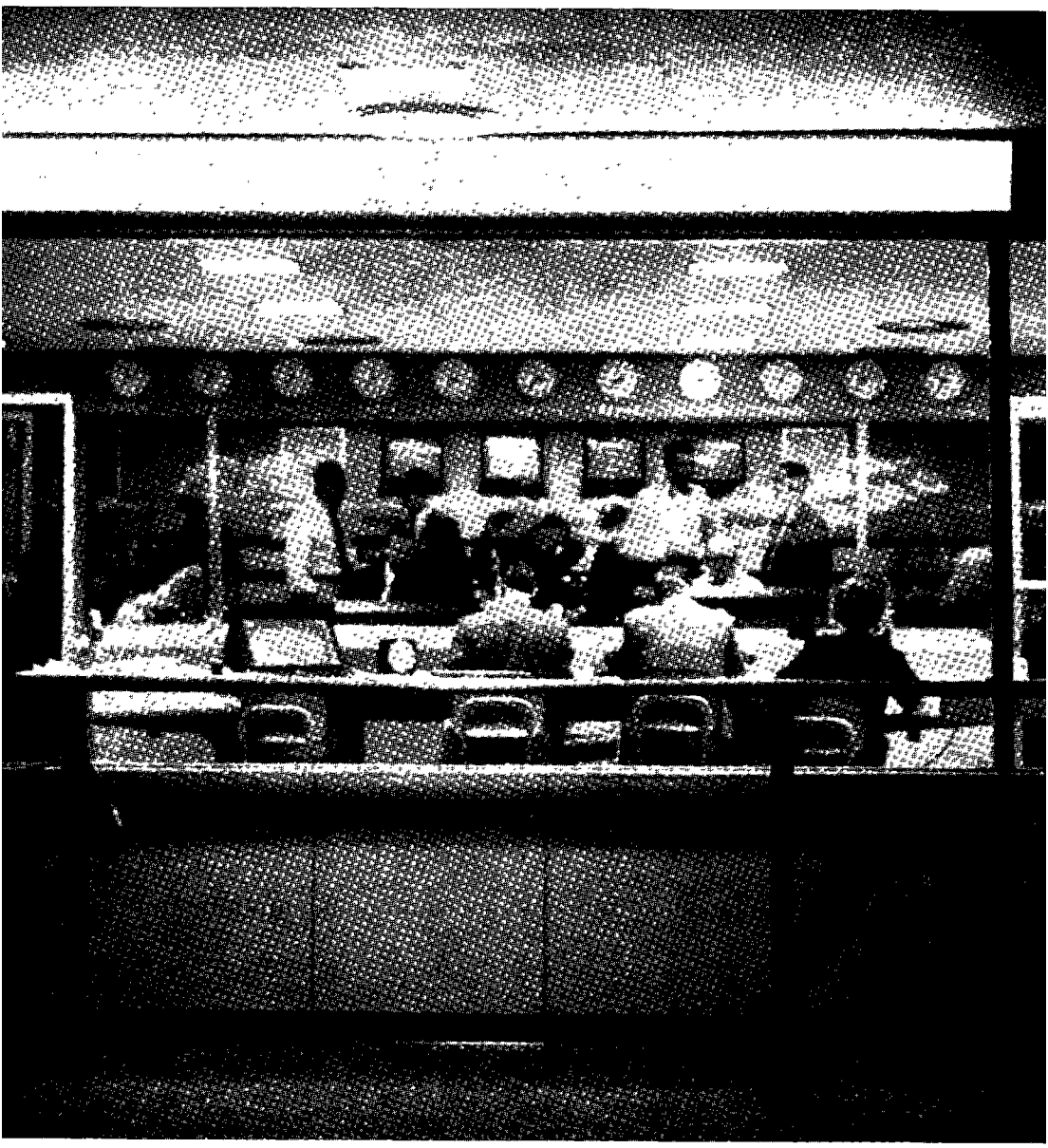
The third sequence over Prague I is between 11.30 and 14.00 hours in which

which accounted for 2.5 per cent of total CBC Trans-Canada broadcasting time, and 7.3 per cent of the private unafiliated French language station time.

1. See Organisation Internationale de Radiodiffusion, *IVe Session de la Commission des Programmes de l'OIR, Moscou, Mai 1958*, Document No. PK-PL/IV-2a/58.



Mahatma Gandhi records a prayer address for broadcast by All-India Radio. Below is a declaration by Gandhi inscribed over the entrance to AIR studios, New Delhi. [Government of India.]



Control room of the National Broadcasting Corp., New York.
[National Broadcasting Corporation – Bob Ganley.]

emphasis is placed on the midday news, with some agricultural advice and light music and opera. The fourth takes place between 14.00 and 17.00 hours. The early part of this sequence is devoted to programmes for children of pre-school and school age. The second half is recreational, for those returning from work, interspersed with news bulletins.

A fifth and very important part of the broadcasting day occurs between 17.00 and 19.00 hours when most workers have returned home. The emphasis of this sequence is on educational programmes including such topics as scientific and technical problems of industry. The sixth section of the day's broadcasts is between 19.00 and 22.00 hours. The first hour is given over to news of all types, foreign and domestic. Between 20.00 and 22.00 hours the principal artistic programmes of the day are broadcast, including such items as folk music, plays, concerts, lectures by authors and a final news report. The seventh and final section of the Prague I broadcasting day, from 22.00 to 24.00 hours consists of symphonic music, light music and poetry readings. The content of the evening programmes varies according to the availability of material and the day of the week.

Programmes on the different networks are co-ordinated. For instance, if there is a spoken programme on Prague I there will be a musical programme on Prague II, or if there is a light musical programme on Prague I there will be a classical programme on Prague II.

News

One of the major attractions of broadcasting is the news, which enables listeners to learn what is happening at home and in the outside world. The transmission of news and information was the first use made of broadcasting, and in this field radio has an unassailable advantage over every other medium, since the broadcast travels with the speed of light and thus achieves 100 per cent immediacy. The time required to disseminate news is thus reduced to the minimum—the period needed to collect information and transmit it to a broadcasting station. Consequently, news bulletins and related items, such as sports news, interviews, reports on current events, press reviews and political commentaries figure prominently in the schedules of almost all broadcasting systems. The Radiodiffusion-Télévision Française devotes no less than 20 per cent of its time to 'spoken newspaper' programmes. This figure is not exeptional for domestic non-commercial broadcasting systems.

The 'spoken newspaper', however, is rather a misnomer for a news programme. Newspapers have largely surrendered to audio-visual media the task of reporting basic 'news of the day' and are increasingly concerned with providing interpretations of the news, opinions, or in many cases, light entertainment. Exaggerations or distortions by any one newspaper may, moreover, be corrected by freedom of the press where it is effectively enjoyed. Broadcasting, unlike the press, is not available to all shades of opinion for financial and technical reasons, among others, and because there are few dissentient voices, broadcast news often acquires a reputation for authority and objectivity.

Relatively few listeners can, in fact, criticize broadcast news at all. Since radio is largely the first in the field, it is well-nigh impossible to cross-check its ephemeral message with other information media, unless the message is recorded and compared with other accounts. Not many people can discern the the careful phrasing of a statement that is calculated to mislead without being strictly untrue, or supply the essential omission that gives significance to an event hours or even days before the newspapers and the newsreels reporting it are available.

Legislation for News Broadcasts

News is the raw material of public opinion and he who controls its presentation can implant a body of facts and arguments that can mould the outlook of a nation, or marshall the support of millions. In countries organized on a multi-party system, objectivity in news presentation is, therefore, considered essential. 'The announcer reading the news is potentially addressing a whole people, without distinction of opinion, residence, religion, age or sex; he must therefore win the unanimity of this immense public and never impair it.'[1] A number of States which permit commercial broadcasting have thought it necessary to enact legislation to prevent the dissemination of misleading information by radio. For example, Canada's statutory regulations for broadcasting stations (public and private) stipulated, *inter alia*, that no one shall broadcast false or misleading news. The Colombian decree No. 1966 of 1948 provided in Article 10 that 'No radio communications station may transmit anything... which contains false or tendentious reports...'. The United States Communications Act of 1934, as amended, enables a broadcaster's licence to be suspended for transmitting 'false or deceptive signals or communications'. Article 44 of the Japanese Broadcasting Law of 2 May 1950 ordained that the Japan Broadcasting Corporation 'shall broadcast news without distorting the facts'.

States having a single nation-wide broadcasting system have an additional problem to cope with—that of ensuring that the radio news is not deliberately slanted in favour of some sectional or political interest. The Belgian decree of 28 June 1930 provides that 'the information... broadcast by the National Broadcasting Institute shall be of a strictly impartial nature' and the daily news bulletin 'must give the news in a concise and completely unbiased form'. In Italy, a parliamentary control commission has been set up to see that 'the political independence and objectivity of all news broadcasts are duly safeguarded'.[2] In Denmark a programme committee on which all political parties are represented watches over news and other broadcasts, and thus ensures that the Danish radio's news policy cannot be dictated by the government of the day. Many other countries have analogous safeguards. In many cases impartiality is achieved by the way in which the broadcasting services are constituted and organized. Distortion of news need not, however, be the handiwork of the radio editor but may be due to the bias of his news sources.

The most obvious source is the news agencies, on whose world services various broadcasting authorities rely almost entirely. Many radio organizations maintain their own correspondents in major countries abroad and dispatch reporters to cover important events. These correspondents in general provide interpretative 'background' items on notable occurrences and political trends. News broadcasts from abroad are a further vein of information. For example, the BBC maintains a monitoring service with a large staff working night and day, intercepting and reporting broadcasts received from countries throughout the world in 50 languages. The BBC also has 'close contacts with the Foreign Office and other government services, which, though they have no influence on the content of news bulletins, have at their disposal sources of information making it possible to verify and complete news arriving from all parts of the world.'[3]

Under commercial broadcasting systems there are few mandatory limitations on news sources. In Brazil, however, all private stations are obliged to relay a daily information programme, 'Hora do Brasil', distributed by the government through the national news agency. Government information is similarly diffused

1. Georges Hourdin, 'L'information au XXe siècle' in *Le Monde*, Paris, 4 February 1958.
2. Legislative decree of 3 April 1947.
3. BBC, *Ici Londres*, 25 January 1957, quoted in: *EBU Bulletin*, Vol. VIII, No. 42, March-April 1957.

in Paraguay as regards news bulletins broadcast by the national State radio station. In Cuba a decree of 24 January 1948 states that 'news bulletins may be issued from a commercial radio fulfilling the necessary legal conditions ... only by radio press enterprises' which are duly registered as such and which must obtain a special licence from the Ministry of Communications.[1]

There are several national systems, however, whose charters expressly empower them to use the news services as they think fit. This is the case of the BBC, in the United Kingdom, and similar provisions exist in some other British Commonwealth countries. It may be noted that radio stations are not always able to obtain the normal news agency services. In New Zealand, the Press Association decided not to sell news services rights to the New Zealand Broadcasting Service, thus handicapping it in broadcasting home news. Official news is supplied by the Tourist and Publicity Department and is supplemented with other domestic news partly obtained by the service itself, which obtains overseas news from the BBC and other official radio transmissions.

Legislators are often suspicious of foreign news sources. Consequently, broadcast news has frequently to be taken from a specified source, presumably to ensure that at least one version of the news conforms with public policy. In Denmark, news and other information may not be broadcast unless an agreement has been concluded with the Danish news agency for the transmission of such items. In Turkey, all news broadcasts are prepared by the Director-General of the Press. In Switzerland the conceding authority reserved the right to decide which agencies are to supply news for broadcasts, sole rights to do so being vested in the Swiss Telegraphic Agency. The agreement governing the Swedish radio confers a monopoly on the 'telegraphic agency of the Swedish press'.

Although correspondents employed directly by broadcasting organizations are not normally subject to legislative regulation, broadcasters generally avoid engaging foreign nationals as regular contributors in their news services. Writing of the Community of French-language Programmes, René Dovaz, of Radio Geneva, declared: 'Undoubtedly the danger of political influence might become a real one if the existence of the Community... tended to introduce more elements of foreign origin into the Swiss news services.'[2] A step in the opposite direction, however, is marked by the BBC experiment reintroduced in February 1956 with the series entitled 'Radio Link'. In this service nationals of various countries speak from their capital cities and exchange views on issues of common interest.[3]

Cultural Influence

The controls which have been thrown around the newcast testify to the impact of the spoken word and it is this quality which makes radio valuable as an educational medium. Many countries have enlisted broadcasting as an aid in formal class-room tuition, and are able by this means to bring the services of educators to a wide audience of schoolchildren and students. In certain parts of Australia, for example, radio correspondence courses are the only form of tuition available to children living in outlying areas. Mention may also be made of the BBC's broadcasts for schools, the International University of the Air broadcasts over the French network, and the university extension work carried out in the United States by the National Association of Educational Broadcasters, grouping some one hundred and thirty private stations operated by universities and similar institutions.[4]

1. Fernand Terrou and Lucien Solal, *Legislation for Press, Film and Radio*, Paris, Unesco, 1951, p. 145 (*Press, Film and Radio in the World Today* series).
2. *EBU Bulletin*, Vol. VII, No. 39, September-October 1956.
3. *Radio Times*, 27 January 1956.
4. See also Chapter 4 and Bibliography.

Education, however, is not the only sphere in which outstanding personalities can be brought into direct contact with the listening public. The broadcast audience is so large that it warrants employment of the best talent in every field, from dance music and variety to serious forms of cultural entertainment. The opportunities which broadcasting provides for acquainting rich and poor alike with excellence in artistic fields make it an invaluable instrument for raising cultural standards. It can even influence popular linguistic habits, a most conservative aspect of national character, and contribute to public enlightenment in many other ways.

how systems of control evolved

The attributes of broadcasting, viewed in conjunction with the vastness and impressionability of the radio audience, are eminently matters of concern to governments. Reactions of governments to broadcasting have been diverse. Some have put it into uniform, so to speak; others have tried at least to ensure that it will exert a positive influence for the general good; while others have been content to let it pursue its own path so long as it did not actually run counter to public policy or undermine national security and national welfare.

Technically, the imposition of some control over broadcasting was an inescapable necessity in every country. As we shall see later,[1] the physical phenomena associated with radio-electric transmission make it impossible to accommodate more than a very limited number of transmitters on the wave bands suitable for medium- and long-range transmission if an unbearable amount of interference is to be avoided. The machinery for the initial regulation of broadcasting was already in hand, however, because radio had first been used in the field of wireless-telegraphy; and since telegraphy itself had in nearly all cases been utilized by national administrations, States by analogy appropriated to themselves the monopoly of the new medium of Hertzian transmission.[2] Anyone wishing to use a radio frequency therefore had to obtain a licence from the State, which could impose any conditions it thought fit.

'Private enterprise' broadcasting, which developed widely in the Americas, is, socially speaking, the most rudimentary system. This, of course, implies no judgement on the relative merits of commercial versus national systems from the legal or technical point of view. The case for commercial organizations has always been based on the premise that broadcasting is an organ of expression, and hence a vehicle of opinion, comparable to a newspaper, and that the customary guarantees of freedom of speech and expression should also be applied to it. However, the arguments for commercial radio have also been coloured by the assumption that competition in all fields is a salutary thing, productive of greater achievements and better service to the consumer.

It was not long after the birth of broadcasting, however, that a number of countries proclaimed broadcasting to be a State monopoly and placed technical installations, again presumably by analogy with telegraphy, under the control of national postal and telegraph administration. Concessionary companies were allowed to continue under licence with the status of programme contractors, sometimes (as in France and Portugal) side by side with official services. A situation of this kind prevailed in Algeria (where the service was entrusted to a listeners' society), France, Germany, Hungary, Italy, Luxembourg and other countries. In Luxembourg the arrangement has continued up to the present. A similar situation continues in Italy where, although the company has changed,

1. See Chapter 5, 'Use of the Radio Spectrum'.
2. See Chapter 1; and cf. the British Wireless Telegraphy Act, 1904; the United States Radio Act, 1912; the French Act of 30 June 1923 (Article 85), etc.

the majority of stock in the Radiotelevisione Italiana (RAI) is controlled by the State.

Although licences were usually revocable, the State's influence was rather negative, being limited to securing observance of its regulations. In other words, a government could suppress flagrant abuses, in so far as it could bring them under regulation. As broadcasting services grew in importance, a number of countries concluded that the State should have a voice in policy-making and exert more positive control over daily operations. If the legal status of the concern was a joint stock company, the only way of exercising such supervision was to contribute part of the capital. This was the solution adopted in 1924 in Austria, where 82 per cent of the RAVAG stock was publicly owned, in Rumania where private interests were not allowed to hold more than 40 per cent of capital, and in Turkey where the Turkish Wireless Telephony Co. was established in 1927.

The following decade, characterized by the economic depression and widespread social and political stresses, saw an extension of State participation in Europe. In Czechoslovakia and Germany, the State became the majority stockholder in concessionary companies, and in Finland and Poland the government owned no less than 90 per cent of capital. Swedish radio continued to be run privately but the State had a majority on the board of directors. In the Netherlands the State owned 60 per cent of stock in the company operating transmitters.

Active State Participation

This form of organization was at best an empirical solution. Private interests could well argue that broadcasting was in essence a spoken newspaper. But European opinion sensed that it was potentially much more an incomparable vehicle for ideas and cultural enlightenment on the one hand, and an almost irresistible instrument for propaganda and indoctrination on the other. It was generally felt that broadcasting was an activity *sui generis*, something so different from earlier communication media, and so incomparably more intimate and effective, that it could not be left in private hands.

Nationalization is a tried remedy in difficult cases, and it is understandable that a number of countries should have regarded broadcasting as 'a public service which for general reasons of national security, discipline and control' should be the responsibility of the State as the embodiment of the community. Moreover, where the material facilities were controlled by the postal authorities 'it often seemed contrary to all sense and logic . . . that an owner administration could not operate installations which it had created out of nothing.'[1]

As early as the 1920s, the official services in Sweden (1924), Latvia (1925), Lithuania and Ireland (1926) and Yugoslavia (1927) had been transferred to the postal administrations. In France the postal administration was given control of part of the French network in 1936, although 12 private organizations were allowed to continue commercial broadcasting; a similar transfer took place in Algeria and Turkey in 1957. Previously, in 1931, the U.S.S.R. had brought its broadcasting service under direct governmental control, through the Central Committee for Broadcasting appointed by the Council of People's Commissars.

In Germany, with the advent of National Socialism, broadcasting became an official institution directly controlled by the State and the Nazi party through the Reichs Propaganda Minister. In the Federal Republic of Germany broadcasting is conducted by a number of corporate bodies set up under public law but exempt from State control. Italian broadcasting, though monopolized by a private company, is like a government service, the State exercising direct

1. Jean Gantelme, 'From Private Enterprise to the Idea of Public Service in Broadcasting', in *EBU Bulletin*, Vol. I, No. 1, 15 May 1950.

influence through the Minister of Popular Culture on station management and programme composition. A less direct form of government control was introduced in Denmark, where the Statsradiofonien or national service was placed under the Minister of Education and, for the technical side, the Minister of Public Works. Similar measures were adopted in Norway where Norsk Rikskringkasting came under the Minister of Education and Religious Worship.

Another group of countries, of which the United Kingdom was the leader, meanwhile adopted an entirely different approach. While recognizing the status of broadcasting as a public service, these countries considered that a service catering to the general public should be removed from partisan politics as far as was compatible with the public policy and law and order. Although the extent to which any government retained ultimate control varied widely, the basic intention was to have a broadcasting authority acting as a trustee for the national interest, to use the words of the BBC.

After a short period of operation by a private company, the British parliament decided to vest the broadcasting service, as from early 1927, in a public corporation established by Royal Charter. This body, the British Broadcasting Corporation, was given the broadcasting monopoly by licence for an initial 10-year period. The BBC was ultimately answerable to parliament, and although the Postmaster-General might take responsibility for broad policy issues and specifically reserved a formal power of veto over programmes, domestic policy and routine control questions, including the choice of programmes, were left almost entirely to the BBC governors.[1] In 1930 Belgium set up a similar public 'foundation', though at first without a broadcasting monopoly. This body, the Institut National Belge de Radiodiffusion, has a board of management with the Minister of Communications as chairman and including representatives of the Walloon and the Flemish communities, as well as of political and religious groups. Day-to-day administration is left largely to the Institut. A similar motive of non-interference prompted Switzerland to establish in 1931 the Société Suisse de Radiodiffusion, an amalgamation of non-profit-making regional broadcasting organizations. The society was given the concession to transmit programmes as a public service 'from a purely idealistic standpoint'.[2]

World War II all but ended private enterprise broadcasting in many countries, particularly Europe. Whenever a country was occupied one of the invader's first acts was to requisition transmitting facilities and bring broadcasting under direct political control. Even countries which escaped invasion found it necessary to mobilize broadcasting to aid the war effort. This trend was hastened by the switch to centralized forms of government in Eastern European countries, the People's Republic of China and later, smaller countries such as the People's Republics of Korea and Viet-Nam. In Europe today, private enterprise lingers on only in a few countries, such as Andorra, Luxembourg, Monaco, Portugal and Spain, although in Portugal and Spain it exists side by side with a State-owned organization.

european systems

Today broadcasting is a monopoly under the direct State control and operated as a government department with continuous programme supervision in Albania, Bulgaria, People's Republic of China, Czechoslovakia, German Democratic Republic, Hungary, Poland, Rumania, U.S.S.R. and Yugoslavia, to cite only a few cases. It is operated as a public service monopoly with definite autonomy and operational independence of the State in numerous other countries, including Belgium, Finland, Federal Republic of Germany (where

1. *BBC Handbook, 1958*, London, 1958, p. 14.
2. Article 15 of the Deed of Concession.

the various broadcasting organizations are public corporations), and Italy (where it is run by an almost entirely State-owned company), Switzerland, and United Kingdom. In France, Denmark and Norway, the organizations have a legal status like that of a government department. Advisory bodies have, however, been set up to ensure that impartiality is attentively preserved in the programmes. The Netherlands system is of a special type which is referred to below. All of the latter countries have been considerably influenced by the United Kingdom system.

The U.S.S.R. and Rumania provide good examples of broadcasting organizations under State control. In the U.S.S.R. the State Committee for Radio and Television of the Council of Ministers organizes and directs the central broadcasts from Moscow and provides local broadcasting and television with technical help and advice on methods and production. In the republics, broadcasting and television are under the direction of the corresponding organs of the Councils of Ministers of those republics, and in the various regions and territories broadcasting is under the control of local broadcasting organizations (committees or bureaux).

Radio Moscow, the main broadcasting centre, transmits three simultaneous programmes throughout the Soviet Union. One hundred and thirty-two additional programmes are broadcast in the republics, territories and regions.

In Rumania the basic code is Decree No. 216 of 23 May 1949, which provides that 'the right to broadcast words or music . . . with or without wires belongs to the State' (section I). Exercise of this right is entrusted to a 'Broadcasting Committee attached to the Council of Ministers' and composed of a chairman and three to five vice-chairmen appointed by decree of the Council of Ministers, and a variable number of other members appointed by the chairman. The Rumanian radio is required to 'assist in carrying out the government's policy by preparing and broadcasting . . . such programmes as will educate, organize and mobilize all workers for the construction of socialism'. The committee is also expected to supervise all programmes drawn up by broadcasting station editorial staffs, and 'promote and extend culture among the great masses of the people'.[1]

Britain and France

The BBC is an example of a national organization which holds a monopoly and in which an attempt has been made to reduce governmental control to the minimum. Its charter empowers it 'to do all matters and things incidental or pertaining to a body corporate, but so that the corporation shall apply the whole of its income solely in promoting its objects', i.e., it is a non-profit-making body. The nine governors who constitute the corporation and one responsible for its operations are appointed by the Queen-in-Council, and not by the government. Governors may be removed at her pleasure, or if they 'become of unsound mind or bankrupt' or absent themselves from meetings continuously for three months or longer. Further they must include three persons selected for their close touch with opinion in Scotland, Wales and Northern Ireland respectively. The corporation is responsible to the Postmaster-General for compliance with the charter. In extreme cases he may recommend that the Queen revoke and make void the charter; he also has powers of approval in various major financial transactions of the BBC. Through the Postmaster-General, parliament thus retains ultimate control of the corporation.

The BBC still requires a licence from the Postmaster-General to conduct its business, as broadly stated in the charter. This licence contains, in addition to purely technical arrangements, certain important clauses relating to programmes.

1. Terrou and Solal, op. cit., pp. 172–8.

First, the BBC is prohibited from receiving 'money or any valuable consideration from any person in respect of the sending or emitting, or the refraining from sending or emitting, of any matter whatsoever ... and shall not send or emit any commercial advertisement or sponsored programme'. On the other hand, it must give a daily account of parliamentary proceedings, and broadcast official notices (missing persons, wanted suspects, etc.). The most important clause, however, is that which declares the Postmaster-General 'may from time to time ... require the corporation to refrain ... from sending any matter or matters of any class'[1] he may specify by notice. This power enables parliament to secure the governors' compliance on matters to which parliament gives basic importance and to have the last word on any issue, i.e., to prevent the broadcasting service from becoming a state within a state.[2] It has been used on four occasions: to prevent broadcasting on controversial topics (1927, withdrawn in March 1928); to prevent the BBC from expressing an editorial opinion on current affairs or matters of public policy (still in force); to prevent the anticipation of parliamentary debates (July 1955, revoked in December 1957); and to ban regional political broadcasting in Wales, other than nation-wide political transmissions (still in force). Subject to these restrictions, the BBC is entirely free and independent, and has undivided responsibility for conduct of programmes.[3] In this it is aided by an elaborate structure of 31 advisory committees and councils, in addition to two National Broadcasting Councils for Scotland and Wales, which control programme policy and content in the Scottish and Welsh Home Services respectively.

France keenly feels the lack of a charter for its national broadcasting system. The law governing the Radiodiffusion-Télévision Française (RTF) results from a variety of enactments having little connexion with one another. On 1 October 1941 and 7 November 1942 the National Assembly adopted two enactments which defined the objects and responsibilities of the broadcasting authority and these still constitute the RTF's organizational basis. Two other important enactments were the legislative decree of 29 July 1939 which took broadcasting away from the postal authorities and gave it the status of an independent government agency, an 'administration', and the ordinance of 23 March 1945 which annulled all licences to operate private stations.

Since 1945 the RTF has been operated as an *administration spécialisée*, a government agency with a budget accessory to the State budget. The RTF is attached directly to the prime minister's department; the authority may be delegated to a minister or under-secretary of State.[4]

In the view of some observers, the RTF is hampered in its daily operations by a lack of independence and flexibility which is inevitable under the financial restrictions imposed on a government department. Examples of such limitations are requirements for prior authorization of financial commitments, and civil service salary restrictions which put the agency at a considerable disadvantage in obtaining qualified staff.

The RTF is headed by a director-general, who is appointed by decree and is responsible to the prime minister, or the minister or under-secretary in charge of broadcasting. This official is assisted by a higher council, also appointed by the prime minister, which acts as a board of governors, though these functions as initially planned in 1942 have been appreciably curtailed.[5] The director-general is also advised by a programme council of four *ex officio* members and 12 others appointed by the prime minister, or his delegate, on the recommendation of the director-general, and by four specialized committees.

1. Clause 15 (4) of the Licence and Agreement, 12 June 1952.
2. *BBC Handbook, 1958*, p. 16.
3. ibid., p. 20.
4. *EBU Bulletin*, Vol. VII, No. 39, September-October 1956, p. 639.
5. ibid.

Although this legal framework would appear to offer possibilities for almost unlimited governmental control, such control as exists has usually been exercised discreetly. However, it cannot be denied that broadcasting tends to be regarded rather as the handmaiden of the government. When, for example, the State or a nationalized undertaking wishes to float a loan, the RTF is enlisted to extol the bond issue's merits with almost revivalist fervour. Frequent legislative efforts have been made to give the RTF a permanent *statut* or charter.

systems in the americas

While a trend towards monopoly broadcasting was becoming apparent in Europe, broadcasting in the Americas proceeded along different lines. Following the United States example, most of the American countries permitted private enterprises to exploit commercial broadcasting. But while these countries have continued to encourage private enterprise, government regulation has become increasingly evident.

United States of America

The movement towards government control is clearly traced in the United States. As noted in Chapter 1, application of the principle of complete freedom, coupled with a refusal of the courts to permit regulation without express legislative sanction, led to a chaotic situation in the use of frequencies by 1927. 'The chaos that developed as more and more enthusiastic pioneers entered the field of radio was indescribable', Charles Siepmann has observed.[1] It became technically necessary to establish a governmental commission to allocate specific frequencies and control transmitting times of the hundreds of broadcasting stations on the air. This was accomplished by the Radio Act of 1927 and the creation of the Federal Radio Commission (FRC). Although the FRC was not invested with authority to control programmes, it speedily initiated reforms under which it established a yardstick for measuring station performances and denounced abuses in advertising.

The government's efforts to regulate broadcasting were further reinforced by the passing of the Federal Communications Act of 1934. This act established a permanent Federal Communications Commission (FCC) to replace the Federal Radio Commission. The new agency, a public body of seven members appointed by the President of the United States with the Senate's approval, shortly became the keystone of the United States broadcasting structure and initiated an increasing trend towards regulation and control. The FCC was authorized to issue licences for stations and decide on all technical matters calling for regulation; it was also given wide powers over the formation and operation of radio undertakings.

The Radio Communications Act (Section 326) expressly stated that the commission had no authority to censor material broadcast from any station, or draw up rules or lay down conditions of any kind contrary to freedom of expression through broadcasting.[2] Congress thus paid lip-service to the early notion of broadcasting as a forum of opinion, a kind of newspaper provided free of charge over the ether, the cost of which would be paid by the advertisers.

But this conception, which implied the same guarantees of freedom of speech as for the printed press, has lost ground. Although freedom of expression is the right 'of the individual citizen to communicate his ideas and proposals to his

1. Charles A. Siepmann, *Radio, Television and Society*, New York, 1950, p. 6.
2. Terrou and Solal, op. cit., p. 139.

fellow citizens without prohibition or interference',[1] the effect of the FCC's licensing powers was to confine that right, in broadcasting, to the licensees of the relatively few available frequencies. The issue of licences was in fact limited by other considerations than the mere shortage of frequencies. An authorization to broadcast had to conform with the public interest, convenience or necessity, in the FCC's discretion; it could only be granted to applicants with the necessary legal, technical, financial and other qualifications; and no licence could be issued to a foreigner or a company headed by a foreigner, or having considerable foreign capital. The position was well defined by Judge Frankfurter at a later date (1943): 'Unlike other modes of expression, radio inherently is not available to all. That is its unique characteristic, and that is why, unlike other modes of expression, it is subject to governmental regulations. . . .'[2] He also recognized that the debate during the passage of the Federal Communications Act showed that the powers granted to the commission went beyond the mere technical domain and could be used to issue regulations concerning broadcasts and broadcasting networks, provided that any measures taken were in accordance with the aim which the law envisaged.[3]

Broadcasting in the United States was in fact coming to be recognized as a public service, rather than the private prerogative of a licence holder, and it was natural that the FCC, as the duly constituted supervisory authority, should exert correspondingly wider control and inspection. This evolution was emphasized by the issue on 7 March 1946 of an FCC report entitled *Public Service Responsibilities of Broadcast Licensees*, in which it outlined directives for the guidance of broadcasters. The FCC may decide where transmitters shall be situated and what area each shall cover, together with the categories of equipment to be used; should the need arise it may oblige stations to maintain a certain quality in their programmes, to ensure equality and impartiality, and it may prohibit subversive or obscene broadcasts (among others). The transmission of false or deceptive signals or communications is cause for revocation of a licence.[4] The FCC also resists concentration of broadcasting power by limiting to seven the number of stations that can be owned by any individual or firm in a given area.

Latin American Countries

In most Latin American countries, broadcasting is organized on a commercial basis. Powers of regulation and control are, however, normally vested in a branch of government and not exercised through an impartial body such as the FCC in the United States. Control is exercised through the usual machinery of the penal law, and in addition the State is usually empowered to revoke broadcasting licences at any time, with or without compensation to the licensee. The effect is to provide a somewhat variable code of broadcasting regulation with emphasis on the suppression of abuses.

In addition to detailed regulations on the technical organization and working of the services, most of the laws and regulations contain a prohibition against certain types of broadcasts, especially libellous, defamatory, subversive or obscene matter and broadcasts of a nature calculated to create panic, alarm or despondency. A frequent provision is that only nationals of the country concerned may hold broadcasting licences, and in certain cases (e.g., Panama) individual broadcasters must hold an official licence.[5]

Pursuant to the Cuban Legislative Decree No. 653 of 29 January 1953 it is an

1. Canadian Royal Commission on Broadcasting, *Report, 1957*, Vol. I, pp. 83–4.
2. National Broadcasting Co. Inc., versus United States (319 U.S. 190 (1943)).
3. Terrou and Solal, op. cit., pp. 139–40.
4. Federal Communications Act of 1934 (as amended), Section 303 (m) (1) (D) (i).
5. Decree No. 1124 of 15 September 1952 governing operation of radio stations, Article 15.

offence, *inter alia*, to use slang or incorrect expressions, to broadcast in languages other than Spanish, except when special authorization is given, to transmit profane or immoral material, or to broadcast unofficial information about cyclonic disturbances. Unofficial reports of earthquakes are also prohibited under regulations issued in Colombia, which further provide that not more than 20 per cent of programme time may be devoted to commercials, that not more than 20 per cent of actors may be of non-Colombian nationality, and that at least a quarter of the music must be of popular Colombian origin.[1] Mexico, too, requires that a quarter of the daily programme must be composed of typically Mexican music, and that a special licence must be obtained for foreign-language broadcasts.[2] A fairly common provision, already noted in reference to Brazil and Mexico, is that private stations should relay a news bulletin prepared by a government agency or government-owned station.

other forms

A number of countries, however, have attempted to combine the advantages of both methods by organizing a national network supported from licence or tax revenue, and a private system operating from proceeds of commercial publicity. Examples of this group are Australia, Canada and Japan. It is also noteworthy that although the BBC's sound broadcasting monopoly in the United Kingdom appears to be unshakable, a 'mixed' system of this sort has been adopted in the field of television.

Canada

If Canada had chosen to organize broadcasting as a wholly national system serving all its citizens, considerable outlay would have been necessary for transmitting facilities, studios, etc., particularly since Canada is a bilingual country. On the other hand, an entirely commercial system not involving any public expense might have had results not in keeping with Canada's national character. As a result of its contiguity with the United States, a country with more than ten times its population, Canadian stations would have become outlets of the American networks, if only for financial reasons; in addition, the French-speaking minority would probably have received little or no service in its own language. The solution adopted was to combine public and private ownership in a single system.

The basic organization is a public body, the Board of Broadcast Governors (BBG), which is appointed by the Governor-in-Council and is independent of political or partisan control. This board, established under a new Broadcasting Act late in 1958, has authority over the publicly owned stations of the Canadian Broadcasting Corporation (CBC) as well as private radio and television stations.

The CBC, which was previously both a regulatory and operating body, now continues only in the latter role. Its officers are likewise appointed by the Governor-in-Council. The corporation operates three networks (Trans-Canada, Dominion and French) and owns a proportion of the stations affiliated to them. Private stations may be affiliated to the networks in one of several ways (depending on the type of programmes taken) or may be independent.

The BBG has full control over all network arrangements, the content of programmes broadcast by public and private stations, the nature and amount of advertising permissible, the periods to be reserved by private stations for the broadcasting of CBC programmes, the proportion of time that may be

1. Cf. *Broadcasting-Telecasting*, New York, 22 October 1956, p. 101.
2. Terrou and Solal, op. cit., p. 149.

devoted to political broadcasts and the allocation of such time among parties and rival candidates. In addition, it considers new applications for broadcasting licences. Its recommendations are material with respect to the issue or refusal of licences, which are issued by the Governor-in-Council at the request of the Minister of Transport.

Early in 1959 the BBG began its organizational work by holding public hearings preparatory to drafting new radio and television regulations. Following a review of the quality and output of private stations, it called upon a number of broadcasters to show cause why their licences should be renewed. Previously, licences had been renewed almost automatically by the Minister of Transport. The BBG announced, however, that all applications for renewal would henceforth be carefully scrutinized and that it viewed with disfavour stations which relied for their output on dance music and a few news bulletins, interspersed with advertising.[1]

The Netherlands

The Netherlands broadcasting system also differs from the general rule. Technical facilities belong to the State and are operated by the postal administration. Broadcasting is co-ordinated by the Nederlandse Radio Unie, an association of five listeners' broadcasting organizations which are denominational and political in character. Programmes are provided by all five organizations, which share air time on the two groups of transmitters available for home broadcasting.

Under an act of 1928, these organizations are supervised by a permanent delegate of the Minister of Education, who is assisted by an impartial radio council, the official advisory body on all broadcasting questions. The delegate has fairly extensive powers under decrees issued in 1947. In addition to inspecting programmes he can, for example, suspend broadcasters for infringements of the regulations.[2] To obtain a broadcasting licence, an organization must show that it satisfies religious or cultural needs.[3] Four of the organizations maintain an ideological line which results in a fairly high percentage of educational and cultural programmes (some 60 per cent of total air time). Wired broadcasting, in contrast, has a much greater proportion of lighter fare—a factor which may contribute to the popularity of wired broadcasting in the Netherlands, where this system has a very high density.

financing

Broadcasting is a costly business. Transmission facilities, studios, etc., represent a heavy capital outlay which, incidentally, is increasing with the development of new and more advanced broadcasting techniques. Overhead costs of administration and maintenance are also considerable. Furthermore, the application of a dynamic programming policy with the staging of original musical and dramatic productions, involves heavy fees for professional talent, commissioned works, copyright licences and the like.

In countries where private enterprise is the ruling factor in broadcasting, the problem is relatively simple. Commercial stations are financed either from income from advertisements and sponsored programmes placed with them directly, or by leasing part of their air time to one of the national networks,

1. *The Times*, London, 21 February 1959.
2. Terrou and Solal, op. cit., p. 199.
3. J. de Boer and Phil Cameron, 'Dutch Radio the Third Way', *Journalism Quarterly*, Winter 1955.

which then provide programmes, including advertising, for a certain number of hours a day. In the United States, the 'educational' stations are generally operated directly out of university funds, or more frequently, by non-profit-making foundations which, subject to certain conditions, are exempt from taxation.

In countries where broadcasting is a monopoly, listeners are usually required to take out a receiving licence for which a fee is payable. This fee is frequently collected by the postal authorities, as the original holders of the monopoly of wireless-telegraphy. As a rule the broadcasting organization does not receive the entire amount of the licence fees or listening taxes, as they are variously called, deductions being made for the costs of collection, upkeep of transmitting equipment, suppression of interference, discovery of unlicensed sets and so on. Sometimes, the State appropriates part of the proceeds as general revenue. There is little doubt that the licence fee is a form of tax and not an element in a contract between broadcaster and listener.[1]

Certain monopoly organizations may derive income from other sources. A limited amount of commercial advertising is conducted on the Italian networks. In France, the RTF can in certain circumstances obtain payment for publicity given to bond issues and for semi-sponsored programmes arranged by nationalized companies such as Air France. The regional societies constituting the system in the Federal Republic of Germany may also accept commercial advertising, though in moderation. Publications are a more frequent source of revenue and some organizations derive a large part of their income from them. Examples of such publications are the BBC's *Radio Times*, which has one of the largest circulations in the world (approaching 9 million copies per issue), and the programme schedules published by the five rival Netherlands societies.

international organizations

Because of the frontier-vaulting characteristics of radio, the world's broadcasting depends on a certain degree of international co-operation and co-ordination for its proper functioning. Owing to various political problems and the way broadcasting evolved, this task is not carried out by any one organization but is divided among five.

The first in importance, and membership, is the International Telecommunication Union. The ITU is primarily occupied with the technical side of broadcasting and with the general problem of co-ordinating the three major world telecommunication systems, radio, telegraph and telephone. In its present form, as one of the Specialized Agencies of the United Nations, the ITU derives its authority from the International Telecommunication Convention, as revised at the Plenipotentiary Conference at Buenos Aires in 1952. But it traces its descent directly from the International Telegraph Union, founded in 1865, and is thus the oldest of the universal intergovernmental organizations. With membership from every State and territory, or group of territories, in the world, the ITU is composed of 95 members and five associate members.[2]

The aims and objectives of the ITU, as laid down in the International Telecommunication Convention are, in substance: (a) to maintain and extend international co-operation for the improvement and rational use of telecommunication[3] of all kinds; (b) to promote the development of technical

1. Cf. the judgement of the Italian Supreme Court of 15 October 1955.
2. Status as of July 1958. See Pictograph 5, facing page 106.
3. 'Telecommunication', a word coined in 1932, is defined as 'any transmission, emission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, visual or other electromagnetic systems' (International Telecommunication Convention, Annex 3).

facilities and their most efficient operation with a view to improving the efficiency of telecommunication services, increasing their usefulness and making them generally available to the public; and (c) to harmonize the actions of nations in the attainment of these common ends.

Of the ITU's eight major organs, six are concerned with radio matters. The supreme organ of the union is the Plenipotentiary Conference which has as its major task the revision of the convention. The convention, which is the constitution of the ITU, contains provisions concerning organizations of the union, application of the convention and of the Telegraph, Telephone and Radio Regulations, general provisions relating to telecommunication and special provision for radio. The Plenipotentiary Conference meets in principle once every five years.

To take care of problems arising between plenipotentiary conferences, there is the Administrative Council, composed of the representatives of 18 countries elected by the Plenipotentiary Conference. Although the Administrative Council was originally intended to perform only administrative and financial functions, its authority has been widened over the years to the point where it has become a clearing house for any problem, legal, political, administrative, financial or technical concerning the telegraph, telephone and radio services.

The Radio Regulations, which are annexed to the convention, contain regulations concerning the use of the radio spectrum and technical rules for the operation of the various radio services including broadcasting. The regulations are revised by the ordinary Administrative Radio Conference, which meets normally every five years at the same time and place as the Plenipotentiary Conference. The convention also contains provision for the calling of an extraordinary or special radio conference by a decision of a higher conference, on the application of 20 members, or on the proposal of the Administrative Council. Extraordinary conferences may also revise provisions of the Radio Regulations if such action has been approved by a majority of members of the Union.[1]

The convention also provides for an International Radio Consultative Committee, composed of interested members and associate members of the union and private operating agencies. Its purpose is to provide a forum where those interested in broadcasting and other radio communication may confer, either by correspondence or in meeting, on technical or operational questions. Decisions of this committee are published, in the form of recommendations, by the ITU'S General Secretariat.

The General Secretariat is the organ of liaison between radio administrations throughout the world. With it are deposited the instruments or ratification of the convention. It publishes and distributes documents dealing with radio and provides the secretariat for conferences.

The ITU also includes an International Frequency Registration Board, composed of 11 independent members nominated by members of the union. The board records frequency assignments made by various countries and provides countries with advice on the operation of transmitters so as to eliminate interference.[2]

More specifically occupied with broadcasting (and television) problems are five international organizations or conference series with varying membership: the European Broadcasting Union, the International Broadcasting Organization, the Inter-American Association of Broadcasters, the Commonwealth Broadcasting Conference and the Asian Broadcasters Conference. All of these bodies are concerned with the promotion of international relays and programme

1. Similar conferences are provided for the telegraph and telephone aspects of the union's activities.
2. The functions of this organ are described in greater detail in Chapter 6.

exchanges, the general improvement of broadcasting techniques and the exchange of information.

The first organization in the field was the International Broadcasting Union (UIR), founded in Geneva in 1925 as an association of broadcasting agencies. Until World War II the UIR was active in promoting international programme exchanges and in bringing order to the broadcasting frequency band. The UIR eventually had active members in 28 European countries and associate members in 12 countries outside of Europe.

Because of post-war political difficulties, the UIR was dissolved in 1946 and replaced by the International Broadcasting Organization (OIR). Because of further international political differences, a number of broadcasting organizations left the OIR in 1949 and created a rival body, the European Broadcasting Union (EBU) with headquarters in Geneva and a technical office in Brussels. The OIR transferred its headquarters to Prague. In 1959 the EBU could claim active members in 26 countries[1] and associate members in 14 others.[2] The OIR grouped organizations in 20 countries.[3]

To meet their special needs, associations of privately-owned broadcasting stations formed a separate organization, the Inter-American Association of Broadcasters (IAAB) (Mexico City, 1948). This body, with headquarters at Santiago, Chile, has member associations in 19 countries,[4] grouping over 4,500 radio and 500 television stations. Another post-war development has been the organization of a series of Commonwealth Broadcasting Conferences at which broadcasting authorities of British Commonwealth countries have reviewed planning arrangements and the exchange of staff and programmes. Broadcasting organizations of Asian countries have initiated a similar series of conferences, the first having been held in Tokyo in 1957.

In view of its constitutional mandate to promote the free flow of information, Unesco has collaborated closely with the ITU in efforts to further the use of broadcasting for that objective. This working relationship between the two Specialized Agencies dates from 1947, when the ITU convened its first post-war Plenipotentiary Conference at Atlantic City. In a message to the conference, the Director-General of Unesco set forth his Organization's interest in the use of telecommunication for the free flow of ideas and as a link between peoples. Stressing the importance of radio as an instrument of transmission which knows no frontiers, he urged that frequencies for international broadcasting be allocated in a manner which would give all nations and diverse cultures adequate facilities for expression. At subsequent conferences of the ITU, Unesco has urged the use of radio in the interests of peace; the expansion of radio-communication facilities in underdeveloped areas; encouragement for the international exchange of programmes; the extension of educational, scientific and cultural broadcasts; and the promotion of professional training for radio personnel.

1. Austria, Belgium, Denmark, Finland, France, Federal Republic of Germany, Greece, Holy See, Iceland, Ireland, Italy, Lebanon, Luxembourg, Monaco, Morocco, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Tunisia, Turkey, United Arabic Republic, United Kingdom, Yugoslavia.
2. Australia, Belgian Congo, Burma, Canada, Ceylon, Ghana, Haiti, Japan, New Zealand, Pakistan, Portugal, Union of South Africa, United Kingdom, United States of America.
3. Albania, Bulgaria, Byelorussian Soviet Socialist Republic, China (People's Republic of), Czechoslovakia, Estonian Soviet Socialist Republic, Finland, German Democratic Republic, Hungary, Korea (Democratic People's Republic of), Latvian Soviet Socialist Republic, Lithuanian Soviet Socialist Republic, Moldavian Soviet Socialist Republic, Mongolia, Poland, Rumania, Ukrainian Soviet Socialist Republic, U.S.S.R., United Arab Republic, Viet-Nam (Democratic Republic of).
4. Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, United States of America, Uruguay, Venezuela.

broadcasting in less advanced areas

3

We have seen how over a large part of the world, paucity of facilities deprives people of the opportunity to be sufficiently informed. Although very few countries are entirely lacking in some form of press, broadcasting or film facilities, the basic question is whether the average person can count, as part of his daily experience, on access to news and information concerning more than purely local affairs.

In its survey, *World Communications*,[1] Unesco has adopted the criterion that a country is inadequately supplied with information media if it has less than ten copies of daily newspapers, less than five radio receivers and less than two cinema seats per 100 inhabitants. On this basis, 100 countries, 90 of them in Africa and Asia, may be considered as having inadequate facilities for press, broadcasting and film. Their combined population of 1,400 million is 56 per cent of the world total. An additional 17 countries, representing about 2 per cent of the world total, have insufficient press and broadcasting facilities. 'In short, it appears that nearly 60 per cent of the world's peoples lack the means of being adequately informed of developments at home, let alone in other countries.'[2]

In the field of broadcasting, as of other media, Africa is by far the worst equipped. With the exception of Algeria, Egypt, Morocco, Tunisia and the Union of South Africa, few countries have as many as one receiver per 100 inhabitants. Asia is only a little better supplied. With the exception of certain countries bordering on the Mediterranean in the west, and Japan and the Philippines in the east, the average number of receivers per 100 persons rarely exceeds six, and in some areas there is less than one per 100 inhabitants. Some twenty additional countries, most of them in Central and South America, complete the picture of inadequacy in broadcasting services.

Although a powerful case may be made for improving press and film facilities in less advanced countries, there is an even stronger one for an intensified effort to expand their broadcasting services. First, it must be recognized that in many of these countries transport facilities are also extremely limited. Consequently, great difficulty would be encountered in transporting newspapers and film from urban centres to outlying areas. Radio, on the other hand, can communicate over long distances despite such barriers as mountains, rivers and jungles. Second, there is the economic consideration. After costs of installation have

1. *World Communications*, 3rd ed., Paris, Unesco, 1956, pp. 48–9.
2. United Nations document, *Freedom of Information: The Status of Information Enterprises in Underdeveloped Countries*, New York, 1956.

Indian farmers discuss with an interviewer of All-India Radio the success of agricultural experiments they have made after listening to broadcasts of AIR's Farm Radio Forum. [Government of India.]

Students in New Ireland (Australian Trust Territory of New Guinea) listen to an educational broadcast on their school radio set.

[UNATIONS from Australian Government.]

been met, the maintenance of a broadcasting service is relatively inexpensive and considerable use may be made of local personnel. On the other hand, films must frequently be purchased from abroad in the currencies of the major producers, and newspaper enterprises need steady supplies of highly-priced newsprint, for the most part also imported. The third and most important advantage of radio is that it can fulfil its task of informing and educating the public regardless of whether listeners are literate or illiterate. As Unesco has pointed out, the countries which are poor in information media are also those where the incidence of illiteracy is greatest.[1]

means of transmission

Although the problems involved in establishing or expanding transmitting facilities in the underdeveloped countries are fewer than those concerning reception, they are nevertheless considerable and complex. Most of these countries are located in the tropical zone where radio wave propagation conditions are difficult. Inadequate electric power supplies often limit the power of the transmitters. The cost of installing and maintaining broadcasting services frequently puts a strain on already weak economies, and technicians to install and operate broadcasting equipment are often difficult to find. These and many other obstacles must be overcome to assure transmissions which are reliable and of good quality.

The United Kingdom Colonial Office estimates that 'starting from scratch, it takes about two years to complete a broadcasting service . . .'.[2] Before work can be commenced, a survey must be made to determine the type of broadcasting system best suited to the area concerned. Plans must next be drawn up in consultation with the interested authorities on the basis of needs, capabilities and resources. Finally, experienced and qualified engineers must be found to order, install and operate the new services.

The major problem has been to adopt a transmitting system (medium, high or very high frequency with frequency modulation), which would provide reliable coverage for the areas under consideration. In most of the underdeveloped countries there was little concentration of receivers when broadcasting was first introduced. Listeners were dispersed in small groups, or individually, throughout the area. In almost every case, high-frequency transmitters were installed to provide these widely scattered listeners with a minimum service at the lowest installation and maintenance cost. Medium-wave transmitters did not have a sufficiently wide effective range because of the heavy atmospheric interference present in tropical areas. Moreover it was financially impracticable to install transmitters to reach all parts of an area of any size, even if adequate electric power supplies were available.

As these countries slowly developed, two different audiences, one rural and one urban, came into being. The rural population, being essentially the same as the original, dispersed audience, has had to remain content with high-frequency transmission with the associated disadvantages of interference and inconsistent propagation. Some improvements in signals have, however, been achieved, as a result of progress made in the knowledge of the high-frequency propagation mechanism, especially through the use of vertical incidence transmission.

In the new areas of urban, high-density population, it has become necessary to provide a better service than that obtained from high-frequency transmissions. Two alternatives are available to a country starting a local broadcasting service:

1. *World Communications*, 2nd ed., Paris, Unesco, 1951, p. 30.
2. United Kingdom, Colonial Office, *Handbook on Broadcasting Services in the Colonies, 1957*, London, 1957, p. iii.

medium-wave broadcasting or very high-frequency, frequency modulation (FM), transmission. Despite its limitations, there has been a general trend toward medium-wave transmission, because it is better developed. Consequently, most new local broadcasting in less advanced areas is carried out with medium-wave transmitters.

More recently, however, frequency modulation has attracted interest in various tropical areas, such as Jamaica and Nigeria.[1] An FM transmitter of comparable radiated power would, it appears, have at least as good a service area as a medium-wave transmitter in tropical zones. Moreover, it would provide a much better quality signal. It is also far from certain whether the medium-wave broadcasting band is available to the same extent in tropical zones as elsewhere. The reason is that a number of other radio services which normally operate in lower frequency bands are forced by the high level of atmospherics in tropical areas to use the frequencies of the broadcast band. It is also likely, as more and more Asian and African countries turn to medium-wave broadcasting, that the medium-wave band will become overloaded. It would seem a pity if countries now establishing their broadcasting systems were to risk finding themselves in a situation similar to that in Europe, where the medium-wave band is chaotically overloaded. Whether frequency modulation transmission can become a serious competitor to the medium-wave service depends primarily on the availability of inexpensive receivers to capture FM emissions.

Financing a Service

Although transmitting equipment must be imported from a small number of industrialized countries, its purchase and installation are not a major obstacle to most underdeveloped areas. Since World War II, most independent States have been able to raise funds for new services, and the controlling powers of non-self-governing territories seem to have recognized the necessity of appropriating the necessary credits. For example, the United Kingdom between 1949 and 1957 contributed over £1,300,000 ($3,640,000) from its central Colonial Development and Welfare Funds to begin or complete new broadcasting schemes in 30 territories.[2] In addition, technical personnel have received adequate training through the enterprises which have installed equipment, or through study in the more advanced countries.

Following the installation of transmitting facilities, operating costs must be met. The ideal solution would be to have an independent broadcasting service supported primarily by local resources. This is possible, however, only where costs can be met from the sale of advertising time or from listeners, either by means of a licence fee for receivers or by means of subscriptions. Commerical broadcasting has developed in only a relatively small number of less advanced countries, most of them being in the Americas. In Jamaica, for example, a subsidiary of Broadcast Relay Service (Overseas) Ltd. of London operates a commercial broadcasting system which provides almost complete island-wide service 18 hours a day. In contrast, the commercial service which Ceylon recently introduced in addition to its governmental service has enjoyed only limited success. The basic difficulty is that in most of the less advanced countries, few markets for products are sufficiently developed to interest advertisers.[3]

For the great majority of these countries, receiver licence fees are no better as

1. The Jamaica Broadcasting Co. Ltd., a subsidiary of Broadcast Relay Service (Overseas) Ltd. has already built two frequency modulation stations in Jamaica. See also the article by John W. Murray, chief engineer of the Nigerian Broadcasting Corporation, in *Wireless World*, London, Vol. 62, No. 11, November 1956, p. 551.
2. United Kingdom, Colonial Office, op. cit., loc. cit.
3. The present discussion does not deal primarily with wired broadcasting systems, many of which are commercial.

a source of revenue, since listeners are too few and too poor to provide the necessary funds. In a number of such areas, licence fees are nevertheless collected. They do provide some income, and payment doubtless gives the listener the feeling that the system actually belongs to him. But the yield remains inadequate. In Nigeria, for instance, the annual receiver fee of 10 shillings ($1.40) brought in only £4,180 ($11,704) in 1955-56, as against government broadcasting expenditure of £256,580 ($718,424).[1] In Pakistan, the licence fee of 10 rupees ($3.03) in 1954 yielded only 800,000 rupees ($242,420), far short of Radio Pakistan's annual budget of 5,340,000 rupees ($1,618,180).[2]

In view of the difficulty of securing financial independence through more conventional means for their broadcasting services, most underdeveloped countries will probably have to continue relying on government subsidies for many years to come. An interesting exception to normal means of financing is, however, provided by Kenya. In 1931 the government and a commercial telegraph company concluded an agreement whereby the company would carry out broadcasting and bear the costs, in return for a monopoly of international telegraph traffic in the colony. A listener's licence fee, reduced in 1935 to 30 shillings (5 shillings for Africans), was imposed to aid the company to meet expenses. The original return was, of course, very small. In recent years, however, the number of licence holders has risen to the point where 'the broadcasting service is paying its way'.[3]

listening facilities

If it is to fulfil its function as a mass communication medium, broadcasting in the less advanced areas must be made as widely available as possible. The objective in such countries, as in the advanced areas, should be to reach a point where there is one receiver for each family. It is not sufficient to produce programmes only for the European population of a colony or for the native rulers and wealthy families of a State. Yet this would be the result if, after better transmission has been provided, nothing was done to improve listening facilities.

The ideal receiver should be simple and reliable, should consume little power and, above all, should be within the means of the local population. Simplicity of design is essential so that (a) a person of little or no education can tune in to the stations he wants and get the best possible reception without undue difficulty, and (b) there is little risk of the set being damaged as a result of inexperienced handling. To be reliable, the set would need to be tropicalized; poor transportation facilities in most underdeveloped areas make visits to a repair shop difficult and expensive. Another consideration is that in view of the general dearth of technicians, those who do have the necessary skills should not be preoccupied with relatively simple repair work. The set also should be equipped to run on batteries, since in many areas no power from electric mains is available. Even where such power is available it is often generated by diesel engines and the cost per unit is too high for everyday purposes. Above all, the ideal set should be so priced as to be within the means of the average potential listener. In many of the poorer countries the average citizen is barely able to pay for the necessities of life. Notwithstanding the advantages he might gain by having a radio receiver, it would hardly be practical for him to devote two or three months' earnings to buying one.

1. United Kingdom, Colonial Office, op. cit., pp. 85–6.
2. Kenneth E. Olsen and Abdul G. Eirabie, 'Radio Pakistan: Voice of a New Nation', *Journalism Quarterly*, Vol. 31, No. 1, Winter, 1954, pp. 73–9.
3. United Kingdom, Colonial Office, op cit., p. 59.

Efforts in Africa

Some of the underdeveloped areas have endeavoured to make inexpensive sets available. An important experiment in this field was the introduction of the 'saucepan special' receiver in Northern Rhodesia. The story of the saucepan radio illustrates some of the problems encountered.

The Northern Rhodesian broadcasting authorities (the Central African Broadcasting Board) first had to draw up specifications for a receiver. To ensure that the receiver would meet the needs of the local population, the design work was assigned to an engineer with long experience in the colony. Unexpectedly, he discovered that the receiver had to be painted blue, because every Central African tribe had some kind of superstition about almost every other colour. The next and perhaps most difficult step was to find a manufacturer who would invest time and money in producing prototype receivers and undertake to manufacture the selected one on a very low profit margin. It took three years to find (in the United Kingdom) a manufacturer who had the vision and enterprise to see the vast potential market for the poor man's radio and the part which radio could play in the development of the colonies.

The receiver finally adopted, by agreement between the manufacturer, the Colonial Office and the BBC, was a simplified four-valve superhet short-wave set with a band spread of from 3 to 12 megacycles, and operated by an external dry-cell battery giving an estimated 300 hours of service. The cabinet was, in effect, a large aluminium saucepan of nine inches diameter, with a back plate attached by screws and sealed. The set had only a combined on-off switch-volume control, two-speed tuning control and tuning dial. It was tropicalized throughout and all openings were covered with gauze to prevent the entry of insects. The government agreed to suspend import duty on the sets, which initially sold at £5 ($14). The manufacturer began mass production with an immediate order of 2,000 receivers and a guarantee of 3,500 more.

The next step was to establish a distribution system which would help keep the price of the set as low as possible. A wholesale and retail firm with the widest network of stores in the area agreed to distribute the receivers at a very low profit margin in return for exclusive importing rights. A motor transport firm undertook to transport the sets free of charge, including items for repair.

The first shipment of 2,000 receivers began to arrive in Northern Rhodesia in September 1949, and within a short time most stores had sold out their supplies. By early 1957, over 50,000 cheap battery sets had entered Central Africa, over 50 per cent being in the hands of Africans.[1] Sales to Europeans were not discouraged, since there appeared to be a psychological advantage in purchases being made first by Europeans.

Nigeria provides another recent example of efforts to bring low-cost receivers to the local population. Few manufacturers or distributors had shown interest in supplying Nigeria with sets specially suited to local needs, although its population of 35 million offered a substantial market. It was not until 1953, when the government-controlled Nigerian Broadcasting Service took the initiative and imported some 1,000 battery-operated, four-valve, short-wave sets priced at £5 10s. ($15.40) that commercial groups awoke to Nigeria's possibilities. In 1954, three Western European countries made an organized effort to supply this market. The following figures, covering the four years subsequent to the broadcasting service's action, show how the flow of receivers imported into Nigeria has increased:[2] 1954, 10,524; 1955, 23,029; 1956, 61,025; 1957, 39,933; January 1958, 3,732.

1. United Kingdom, Colonial Office, op. cit., p. 95.
2. From a communication from the Nigerian Broadcasting Corporation, 31 May 1958. The high figure for 1956 is attributed to a salary revision in which government workers received lump sum payments for arrears.

The country now has a wide range of receivers, ranging in price from £5 10s. to £12 ($15.40 to $33.60). Nigerian experts agree that an even cheaper set would find a large market provided it was of attractive appearance, had adequate sensitivity, and medium-wave as well as short-wave bands.

Despite these attempts, much has yet to be done to assure provision of an inexpensive and reliable set for the underdeveloped countries. Many 'cheap' sets have too narrow a frequency range and are often unpleasingly designed. Most manufacturers consider that their ordinary receivers, with perhaps the addition of tropicalization, should be suitable for such areas. In view of the many millions of potential customers living in Africa and Asia alone, it is strange that no manufacturer or group of manufacturers has made any serious effort to capture this market by designing an inexpensive receiver to meet its particular requirements. Governments, on the other hand, could do much to encourage the production and sale of a low-cost set. Could not a group of administrations pool their resources and ensure a broad, common market which would induce a manufacturer to make the necessary effort? Above all, why do governments stress the need to provide people of little means with an inexpensive set and at the same time impose on receivers import duties of as much as 60 per cent?[1]

Since the ideal receiver does not yet exist, other means of reaching listeners of limited education and income must be employed. One of the simplest of such means is collective listening. Through government initiative or assistance, receivers are installed in public places or placed in the care of responsible persons. At the same time, arrangements for the periodic inspection and recharging of batteries are made. To assure the maximum result from this form of listening, the equipment should be of high quality and, for acoustic reasons, should be installed in a building wherever possible. If the equipment is set outside, it should be placed in a spot where people are apt to spend their leisure time, and efforts should be made to arouse their interest in the broadcasts. Community listening services of this type are widely used in underdeveloped areas.

Unfortunately, this system labours under a major disadvantage. As J. Grenfell Williams, former head of the BBC Colonial Service, has observed: 'It is a comparatively simple matter to arouse interest. It is a very different matter to sustain it. Busy, tired people, who have worked all day in the fields—and in most undeveloped countries the whole community works very hard—will not easily be persuaded to come together at regular times every day unless there is something pretty powerful to attract them. And if they are persuaded to listen, conditions are often too difficult to make listening easy or pleasurable. There is indeed a real danger of this kind of listening doing positive harm to broadcasting which may well be ignored after the first novelty of it has worn off, and become merely another voice added to the voices of the country.'[2]

reaching the audience

No matter how complete the transmitter coverage or the distribution of receivers may be, a broadcasting system in an underdeveloped country is worthless unless the programmes produced are meaningful to the audience. 'It is little use merely running a well-meaning general broadcasting service', it has been observed. 'It can be positively harmful at least to the reputation of broadcasting itself, if the programmes heard are so alien either because of their language, their mode

1. For an account of tariffs that tend to hinder the use of radio, see *Trade Barriers to Knowledge*, Paris, Unesco, 1955.
2. J. Grenfell Williams, *Radio in Fundamental Education*, Unesco, Paris, 1950, p. 139 *(Press, Film and Radio in the World Today series)*.

of presentation, or even the use of music which means nothing to the ears of the people.'[1] The three essentials for an effective service are a competent, well-trained staff, programmes specially designed for the audience, and continuous audience research.

The first essential in organizing a broadcasting system in an underdeveloped area is a local staff skilled and experienced in the fundamental art of presentation. In the past, most colonial administrations relied on staff recruited from the mother country. When colonial broadcasting was directed primarily to the resident European population, this expedient was satisfactory for most purposes. As broadcasting began to make the transition, for one reason or another, from a service primarily for Europeans to one for all of the inhabitants of a territory, the need for local programming staff became apparent. Newly independent States have found it necessary to establish training centres, with the help of experts from more advanced countries, or to send selected students abroad for training. In dependent areas, recruits were incorporated into the local broadcasting services for 'on the spot' training or visited the administrating country for training before joining the local programming staff.

One of the first countries to recognize the need to develop a corps of trained local staff was the United Kingdom. Selected candidates, at first from dependent areas only, were sent to London to receive instruction in the British Broadcasting Corporation's regular training centres. Special courses dealing with the problems of underdeveloped areas were introduced and the category of students accepted was broadened to include those from all Commonwealth countries, and from other areas as well. More than a thousand members of staff and guests from overseas broadcasting organizations passed through the BBC Staff Training Department in 1957.[2]

In France, a novel experiment was begun in 1954 when a broadcasting station was constructed in the Forest of St. Germain, near Paris, for the training of staff for overseas stations. The station, whose transmitter caters for listeners in the neighbourhood, includes studios and other equipment. An attempt is made to reproduce the actual conditions which trainees will encounter in their home territories. A report prepared in December 1956 stated that 'nearly half the enrolment is African, many of the candidates being selected on the results of a competition held in 12 centres in the French Union, from Dakar to Tananarive.'[3] One of the centre's major purposes is to make possible the steady 'Africanization' of higher level staffs of overseas territories. In the South Pacific, the New Zealand administration trains Western Samoan staff both by means of correspondence courses and by sending selected candidates to New Zealand for special instruction.[4]

Even with trained staffs, the problem of programming is extremely complicated. Although basic techniques may be used, they must in all cases be adapted to meet the needs of the local population. Because of the extremely varied social composition of audiences in the underdeveloped countries, it would be impossible to review here the manifold problems that have arisen. Attention will therefore be directed to some of the current major difficulties as examples of what programming staffs must face in underdeveloped areas.

Language and Other Problems

In most areas, broadcasts must be given in one or more dialects or vernaculars, and also in a European language, in order to reach the local audience. For example, when the United Kingdom authorities decided to beam programmes

1. Williams, op. cit., p. 110.
2. *BBC Handbook, 1958*, London, p. 163.
3. *EBU Bulletin*, Vol. VIII, No. 41, January-February 1957, pp. 24–6.
4. Williams, op. cit., p. 110.

directly to Africans on the Gold Coast (now Ghana) during World War II, they discovered that no less than five vernaculars had to be employed.[1] To be completely understood and win public confidence, the broadcasters had to use what the people themselves called a 'deep' vernacular—'a highly figurative and allusive form of language which requires a knowledge of the doings of mythical figures, the tradition, the folk-lore, the proverbs and rough country humour passed orally from one generation to another'.[2] Other examples of areas where a number of languages are used in broadcasting are Kenya (11), North Borneo (4), Northern Rhodesia (9) and Sarawak (4). In addition to direct programming problems, the use of several languages makes necessary the employment of local translators whose renderings are accurate and colloquial.

In many underdeveloped countries, broadcasters have also found that, at least during the initial years, programmes must be directed specifically to the reception area. In New Guinea, an extreme example, the people of the Papuan village of Boera complained that they were expected to listen to the songs of Hanuabada, a village only 20 miles away.[3] Even when subjects of wider interest are presented, the broadcaster must attempt to identify the particular region with the programme. In 1955 the French overseas broadcasting service made an audience survey before the opening of the new African station in Tchad, an area with about a million Moslems and 2 million members of the Sara tribe. It was found that the principal points of interest to listeners were, first, religion (Moslem, Catholic, Protestant and animist); second, economic, social and political problems such as 'general evolution of Tchad with the different points of view of Moslems and the Sara tribe, pan-African influence, constitution of the French Union, influence of the association of students from the Tchad in Paris, etc.';[4] and only third were such everyday subjects as hunting, fishing, sports, travel, handicrafts, folk-lore and public health.

The difficulties of determining the proper form in which to transmit messages to unsophisticated listeners are legion. The following quotation from a report on early broadcasting in Ghana indicates the expedients which must sometimes be employed: 'The simplest form of dramatization involved one of the basic two broadcasters playing the part of the village fool or sluggard, and having his foolishness or idleness exposed by his opposite number. ... The exchange of dialogue was generally interspersed with, and certainly always ended with a proverb, often pithy enough to be a wisecrack from the deep vernacular which, in the true African manner, always led again to the inevitable song.'[5]

Although many other examples of problems and their solutions could be cited, those already given should suffice to underline the need of thorough preparation and research to make broadcasting in underdeveloped areas effective. The necessity for continuous audience research is particularly evident.

technical assistance

The United Nations technical assistance programme is a powerful potential means of aiding less advanced countries in developing adequate broadcasting services. In addition to the United Nations itself, there are two of its Specialized Agencies which can lend effective aid. They are the International Telecommunication Union, which is responsible for all technical aspects of assistance in

1. When the United Kingdom gave the Gold Coast self-rule, the following languages were in use: English, Dagbani, Ewe, Fanti, Ga, Hausa and Twi.
2. Williams, op. cit., p. 45.
3. ibid., p. 24.
4. A report on an article from *La Rose des Voix*, January 1956, in *EBU Bulletin*, Vol. VII, No. 37, May-June 1956, p. 372.
5. Williams, op. cit., p. 19.

the field of telecommunication, and Unesco, the leading agency in mass education, of which broadcasting is an essential instrument.

Although the ITU has been extremely active in the fields of telegraph and radio communication since it became directly connected with the technical assistance programme in 1952, not a great deal has been done under the specific heading of broadcasting. Only three countries, Jordan, Lebanon and Saudi Arabia, have received the aid of ITU experts for the expansion of broadcasting facilities. The most complete of the three projects was that carried out in Lebanon, where two ITU experts helped draw up specifications for the improvement of a medium-frequency transmitter and the installation of a high-frequency service. Later they revisited Lebanon to aid the government in examining the bids for construction and will again return to help supervise the construction itself. The ITU has also approved two fellowships for study in broadcasting, one having been awarded to the Republic of China and the other to Japan. In addition, the Union hopes to assist students from Argentina, Ethiopia and Lebanon to obtain training abroad in broadcasting techniques.

Unesco has carried out a variety of activities in the broadcasting field. Both within and separately from the technical assistance programme, it has conducted surveys of the technical resources and needs of underdeveloped countries, awarded and administered fellowships, aided the development of broadcasting services, established projects for the use of broadcasting in education, sought the agreement of governments to lower import duties on receivers and attempted to interest broadcasters in the possibility of encouraging the manufacture of low-priced sets.

Since 1947, for example, Unesco has administered some thirty fellowships in broadcasting, most of them being awarded to persons in underdeveloped countries. The fellowships covered script-writing, programme production and technical operations, and the use of broadcasting in education.

Unesco has also assisted in the development of transmission services. For example, since 1955 the Organization has been helping Libya to develop a national broadcasting service. Libya, which became an independent State in 1951, was one of the few countries without a service of its own. In 1955 a preliminary survey was carried out by a Unesco team, assisted by an engineer selected with the assistance of the ITU. The team's report served as a blue print for the organization of the service. While equipment was being installed by a firm of contractors, an initial service from temporary transmitters came on the air in 1957. Since 1956 Unesco experts have been helping the government in planning the organization and operation of the service, and have set up both technical and programme training courses for Libyan personnel.

Farm Forums

An example of Unesco's work to encourage the use of broadcasting in adult education is its sponsorship of an experiment to utilize the 'farm forum' technique in India. The Canadian farm forum project, upon which the Unesco experiment is based, was launched in 1941 to help rural residents of Canada to understand and overcome the new economic, political and social problems confronting them. The older forms of education by radio were considered to be ineffective because broadcasts alone did not hold the attention of the audience and too little was retained of what was heard.

The farm forum programme was basically very simple. First, the broadcasting authorities selected a series of weekly programmes dealing with the farmer's problems. Second, special groups known as forums were recruited in rural areas to listen to and discuss the broadcasts. Audience tests showed that the listener's attention was effectively held and much more of the programme

content retained. At its peak, the forum project included some 1,606 units in all parts of Canada with a total of 20,769 individual participants.[1]

In 1956 Unesco decided to study the possibility of using the forum technique in rural areas of India, despite the radical difference in the potential audience. The Canadian listeners were literate, accustomed to agricultural innovation, and most of them already had receivers in their homes. The potential Indian audience, on the other hand, was largely illiterate, unaccustomed to formal presentations, and generally unused to radio in any form. It was, in short, typical of populations in many of the underdeveloped areas.

With the co-operation of the Indian Ministry of Information and Broadcasting and of All-India Radio, listener groups of 20 members each were organized in 150 villages of Bombay State. Fifty villages received their first sets when the forum was established. In view of the short interval between the end of the broadcasts and the onset of the monsoon season, the villages selected were limited to those that could be reached by not more than three to five miles' walk from the nearest bus stop.

From its station in Poona, All-India Radio broadcast 20 special programmes of half an hour each between mid-February and the end of April 1956. The programmes, which were regularly listened to and discussed, dealt with the Indian farmer's special problems. Subjects included animal husbandry, fruit growing, poultry raising, village improvements and miscellaneous items such as the superiority of the doctor over the local medicine man. The method of presentation ranged from talks and discussions to recitals in classic drama style.

The experiment, in the words of Paul Neurath, director of the project, was 'a ringing success.'[2] A test based on six special questions showed that after the experiment, participants in forum villages were in general able to give '3 correct and 3 half-correct answers, where before they gave 1 correct, 4 half-correct and 1 wrong answer.'[3] With regard to individual topics, the test showed, for example, that out of 238 forum people 157 knew that malaria was carried by mosquitoes, whereas before the experiment only 107 did so; the number of participants who knew that clean water was a precaution against the guinea worm rose from 129 to 197; 71 more people knew that government help was available to the dry farmer; and 62 more knew that the farmer could obtain government loans.[4]

Another example of the use of broadcasting for rural education is the Acción Cultural Popular (ACP) project which has been initiated in Colombia. Unesco has assisted in the project by providing experts and fellowships.

The ACP was started by a young priest, Father Salcedo, whose original purpose was to establish an adult education broadcasting service in his parish in the valley of Tenza, about 80 per cent of the population of which was illiterate. The project started in 1948 with experimental educational courses broadcast from a 1 kW transmitter, located in Sutatenza, the main community in the valley, to 15 schools in the surrounding area which had been equipped with battery receivers. By 1958 the ACP owned several transmitters serving nearly 170,000 listening groups throughout the whole of Colombia. These transmitters included the most powerful in the country.

The ACP listening groups meet at a centre in each village or area, designated as the 'radio school'. An official assistant for the project is named, his main duties being to take attendance, turn on the radio when school begins, and write lessons out on the blackboard following the instructions which are broadcast.

1. John Nicol, *et al.*, *Canada's Farm Radio Forum*, Paris, Unesco, 1954, pp. 70–1.
2. *Preliminary Summary Report on Unesco Project of Adult Education at All-India Radio, Poona*, New Delhi, 1956, p. 17.
3. ibid., p. 10.
4. ibid., pp. 14–15.

Sets which can be tuned in only to ACP broadcasts are sold to each listening group at cost price. Each 'school' receives a free supply of chalk, an eraser, textbooks and an alarm clock to remind the class when it is time to convene.

The educational programme starts at 5.50 a.m., and lasts one hour and twenty-five minutes. This is the time that most men can spare from their fields. Depending on the day of the week, it deals with reading and writing, hygiene, history, and religion or civics. A news broadcast always comes at the end. The programme is repeated at 3.50 in the afternoon for women and again at 5 in the afternoon for men who might have missed the morning class. In the evening, from 6.15 to 9, school being over, ACP stations broadcast recreational programmes, which in themselves are to the greatest possible extent chosen for their educational or cultural value. Aside from the regular programmes, an ACP 1 kW transmitter broadcasts a special programme for workers at the recently completed Colombian steel mill. Most of these workers were formerly unskilled country-folk, and the mass media are proving of value in helping them to adapt to the life of industrial workers.

Centres have been established to train laymen and laywomen from provincial districts qualified to help the country-folk apply the knowledge obtained from the radio classes. By mid-1957 over 500 men and some 450 women had completed courses which lasted several months.

ACP stations have also been used since April 1956 to provide additional training for rural teachers, many of whom were judged by the authorities to be insufficiently qualified. Subjects taught during this course include arithmetic, hygiene, Spanish, educational techniques and religion. Moreover, ACP now assists in the preparation of printed material needed for rural education, including literacy primers and textbooks.

One of the more outstanding features of the ACP is the way in which it was financed. The original funds were made up of voluntary subscriptions by the participants of each listening group. The government subsequently paid a considerable subsidy and facilitated the purchase of material abroad by granting import licences and the necessary foreign currency allowances, and waiving customs duties. Finances are now obtained by renting a part of the large building which the ACP has built in Bogota to house its headquarters. The possibility of securing further revenue through the advertising of certain agricultural products is under discussion.

The success of the farm forum technique in such widely contrasting countries as Canada, Colombia and India further illustrates the adaptability of broadcasting as an instrument for education in both the advanced and in the less advanced areas of the world. There can be no economic development in the underdeveloped areas without an accompanying rise in the general standard of education. But when one is attempting to accomplish in a matter of years a task which has been the product of centuries in the advanced countries, the traditional means of education alone prove inadequate, and full advantage must be taken of the possibilities offered by the media of mass communication. The part that broadcasting can play in popular education is thus a matter of vital importance to modern society.

broadcasting between countries

4

Radio can be used in various ways to transmit programmes across frontiers. The primary method is to broadcast on frequency bands which permit the listener to capture the programme directly from the transmitter. Relatively few listeners have any conception of the number and volume of transmissions thus made available to them. Another method of reaching an audience abroad is through direct relays of special broadcasts arranged by the transmitting and receiving countries. The listener thus receives programmes emanating at a prearranged time from a foreign transmitter and relayed through his own national or local station. An additional method is through the exchange of recorded programmes between the broadcasting administrations of different countries. These recordings are then rebroadcast from the stations of the listener's country at a convenient time.

Each of these methods has its attendant problems. Governments are not always desirous of having nationals listen to foreign broadcasts coming directly into their homes without domestic control over the contents of programmes. Direct relay broadcasts call for a great deal of international co-operation in making the necessary programme arrangements. This also applies to the exchange of transcriptions. In all three methods, moreover, there are involved the inherent problems of copyright and related questions which must be solved to the satisfaction of all parties.

This chapter deals with the forms and the extent of international broadcasting, the exchange of cultural programmes, the various problems, such as freedom to listen and copyright, which affect the flow of transmissions across frontiers.

international broadcasting

A highly developed system of domestic broadcasting is now universally considered to be an essential element of national life. In the international field, radio is being increasingly employed by countries seeking to speak directly to the peoples of other lands. Hundreds of transmitters pour out thousands of hours of programmes every week directed to every corner of the globe and broadcast in almost every language, and in a great many dialects. The International Broadcasting Service of the United States Information Agency (Voice of America) alone advertises 'broadcasts in 41 languages, over a network of 78 transmitters, around the clock, around the globe.' By a turn of the radio dial, a

listener anywhere in the world may have access to an amazing variety of programmes from abroad. He can hear of events occurring thousands of miles away, receive foreign interpretations of the world's news, learn about the daily life and culture of distant peoples, or enjoy music in all its forms. Although the average listener may take only limited advantage of what international broadcasting has to offer, it is always available when desired.

While most international broadcasts are transmitted on short waves, programmes are often transmitted on medium and even long waves for regional international consumption. It is also noteworthy that, since radio transcends national frontiers, many domestic programmes are clearly received by listeners in neighbouring countries. From Switzerland, for example, domestic broadcasts in French are heard in France, those in German are received in both Austria and Germany, and those in Italian are heard in Italy.

To avoid confusing the issue, this chapter does not deal with such incidental international broadcasts, but rather with those which are especially prepared for foreign consumption: 'external' broadcasting in the sense that the British Broadcasting Corporation uses the term.

Although many countries maintain an international service, the amount of time they broadcast varies considerably. Some countries transmit only for a sufficient period to claim a place among the world's international broadcasters. Iceland, for example, has a foreign service in Icelandic consisting of one hour daily on weekdays and two hours on Sunday. Thailand maintains two programmes, a general overseas service of one hour and thirty-two minutes a day, and a North American service of one hour daily. In contrast, the three major broadcasters—the United States, the U.S.S.R. and the United Kingdom—transmit between 80 and 130 hours daily. In the first half of 1957, the Voice of America broadcast an average of 128 hours (57 original and 71 repeat) a day;[1] in 1956 the daily average for the U.S.S.R. exceeded 100 hours;[2] for the United Kingdom 80 hours.[3] The Voice of America's 128 hours did not include special short-wave broadcasts to the United States armed forces in various parts of the world nor the two non-governmental organizations which also engage in international broadcasting. In the case of the U.S.S.R., it should be noted that 'broadcasts for listeners abroad are also organized by the radio organizations of a number of Soviet Socialist Republics'.[2]

The number and location of transmitters used for external broadcasting also vary greatly from country to country. Lebanon, one of the most recent planners of an international service, in 1958 began building a station which will include one 100-kW short-wave transmitter 'to reach the entire world, including South America, Australia and Africa.'[4] The United States, on the other hand, uses a network of some 78 transmitters for external broadcasts. The Voice of America's programmes originate in Washington, D.C., or New York, are transmitted by wire to 30 domestic transmitters and thence sent by short wave to any or all of the 55 repeater stations at 10 relay centres abroad. In addition, the Voice of America maintains three transmitters (one medium and two short wave) on a ship which can in case of necessity be moved. The Voice of America's transmitters have a combined output of some 8 million watts.[5] The British Broadcasting Corporation maintains 37 short wave transmitters in the United Kingdom and

1. United States Information Service, *Eighth Review of Operations, 1 January-30 June 1957*, Washington, D.C., 1957.
2. Letter from the chairman of the National Commission of the U.S.S.R. for Unesco, 14 November 1957.
3. *BBC Handbook, 1958*, London, 1958, p. 39.
4. Lebanon, *The Lebanese Broadcasting Station*, Beirut, 1958.
5. *Broadcasting*, Washington, D.C., Vol. 59, No. 1, 6 January 1958, p. 72. See also E. T. Martin, Julius Ross and George Jacobs, 'Technical Development of the Voice of America Broadcasting System', *Electrical Engineering*, June 1955, pp. 459–64.

two in Malaya for its external services. In addition, it uses medium-wave transmitters in the United Kingdom and Germany for broadcasting within Europe. The BBC's installations in the United Kingdom alone includes some 180 specially built directional antennae.[1]

Aims of External Services

There seems to be general agreement among nations that ideally the purposes of international broadcasting are (a) to present the best of the culture and ideas of the broadcasting country; (b) to present world news objectively; (c) to explain the broadcasting country's viewpoint on important world problems; and (d) to promote international understanding.[2]

The first objective has been well expressed by the Swiss Broadcasting Service: 'Without being obtrusive or egotistical, we must demonstrate that we are not only a country of industry, commerce and travel; that Switzerland is also, and above all, a country with an indigenous civilization, both lofty and ancient, and that throughout history we have added our contribution to the culture of Europe and the World.'[3] The other objectives have been defined as follows by the Director-General of the BBC: 'To state the truth with as much exactitude and sincerity as it is given to human beings to achieve; to elucidate objectively the world situation and the thoughts and actions of this country; and to build a closer understanding between peoples by providing interest, information, and entertainment, each in due measure according to the needs of the many audiences.'[4] Appropriately, the BBC's official motto is 'Nation shall speak Peace unto Nation'.

The Act of Congress of the United States which established the International Broadcasting Service includes as its objective: 'to promote a better understanding of the United States in other countries, and to increase mutual understanding between the people of the United States and the people of other countries'.[5]

Since external broadcasts are primarily for foreign consumption and can therefore affect a country's foreign relations profoundly, government regulation or control is usually more complete than in domestic broadcasting. In the United States, for example, where domestic broadcasting is very largely private and commercial, external broadcasting is mainly conducted by the federal government. The official external service is maintained by the Voice of America, a subdivision of the United States Information Agency, whose director reports directly to the president. In addition, the Voice of America co-operates closely with the Department of State. A similar situation exists in other countries where commercial broadcasting is general.

In countries where domestic broadcasting is conducted by a branch of the central government, or by a public corporation, external services are closely linked to the agency for foreign affairs. For example, the Canadian Royal Commission on Broadcasting makes the following observation on the Canadian Broadcasting Corporation's international service: 'Although this service is managed by the CBC, its policies are laid down by the Department of External Affairs. ... It is essentially an arm of the government.'[6] Even the British Broadcasting Corporation, which rightly prides itself on its independence, concedes that, while programme content is strictly a BBC responsibility, the

1. *BBC Handbook, 1958*, p. 65.
2. See also Chapter 1, page 22.
3. Switzerland, Service de la Radiodiffusion Suisse, *Les dix ans de la Radiodiffusion suisse*, Berne, 1941, p. 156.
4. *BBC Handbook, 1958*, p. 20.
5. U.S. Public Law 402, 80th Congress.
6. Canadian Royal Commission on Broadcasting, *Report, 1957*, Ottawa, 1957, p. 215.

'languages and hours of broadcasting are prescribed by the government'. In addition, the BBC is required to 'obtain from the government department concerned such information about conditions in these countries and the policies of HM government(s) toward them as will permit it to plan the programme in the national interest.'[1]

Since payment cannot be extracted from listeners abroad, the cost of international broadcasting must be borne by the transmitting country. In countries where domestic broadcasting is conducted by commercial enterprises, external broadcasting costs are usually met by government appropriations from the general treasury. In the United States, for instance, the Voice of America is provided for in the general executive budget as a part of the United States Information Agency. In countries where a licence fee is levied on receivers, external broadcasting is financed in various ways. Some countries provide funds from the general treasury and others from licence revenues. Canada, for example, pays for all maintenance and operating costs of the Canadian Broadcasting Corporation's International Service through a parliamentary appropriation. 'These costs', the corporation explains, 'are not considered as chargeable to the CBC because ... revenues from licence fees are used only to serve listeners within Canada'. The United Kingdom follows a similar course. A number of other countries, of which Switzerland and the U.S.S.R. are examples, pay for their external services from revenues received through internal licence fees.

Dominance of Spoken Word

Spoken programmes play a much more important part in international than in domestic broadcasting. In the BBC's external services, for example, a high proportion of the foreign-language programmes consists of news and talks which are prepared by the staff. Even in those services which provide entertainment there is a higher proportion of the spoken word.[2] Similarly, the basic element in the Voice of America's programming is news—'what is happening in America, what is happening abroad. Next comes commentary. These are editorials from American newspapers and periodicals, and more recently has been added a roundup of American radio commentation'.[3]

In the case of Radio Japan, the Japanese Broadcasting Corporation's external service, news, commentaries and talks represent nearly 60 per cent of all foreign transmissions. Some 42 per cent is, in fact, devoted exclusively to news. Music, on the other hand, makes up only 30 per cent of Radio Japan's output.[4]

It is generally conceded that one of the most popular external broadcasts is the BBC's instructional spoken programme, 'English by Radio'. This programme, which in 1957 took up about thirty six and a half hours a week of the BBC's external broadcasting time, is believed to reach 'a world audience numbering several millions ... by direct broadcasts from London and by recorded broadcasts from local stations'.[5] Bilingual lessons are prepared in some thirty-five languages for beginners, advanced lessons being given only in English. Although these broadcasts do not necessarily reflect any special point of view, they have a prestige value for the BBC; in addition, their 'continued and growing success' has resulted in 'a steady recruiting of listeners ... to programmes in English'.[6] It is interesting to note that several other countries have begun to give language lessons in their external services.

1. From a Government White Paper on broadcasting policy, quoted in: *BBC Handbook, 1958*, p. 40.
2. *BBC Handbook, 1958*, p. 223.
3. *Broadcasting*, Vol. 54, No. 1, 6 January 1958, p. 67.
4. *Japan Broadcasting Corporation (NHK) through Charts and Diagrams*, Tokyo, 1957, p. 20.
5. *BBC Handbook, 1958*, p. 46.
6. *BBC Handbook, 1957*, p. 40.

External broadcasting organizations make a considerable effort to provide news for foreign listeners, as is illustrated by the following quotation from the BBC publication, *ICI Londres:* 'For its information the BBC relies on a number of sources: its own correspondents living abroad in the main foreign centres and its special envoys; its monitoring service with a large staff working night and day, intercepting and reporting foreign broadcasts throughout the world in 50 languages; the leading news agencies; and close contacts with the Foreign Office and other government services, which though they have no influence on the content of news bulletins, have at their disposal sources of information making it possible to verify and complete the telegrams reaching Bush House from all corners of the world. Specialists sort out the telegrams and prepare the bulletins which are drawn up in English and translated into more than thirty languages. A third of these specialists are professional journalists who have gained their experience in London, another third are journalists with a particular knowledge of a given part of the world, and the remainder are men who have come straight from the universities to the BBC and have been given a complete training in the field of news and the technique of broadcasting.'[1]

Some countries devote a greater proportion of time to music in their external services. Among them are the tropical countries, where short-wave broadcasting is the rule rather than the exception. The same applies for countries where radio in any form is still a novelty. In both cases, the listener does not expect high-quality reception. Musical programmes, even if deteriorated in transmission, are acceptable. Many countries, again, tend to provide more music in programmes directed to neighbouring countries which have common interests with them. In such cases, the time that would be used to explain the viewpoints of the transmitting country is often devoted to entertainment. Finally, when an external broadcasting organization has a medium-wave transmitter available, it can and generally does provide more musical programmes. An attempt to adapt programmes to the needs of listeners is apparent in the following comment on the output of Radio Australia, the Australian Broadcasting Commission's overseas service: 'Spoken-word sessions occupy most of the broadcast time in transmissions to countries seeking information about Australia—North America, Europe and Africa, for instance. In some places, however, people choose Radio Australia for their normal day-to-day listening, and the programmes are therefore largely of the entertainment type, music, etc. This applies to New Zealand, the Pacific Islands, and parts of South-East Asia.'[2]

In general, the cost of international broadcasting is much lower per hour of transmission than that of domestic broadcasting. News and talks are much less expensive to produce than other types of programmes. In addition, many domestic service programmes can be and are used in external services, without much extra cost. Finally, a large proportion of the total of hours of external broadcasts often consists of repeat programmes. The same programmes may be broadcast simultaneously to several countries or regions, or repeated at different hours of the day to ensure that the intended audiences are reached. Operating costs are, of course, much less if the two services share the same technical and administrative organization. Table 3 gives a comparison of hourly costs of the BBC's domestic and external services.[3]

There are thus several reasons why spoken programmes dominate international transmissions. First, the spoken programme is more adaptable to the general aims of international broadcasting, outlined earlier in this chapter. Second, high frequencies, which are most widely used in direct external broadcasting, do not

1. BBC, *Ici Londres*, 25 January 1957, quoted in: *EBU Bulletin*, Vol. VIII, No. 42, March-April 1957, p. 168.
2. From the Australian Broadcasting Commission's *ABC Weekly*, 20 November 1954, quoted in: *EBU Bulletin*, Vol. VI, No. 30, March-April 1955, p. 149.
3. *BBC Handbook, 1958*, p. 222.

TABLE 3

	Hours and cost per hour		Total expenditure on external services
	Domestic sound broadcasting	External services	
Programme hours for year	20 120	29 561	
Cost per hour[1]	£	£	£
Programmes	314	89	2 619 000
Engineering	136	45	1 335 000
Other	125	33	963 000
			4 917 000

1. £ sterling = U.S. $2.80.

reproduce sound very faithfully because of unstable propagation characteristics. Distortion in spoken programmes discourages listening much less than distortion in music. Third, news and talks cost relatively little to produce, both with regard to techniques and to copyright and related questions.

International Audiences

A major unknown element in international broadcasting is the listening audience. In domestic broadcasting, it is difficult enough to determine the size of a national or local audience, the times of listening and programme preference. In the international field the difficulties are far greater. A transmitting country sometimes finds it possible, though at considerable expense, to conduct sample surveys in friendly, more advanced receiving countries. In addition, many broadcasting organizations have followed the BBC's practice of establishing listener panels abroad which report on their reactions to external broadcasts.

If financial or other circumstances do not permit surveys, or if there are no competent polling organizations in the receiving countries, international broadcasters rely on the analysis of letters received from listeners abroad. To encourage letter writing, many international broadcasters not only solicit communications, but conduct various types of competitions. If the receiving countries are unfriendly, international broadcasters not only analyse letters but keep a close watch on all kinds of publications which might give a clue to the size and preferences of audiences, or even to the fact that transmissions are being received. It may be assumed, however, that despite the effort spent on this international research, few if any broadcasting organizations are satisfied with their knowledge of audiences abroad.

Bearing in mind the limitations inherent in external listener research, it may be useful to review some of the statistical findings by broadcasting organizations. It should be noted that these figures do not necessarily differentiate between audiences of direct broadcasts and those of rebroadcasts and programme exchanges. In 1957 the BBC announced that 'Surveys in France . . . showed that early in 1956 the total occasional audience was about 3.3 million, amounting to 11 per cent of the adult population. Of these about 300,000 listen every day. In West Berlin and the Federal Republic of Germany the figure was approximately 3 million, about 192,000 of whom listen every day.'[1] 'In a survey made in Karachi', the BBC added, 'it was established that 30 per cent of the licence-

1. *BBC Handbook, 1957*, p. 132.

At a Moscow medical institute, television enables students to watch an experimental operation on a dog's heart. [Soviet Information Bureau.]

The U.S. Ambassador to the U.S.S.R., Mr. Llewellyn Thompson, urges the free flow of ideas between East and West in a broadcast from Moscow in 1958. He was the first U.S. envoy to speak over Soviet radio and television.

[The Associated Press.]

holders listened to the BBC's programmes in Urdu, and the audience for the General Overseas Service was only slightly lower. In Madras the audience of the General Overseas Service was rather more than a quarter of the licence-holders.'[1] In 1956 the Voice of America received a total of 326,000 letters from all over the world. These included '10,000 letters from listeners to its Arabic programmes, 20,000 from Iranians, 5,000 from Turkish listeners'.[2]

The Canadian Broadcasting Corporation recently reported that 'the number of listeners who write to the International Service to obtain the time-table, to comment on the programmes or to seek information has been maintained at between 30,000 and 40,000 per annum since 1948'.[3] The Société Suisse de Radiodiffusion states that during one year its short-wave service received, among others, 3,059 letters from the United Kingdom, 1,711 from Spain, 1,297 from within Switzerland itself, 1,211 from the United States and 421 from Japan.[4]

The audience for international broadcasts is undoubtedly much smaller than that for domestic programmes. There are various reasons for this limitation. If an international service is conducted by short wave, the listener must have a receiver that can capture short wave transmissions; the quality of reception may be relatively poor, there may be deliberate jamming of broadcasts. Furthermore, many listeners do not have the proper antennae to receive short wave broadcasts, nor the time or patience to carry out the complicated tuning required to pick up short wave broadcasts. If an international service is conducted on medium waves, the crowding of the bands by domestic broadcasting stations seriously affects the quality of reception and the listener's local station competes strongly for his attention.

A small group of stations engaged in international broadcasting depart sufficiently from the norm, as regards both purpose and audience, to merit separate attention. They are Radio Andorra, Radio Ceylon, Radio Luxembourg and Radio Monte Carlo. Each of these stations beams special commercial programmes to neighbouring areas. Radio Luxembourg, for example, broadcasts daily from 4.45 a.m. to 11 p.m. in French, German, Hungarian, Polish, English and Flemish. Radio Ceylon, on the other side of the world, beams programmes to Asia in English, Hindi and Tamil and to South-East Asia and Africa in English.[5] All of these stations, whose primary aim is to profit through the advertising of goods and services, seem to have large numbers of faithful listeners to the programmes of light music which characterize their broadcasts. From time to time complaints are heard about the activities of such stations, and on one occasion an attempt was made to have them internationally condemned.[6] The attempt failed and the stations have continued to flourish.[7]

United Nations Radio

An international broadcasting service is usually regarded as being connected with a particular nation, and despite the presumably objective nature of its

1. *BBC Handbook, 1958*, p. 154.
2. *Broadcasting*, Vol. 54, No. 1, p. 64.
3. See *EBU Bulletin*, Vol. IV, No. 22, 15 November 1953, p. 646.
4. Switzerland, Société Suisse de Radiodiffusion, *Rapport annuel sur l'exercice 1951*, p. 66.
5. See *World Radio Handbook*, 1958, pp. 65 and 98.
6. The argument for condemnation was based on the fact that there were not enough frequencies available for domestic broadcasting stations, much less for international commercial ones. Those opposing condemnation maintained that no-one had the right to control programme content of the transmissions of any country. See ITU, *Documents de la Conférence internationale des radiocommunications du Caire*, 1938, Tome I, p. 553, and Tome II, pp. 630–1, 639–64, and 652–4.
7. The future of the most recent addition to the list of international commercial stations (Europe No. I in the Saar) is in doubt at the time of writing in view of the transfer of the Saar to Germany, which does not have a commercial system.

broadcasts, with the point of view of that nation. The international broadcasting service of the United Nations consequently comes under a separate category. The United Nations Radio, as it is called, is conducted by the United Nations Secretariat and maintained from the contributions of Member States. Its primary aim is to present the work of the United Nations and its Specialized Agencies in as objective a light as possible.

United Nations Radio is the successor to Radio Nations, the international broadcasting service of the League of Nations. Radio Nations was inaugurated in 1932, its equipment consisting of a medium- and short-wave station located in Prangins, near Geneva, Switzerland and operated by Radio Suisse. Its purpose was to maintain contact with special missions and Member States, and to broadcast programmes dealing with the work of the League. Weekly news bulletins were given in English, French and Spanish, and from time to time special broadcasts of meetings of the assembly or of commissions were presented. Regular transmissions of Radio Nations ended with the outbreak of war in 1939.

Although the two services have a common heritage, the United Nations Radio operates on a wider and more varied scale. It broadcasts about 14 hours a day in 28 languages and transmits an additional 10 hours daily when the United Nations General Assembly and Security Council are in session. Broadcasts consist mostly of news bulletins on the activities of the United Nations, supplemented by short programmes of a more general character.[1]

The United Nations Radio does not own its transmitting facilities, as did Radio Nations, but rents short-wave transmitters in the United States and elsewhere. From these centres programmes are beamed to all parts of the world.

The United Nations Radio has followed the general trend towards placing programmes on domestic networks through rebroadcasts and recordings. Its programmes are regularly rebroadcast by stations in 73 Member States and in 44 non-Member States. In addition, certain stations in the United States and Canada receive programmes by direct wire from United Nations Headquarters in New York. The United Nations Radio also prepares recorded programmes in 23 languages and distributes them without charge to interested broadcasting organizations.

Despite many suggestions that the United Nations should have its own medium- and short-wave stations to publicize its principles and activities internationally, no positive action has been taken because of the problem of costs. In addition, the necessary unoccupied frequencies would have to be found.

international relays and programme exchanges

Although direct transmission is still widely employed in international broadcasting, broadcasters are giving increasing attention to methods that permit their programmes to be transmitted from the external listener's local station. There are three such methods: (a) the direct relay of programmes from abroad; (b) the rebroadcasting of programmes which have been previously recorded on discs or tapes; and (c) the broadcasting of programmes which have been specially prepared, recorded on discs or tapes and sent to the listener's station.

It is claimed that relays, rebroadcasts and programme exchanges have all of the advantages that direct international broadcasting lacks. Programmes transmitted from local stations reach larger audiences because no special tuning or equipment is needed. Since the quality of transmission from a local station is superior, broadcasts can include a larger cultural programme, such as serious music or drama. The disadvantages, on the other hand, are few but important.

1. United Nations, Department of Public Information, *Broadcasts from the United Nations* 1 November 1957, New York.

First, programmes reach the listener only through his local or national broadcasting organization. Contents of programmes can thus be controlled. Second, there is a loss of both intimacy and immediacy in the case of two of the methods —rebroadcasts and programme exchanges. Recordings particularly suffer from this disadvantage and hence must be planned so that currently topical subjects are not included. In other words, relays, rebroadcasts and exchanges of programmes can supplement but not replace direct international broadcasting as a means of promoting the free flow of information and ideas.

Direct relays

The oldest of the three methods is the direct relay. The early experiments in 1923 and 1924 aroused such interest that, following its creation in 1925, the International Broadcasting Union was given the task of promoting all types of international relays. In order to have the necessary physical facilities, the union undertook to secure the establishment of an international network of telephone circuits specially adapted to the needs of broadcasting.

The international relays organized by the union became world famous. The first multilateral series was the 'National Programme' in which each member of the union prepared a special broadcast for relay by other member organizations. This series began in June 1926 with a concert from Norway. Thirty-four such programmes were transmitted by the end of the series in 1931. In 1930 the union decided to replace the National Programmes by an expanded monthly series called 'European Concerts' which emphasized the typical music of member countries. All members of the union who had the necessary technical equipment were obliged to relay these broadcasts. In 1936, the union moved further afield and organized a series of World Concerts. These programmes, of 30 minutes' duration, were composed of typical national works given by musicians of the originating country. The scope of this final series of relays is apparent in that the first three were given by the United States, the Netherlands East Indies and Argentina. The International Broadcasting Union also encouraged the relay of programmes in the spoken word. An example was the Nordic Day series between Denmark, Sweden and Norway, in which the respective monarchs spoke to combined Scandinavian audiences.

Broadcast relays since the war have covered almost every field of musical entertainment, sports and important national events. For example, 37 performances of the Salzburg Festival of Music in 1957 were relayed to 55 broadcasting organizations in 30 countries. They included almost all of the countries of Europe and various South American countries, as well as Australia, Algeria, Canada, Egypt, Israel, Japan, Morocco, Union of South Africa and the United States.[1] Other events thus broadcast were the coronation of Queen Elizabeth II and the Olympic Games. Future relays are to include a series on 'Science in the service of peace', organized by the International Broadcasting Organization, the third Asian Games and a possible Asian music festival to be broadcast by the Asian Broadcasters' Conference.[2] The extent of international relays is indicated by a report by the French broadcasting administration that, in 1956, 1,862 programmes from France representing some 1,890 broadcast hours were relayed by other countries. France in return received relays of 1,760 programmes representing a total of 2,403 hours.[3]

Recorded Programmes

Direct relays have an inherent weakness in that they must be received by an

1. *EBU Bulletin*, Vol. VIII, No. 46, November-December 1957, p. 699.
2. See *OIR Documentation and Information Bulletin*, No. 2–3(61–62), July 1957, pp. 74 and 80, and *EBU Bulletin*, Vol. VIII, No. 45, September-October 1957, p. 567.
3. *EBU Bulletin*, Vol. VIII, No. 44, July-August 1957, p. 461.

organization abroad at the time set by the originator. Consequently, the hour of the broadcast may conflict with a regularly scheduled programme, thereby necessitating a costly cancellation or postponement; or, if the time zones of the countries conducting the relay vary considerably, the broadcast may fall at an inconvenient hour. The new recording techniques developed during and after World War II have provided a means of overcoming this weakness by permitting the recording of such broadcasts and their rebroadcast over the local stations at a convenient time. This procedure is often used to replace or supplement the direct broadcast in important international relays. The United Kingdom has gone one step further and arranged with interested countries to record and rebroadcast its regular international broadcasts. In 1957, for example, the BBC had bilateral agreements with organizations in 28 countries for the daily rebroadcast of its external programmes, and with 22 others for occasional rebroadcasts. A large proportion of the daily rebroadcasters were, as might be expected, United Kingdom colonies and territories and members of the Commonwealth.[1]

The exchange of recorded programmes is undoubtedly one of the most fruitful practices in contemporary broadcasting. By using high-fidelity discs and tapes, a country lacking a short-wave external service may place the best of its culture at the disposition of a broadcasting organization abroad. Since the recording of daily transmissions is a standard practice among most broadcasting organizations, there is a vast treasure store of potential international exchange material to supplement programmes specially prepared for export. Once a programme has been recorded on disc or tape, it can, furthermore, be broadcast many times before its usefulness ends.

The wide variety of programmes available for exchange is illustrated by the following list available from the BBC transcription service: drama, 96 programmes; music (serious), 75; religion, 85; school, 62; features, 53; children, 20; talks, 110; music (light), 112; and variety, 90.[2] An example of the content of an individual broadcast is furnished by the half-hour BBC programme, broadcast weekly in Canada under the title 'Postmark U.K.'. It contains an introduction 'by an anglophile guest commentator, followed by a personal news-from-home editorial by an outspoken Yorkshireman, who comments informally on the passing scene in the United Kingdom, and lastly—the main feature—tape-recorded sound pictures of places of interest in Britain and of British institutions and ways of life. Old customs and contemporary scenes, industries and crafts, music and songs typical of different areas, bird songs and sounds peculiar to certain districts—all find a place in the programme'.[3]

Extent of Exchanges

Programmes are now being exchanged on a world-wide basis. The Netherlands external service, for example, recently announced that in 1955 it had sent out broadcasts in 26 languages to 93 countries for broadcasting by local stations.[4] The BBC reported that in 1957, 55 countries received its transcriptions for local broadcasting; these outlets included some 70 commercial and educational stations in the United States alone.[4] The French external service sent out 626 recordings to Latin America alone in 1955; they represented over 549 hours of broadcast time.[5] From members of the International Broadcasting Organization come similar reports. The People's Republic of China received some 30 hours of

1. *BBC Handbook, 1958*, pp. 48–9.
2. ibid., pp. 187–8.
3. *EBU Bulletin*, Vol. VIII, No. 43, May-June 1957, p. 317.
4. *BBC Handbook, 1958*, pp. 48–9.
5. *EBU Bulletin*, Vol. VII, No. 37, July-August 1956, pp. 388–9.

recordings from abroad in 1956 and sent out a total of 120 hours to 32 countries.[1] The Polish radio administration in 1955 exchanged programmes with 42 countries, from which it received 264 hours of musical programmes.[2]

The transcription service of the Voice of America is only a small part of its operations; however, as Table 4 shows, the Voice of America has succeeded in ensuring widespread use of the programmes it has produced.[3]

TABLE 4. Disc and tape-recorded programmes for use by foreign broadcasting stations, December 1957

Area	Hours produced weekly	Hours used weekly
American Republics	7.5	930
Near East	10.0	60
Far East	8.5	34
Europe	19.5	797
TOTAL	45.5	1 821

The U.S.S.R. reports regular exchanges of broadcasts with Albania, Belgium, Bulgaria, People's Republic of China, Czechoslovakia, Finland, France, German Democratic Republic, Hungary, India, Democratic People's Republic of Korea, Mongolian People's Republic, Norway, Poland, Rumania, Democratic Republic of Viet-Nam and Yugoslavia. These exchanges covered musical, social and political, literary and dramatic broadcasts, and children's programmes.[4]

Although most programme exchanges take place between countries of a similar international outlook, there has been an increasing number of exchanges between Eastern and Western Europe. For example, Czechoslovakia in 1956 co-operated in exchanges with some 37 countries non-members of the International Broadcasting Organization (OIR). They included Austria, Belgium, Denmark, Egypt, France, Federal Republic of Germany, Italy, Netherlands, Sweden, United Kingdom and Yugoslavia. The Polish broadcasting administration, in the same year, had regular exchanges with organizations in 20 countries not members of the OIR including 'close' relations with France, Italy and Switzerland. At the OIR conference at Sofia in March 1957 it was in fact disclosed that every OIR member had had exchanges or entered into contact in 1956 with members of the European Broadcasting Union.[5]

Most exchanges are organized through bilateral or multilateral agreement by the broadcasting organizations concerned. In some cases, however, governments conclude cultural agreements which provide, *inter alia*, for the exchange of broadcasts. A notable recent example of such agreements was that concluded in January 1958 between the U.S.S.R. and the United States of America. Section II of this agreement reads as follows:

'1. Both parties will provide for an exchange of radio and television broadcasts on the subjects of science, technology, industry, agriculture, education, public health, and sports.

'2. Both parties will provide for regular exchange of radio and television programmes, which will include the exchange of transcribed classical, folk and contemporary musical productions on magnetic tape and records; the exchange of filmed musical, literary, theatrical and similar television productions.

1. *OIR... Bulletin*, No. 8, 5 February 1957, pp. 5–6.
2. *OIR... Bulletin*, No. 4–5 (58), September 1956, p. 229.
3. Communication from the International Broadcasting Service of the United States Information Agency, 31 January 1958.
4. Communication from the chairman of the National Commission of the U.S.S.R. for Unesco, Moscow, 14 November 1957.
5. *OIR... Bulletin*, No. 2–3(61–62), July 1957, pp. 69–70.

'3. For the purpose of strengthening mutual understanding and developing friendly relations between the United States and the Union of Soviet Socialist Republics, both parties agree to organize from time to time an exchange of broadcasts devoted to discussion of such international political problems as may be agreed upon between the two parties. The details of the exchanges shall be agreed upon at the working level.

'4. Both parties will provide for an exchange of samples of equipment for sound-recording and telecasting and their technical specifications.

'5. Both parties will provide for an exchange of delegations of specialists in 1958 to study the production of radio and television programmes, the techniques of sound recording, the equipment of radio and television studios, and the manufacture of films, recording tape, tape recorders and records.'[1]

Both the EBU and the OIR from time to time publish information concerning programmes available to other broadcasting organizations. In a further effort to promote exchanges and bridge the gap between the two organizations, Unesco in 1956 convened an International Meeting of Cultural Radio Programme Directors or Producers, composed of participants from 11 countries, to discuss types of cultural programmes and their importance to the future of broadcasting. At the conclusion of the meeting, the participants issued a statement containing the following points: (a) an increase in exchange of cultural programmes is highly desirable; (b) all countries should make their best programmes available to all countries wishing to use them; (c) Unesco should prepare an index of cultural programmes for exchange; and (d) Unesco should convene an international meeting to work out practical means of programme collaboration and exchange.[2]

Copyright and Related Problems

The exchange of programmes between countries has been hampered to a certain extent by the lack of any clear rules as to the exercise of author's rights in musical or literary works, the conditions which interpreting and performing artists may impose on the use of live or recorded performances, and the rights of record manufacturers and radio broadcasting organizations.

To eliminate such obstacles, various studies aimed at codifying these rights have been undertaken by the Bureau of the International Union for the Protection of Literary and Artistic Works (Berne Union), Unesco, the International Labour Organisation and the Council of Europe. The future of the flow of programmes between countries depends to a large extent on the success of the work of these organizations.[3]

freedom to listen

The ability of radio to cross frontiers without let or hindrance has given rise over the years to a series of problems concerning (a) the right of the person with a receiver to listen to broadcasts from another country; (b) the type of programme which should or should not be broadcast to the people of another country, and (c) the right of a country to stop, by means of the process known as jamming, those programmes which it considers unsuitable for domestic consumption.

In the early days of radio, the listener's right to receive from abroad seems to

1. United States Information Service, Press Release, *U.S.-Soviet Agreement on Exchanges*, 28 January 1958, p. 2.
2. Unesco, Department of Mass Communication, *Reports and Papers on Mass Communication*, No. 23, December 1956, pp. 58–9.
3. Fuller background on copyright problems in the radio field may be found in *Copyright Laws and Treaties of the World*, Paris, Unesco, 1956.

have been generally assumed, since it was never actually questioned. The first international organizations in the broadcasting field were more concerned with technical problems and the protection of the interests of broadcasting enterprises than with the rights of listeners. Later, when certain countries began to use short-wave transmissions for propaganda purposes in the 1930s, governments took no action of any kind to limit the right of listeners, but turned their attention almost exclusively to the content of international programmes. Even during World War II, only a few belligerent countries adopted legislation prohibiting listening to enemy broadcasts.

If the listener's right was assumed before World War II because it was not questioned, a more positive answer was forthcoming in 1948. The Charter of the United Nations committed Member States to promote 'universal respect for, and observance of human rights and fundamental freedom for all . . .'.[1] The United Nations General Assembly unanimously adopted on 10 December 1948 a Universal Declaration of Human Rights.[2] The right to listen to broadcasts from abroad was confirmed in Article 19 which reads as follows: 'Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers.'

At the same time, the General Conference of Unesco, at its third session in Beirut (November-December 1948), adopted a resolution recommending that Member States 'recognize the right of citizens to listen freely to broadcasts from other countries'.[3]

The United Nations' confirmation of freedom to listen raised the further question of the duties of broadcasting administrations toward the external listener and his government: Are there any internationally agreed limits as to what broadcasters may include in international transmissions? A precise answer to this question is more difficult to find.

Even before broadcasters used radio intentionally to address citizens of other countries, its latent ability to cause international political difficulties was recognized. During the first regular meeting of the International Broadcasting Union in 1925, at a time when few countries maintained organizations with regular broadcasting schedules, representatives of member organizations discussed the effect of undiplomatic statements in a domestic broadcast. The alarming prospects evoked by the discussion prompted the union's council to issue a declaration in July 1925 urging members to avoid broadcasting any propaganda that might cause political difficulties in other countries. Members were in fact requested to eliminate from their programmes *anything* dealing with the internal affairs of other countries.[4]

After nearly a year of further experience in broadcasting, the council modified its earlier declaration. The new resolution of March 1926, while still aimed primarily at domestic broadcasts, requested all members to do all in their power to guarantee that national broadcasts 'whether political, religious, economic, intellectual or artistic' should not 'compromise in any way the spirit of international co-operation and good understanding'.[5] The resolution was sent to the Secretary-General of the League of Nations for transmission to the League's Member States. As a result of its interest in this field, the union for a time became a sort of judge of acceptable broadcasts and frequently gave its opinion on 'doubtful' manuscripts submitted to it before being broadcast.[6]

1. United Nations Charter, Article 55.
2. United Nations General Assembly, Official Records, Third Session (I), *Resolutions*, p. 7.
3. Unesco, General Conference, Third Session, 3C/110, Vol. II, Resolution 7.2221.
4. H. Giesecke, in *Broadcasting and Peace*, International Institute of Intellectual Co-operation, Paris 1933, p. 126.
5. A. R. Burrows, ibid., p. 101.
6. ibid., p. 102.

An incident occurring in 1931 renewed interest in the content of broadcast programmes. In that year the Polish Government took offence at some comments in a special German broadcast on the tenth anniversary of the vote on Upper Silesia. After an exchange of diplomatic notes between the two countries, the affair was settled by the signing of an agreement based on the 1926 resolution of the International Broadcasting Union.[1]

The German-Polish affair, combined with the advent of international broadcasting on an organized scale, aroused the interest of the League of Nations. At its ninth assembly, the League requested the International Institute of Intellectual Co-operation to study the educational aspects of broadcasting, including 'all the international questions raised by the use of broadcasting in regard to good international relations'.[2] In the discussions of the Committee of Experts organized by the International Institute, there was general agreement that broadcasting of all kinds could have a disruptive effect on international co-operation. The Commission on Moral Disarmament of the World Disarmament Conference, which also made a study of international broadcasting after the German-Polish incident, took a similar view. However, the Committee of Experts maintained that any international agreement on broadcasting should not include negative control measures which might be considered as international censorship. The emphasis should be on restraint rather than punishment. The committee drew up a draft international agreement which was circulated to all States, both members and non-members of the League of Nations.

International Understanding

In 1936 the council of the League convoked an Intergovernmental Conference for the Adoption of a Convention Concerning the Use of Broadcasting in the Cause of Peace to discuss the committee's draft. The conference, held in Geneva in September 1936, was attended by delegates from 37 countries and observers from three others.[3] The committee's work had been so well done that within a week's time an international agreement had been drafted and signed. The agreement, entitled the International Convention Concerning the Use of Broadcasting in the Cause of Peace, enjoined Contracting States to:

1. Prohibit broadcasts of such a character as to incite the population of any territory to acts incompatible with internal order or security.
2. Ensure that domestic transmissions 'shall not constitute an incitement either to war against another High Contracting Party or to acts likely to lead thereto'.
3. Prohibit 'any transmission likely to harm good international understanding by statements the incorrectness of which is or ought to be known to the persons responsible for the broadcasts'.
4. Ensure, 'especially in time of crisis, that stations ... shall broadcast information concerning international relations the accuracy of which shall have been verified ... by the persons responsible for broadcasting the information'.[4]

1. H. Giesecke, ibid., p. 112.
2. League of Nations, *Assembly Journal*, 1931, p. 115.
3. Delegates: Albania, Argentina, Austria, Belgium, Brazil, Bulgaria, Chile, Cuba, Czechoslovakia, Denmark, Dominican Republic, Ecuador, Egypt, Finland, France, Hungary, India, Ireland, Italy, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Nicaragua, Norway, Poland, Portugal, Rumania, Spain, Sweden, Switzerland, Turkey, U.S.S.R., United Kingdom, Uruguay, Yugoslavia. Observers: Estonia, Latvia and Siam.
4. League of Nations, *Treaty Series*, 1938, Vol. CLXXXVI, pp. 303–17. The Contracting States were also obliged by Article 3 to rectify any incorrect statements at the earliest possible moment.

The convention came into force on 2 April 1938 after the necessary six ratifications had been received.

After remaining in abeyance during World War II, the convention was revived in 1954, when the United Nations General Assembly took note of its existence. In a resolution adopted on 17 December 1954, the General Assembly noted that the convention was still in force and that it constituted 'an important element in the field of freedom of information'. The assembly decided to request Contracting States to indicate whether they wished to transfer to the United Nations the functions which had been performed, under the terms of the convention, by the League of Nations.[1] In addition, the Secretary-General of the United Nations was instructed to prepare a draft protocol for circulation to Contracting States providing for (a) the transfer of duties from the League to the United Nations; (b) the accession of Members and non-Members of the United Nations which were not parties to the convention; and (c) the addition of 'new articles' providing that each Contracting State 'shall refrain from radio broadcasts that would mean unfair attacks or slanders against other peoples anywhere and in so doing to conform strictly to an ethical conduct in the interest of world peace by reporting facts truly and objectively, and to provide that each High Contracting Party shall not interfere with the reception, within its territory, of foreign radio broadcasts'.[2]

In his annual report for the year ended June 1957, the Secretary-General announced that he had circulated the draft protocol, and by 1 June 1957 had received replies from 14 of the 26 States parties to the convention. These replies were grouped as follows:

1. Expressed approval of transfer of functions: Burma, Ceylon, Chile, Denmark, Egypt, Finland, Ireland, Lebanon, Luxembourg, Netherlands, Norway, Pakistan, Sweden, Switzerland.
2. Expressed approval of the whole of the draft protocol: Burma, Denmark, Ireland.
3. Considered itself not bound by the new articles: Switzerland.[3]

The use of frequencies to promote international understanding had meanwhile been advocated by the International Telecommunication Union itself. To the International High-Frequency Broadcasting Conference of the ITU, meeting at Mexico City from October 1948 to April 1949, the Director-General of Unesco sent a statement urging the adoption of an international plan for the equitable allocation of high frequencies, and emphasizing that the frequencies so allocated be used in the interests of peace. The conference adopted the following resolution:

'Considering that it is highly desirable that high-frequency broadcasts should contribute to the development of international co-operation and peace to the greatest possible extent;

'Recommends that the frequencies to be assigned by the conference should not be used for purposes contrary to mutual understanding and tolerance, and that all appropriate steps should be taken to the end that this resolution is followed by practical measures on the part of the governments concerned, and that such mesasures are brought to the attention of the International Telecommunication Union, United Nations and Unesco by the countries members of these organizations'.[4]

1. The League of Nations had been given certain custodial duties and the sole power to propose, on the request of one-third of the Contracting States, the convening of a conference to revise the convention.
2. United Nations, General Assembly Resolution 841(IX), 17 December 1954.
3. United Nations, *Annual Report of the Secretary-General, 16 June 1956 to 15 June 1957*, New York, 1957, p. 83.
4. ITU, International High-Frequency Broadcasting Conference, Mexico City, 1948–49, Documents No. 120, 278, 676 and 804, pp. 20–4.

Jamming

The third question, whether a country has the right to 'jam' unwanted incoming broadcasts, has also been answered, and in the negative, by the United Nations. Jamming, it will be recalled, consists simply of broadcasting noise, with or without intelligence content, on or near the frequency used by the broadcaster. If the noise level of the jamming transmission is sufficiently high, the incoming broadcast can be effectively destroyed.

The first recorded example of jamming was its use by the Dollfuss Government in 1934 to prevent Nazi attacks from Germany being heard in Austria. Jamming spread rapidly as international tensions increased before World War II and during that conflict a number of the belligerent countries engaged in the practice. When the war in Europe ended in 1945, jamming ceased throughout the world, but started again in 1946.

Jamming may be intermittent and selective, or continuous and general. A limited number of countries now resort to the practice. Whatever the reasons cited to justify it, there is no denying that jamming is wasteful and destructive in terms of moral and material resources.

First, it is an outright rejection of man's right to receive information. Second, it reduces the number of frequencies available in the short-wave band, for which there are already more applications than can be met. Third, it can be effectively conducted only at enormous cost to the country concerned. It has been estimated, for example, that one large country annually spends on jamming nearly seven times what it costs another country to conduct a world-wide international broadcasting service.[1] It has also been reported that when a smaller country ceased jamming recently, it saved a sum equal to the cost of maintaining the world-wide service just mentioned.[2]

The practice of jamming was formally condemned in 1950 by the United Nations. In that year the Sub-Commission on Freedom of Information and of the Press, established by the United Nations Commission on Human Rights, studied the problem and drafted a resolution for consideration by the Economic and Social Council which in turn submitted a revised draft to the General Assembly.

Opinions expressed in the General Assembly were divided into two opposing points of view. Both sides agreed that radio could be an effective instrument of goodwill between countries. However, some delegations argued that jamming was a justifiable defence against international broadcasts which were in effect hostile propaganda. They maintained that a country had the right to defend itself against such propaganda in the same way that it prevented opium smuggling or the sale of pornographic literature in its territory. The opposing view, which was espoused by a large majority of delegations, was that countries should raise no barrier whatsoever to the free flow of information. The individual listener, it was maintained, should have the opportunity to judge the value of a programme and if he disliked it, he could turn it off. Furthermore, it was pointed out that jamming was a violation of international agreements in the field of radio.

The viewpoint opposed to jamming prevailed and the following resolution was adopted on 14 December 1950 by 49 votes to 5:[3]

'The General Assembly,

'Whereas freedom to listen to radio broadcasts regardless of source is embodied in Article 19 of the Universal Declaration of Human Rights, which reads: "Everyone has the right to freedom of opinion and expression" and

1. *New York Times*, 16 March 1958.
2. *Broadcasting*, Vol. 59, No. 1, 6 January 1958.
3. United Nations, General Assembly, *Official Records: Fifth Session, Supplement No. 3* (A/1345), 1950, p. 67, and Supplement No. 20(A/1775), *Resolutions*, p. 44. See also *United Nations Bulletin*, New York, January 1951, pp. 43–5.

whereas this right "includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers",

'Whereas Article 44 of the International Telecommunication Convention, Atlantic City, 1947, provides that "All stations, whatever their purpose, must be established and operated in such a manner as not to result in harmful interference to the radio service or communications of other members or associate members ... (and that) each member or associate member undertakes to require the private operating agencies which it recognizes and the other operating agencies duly authorized for this purpose, to observe the provisions of the preceding paragraph",

'Considering that the duly authorized radio operating agencies in some countries are deliberately interfering with the reception by the people of those countries of certain radio signals originating beyond their territories, and bearing in mind the discussion which took place in the Economic and Social Council and in the Sub-Commission on Freedom of Information and of the Press on this subject,

'Considering that peace among nations rests on the goodwill of all peoples and governments and that tolerance and understanding are prerequisites for established goodwill in the international field,

'1. Adopts the declaration of the Economic and Social Council ... to the effect that this type of interference constitutes a violation of the accepted principles of freedom of information;

'2. Condemns measures of this nature as a denial of the right of all persons to be fully informed concerning news, opinions and ideas regardless of frontiers;

'3. Invites the governments of all Member States to refrain from such interference with the right of their peoples to freedom of information:

'4. Invites all governments to refrain from radio broadcasts that would mean unfair attacks or slanders against other peoples anywhere and in so doing to conform strictly to an ethical conduct in the interest of world peace by reporting facts truly and objectively;

'5. Invites also Member States to give every possible facility so that their peoples may know objectively the activities of the United Nations in promoting peace and, in particular, to facilitate the reception and transmission of the United Nations official broadcasts.'

use of the radio spectrum

5

Radio stations are characterized by their transmitting frequency. The range of frequencies available to radio stations is generally referred to as the radio (or electromagnetic) spectrum. The rational use of the spectrum, which has a limited capacity, is the key to many of the problems confronting broadcasting.

The characteristics of frequencies in different parts of the spectrum affect the efficiency and range of broadcast transmission. On one frequency it is possible to provide clear, high-fidelity programmes over a limited area. On another frequency, one may effectively reach a larger area, the size of a country or of a region. On even another frequency it is possible to broadcast directly to the inhabitants of a country thousands of miles from the transmitter.

Broadcasting is not the only service using the radio spectrum, however. It must share it with television, long-range radio telegraph and telephone, aeronautical and maritime radio, amateur and government stations and many other services. Some knowledge of the characteristics of the spectrum, the manner in which the various radio services established their claims to frequencies, and the efforts of nations to work out a rational use of the spectrum, is essential to an understanding of the service which broadcasting can render.

character of the spectrum

The spectrum, or range of frequencies available for radio communication, extends from 10 kilocycles to 3 million megacycles. Not all of these frequencies are in use, however, and many may never be employed by radio. It is generally agreed that the actual usable lower and upper limits of the spectrum are 10 kc and 300,000 Mc. Frequencies below 10 kc are unsatisfactory because of the difficulty of radiating enough power to carry out practical radio work. With frequencies above 300,000 Mc/s, the transmitted signal is greatly attenuated by such things as rain, oxygen, and water vapour. These limits should be regarded with caution, however. Between 1906 and 1950 the upper limit was increased from 1,000 kc/s to 300,000 Mc/s, and the lower limit reduced from 500 to 10 kc/s. Techniques may possibly be discovered which will permit the use of even higher or lower frequencies.[1]

For convenience, the usable parts of the radio spectrum are broken down into

1. A glossary defining many of the technical terms used here appears on page 151.

a number of subdivisions. The nomenclature adopted by the ITU is as follows:

Frequency Range	*Designation*
Below 30 kc/s	Very Low Frequency (VLF)
30 to 300 kc/s	Low Frequency (LF)
300 to 3,000 kc/s	Medium Frequency (MF)
3,000 to 30,000 kc/s	High Frequency (HF)
30,000 kc to 300 Mc/s	Very High Frequency (VHF)
300 to 3,000 Mc/s	Ultra High Frequency (UHF)
3,000 to 30,000 Mc/s	Super High Frequency (SHF)
30,000 to 300,000 Mc/s	Extremely High Frequency (EHF)

The dividing line between the use of kilocycles and megacycles as the unit is 30,000 kc/s.

Although the usable portion of the spectrum embraces almost 300,000 million cycles, it does not follow that there is that number of places for transmitters. In this respect, the standard practice of referring to transmissions in terms of single frequencies is highly misleading. The actual emission of any one transmitter occupies much more spectrum space than the single frequency by which it is identified. Depending on its location in the spectrum and the type of traffic that it must carry, the width of the channel used by a transmitter may vary from only a few cycles to several million cycles. The channel, or channels, assigned to a station must be large enough to provide for efficient operation and eliminate the possibility of harmful interference to users of adjacent channels.

Different parts of the spectrum have special characteristics which largely determine the use to which a given frequency can be put. These characteristics vary with the time of day, season, or year. Not all the phenomena observed are properly understood, but with the knowledge presently available fairly accurate forecasts can be made as to the probability of any given communication being effective.

Means of Propagation

Perhaps the most important consideration to be taken into account when using a frequency is the mode of propagation of the radio wave. These waves, which travel with the velocity of light, are of three principal types, differentiated by the way in which they pass from the transmitter to the receiver. The three types are: (a) the 'sky wave', which travels up to the ionized layers in the earth's upper atmosphere, whence it is reflected back to the earth; (b) the 'ground wave', which travels along the surface of the earth; and (c) the 'direct wave', which travels on the line of sight. Most long-distance radio communication employs the sky wave, and most short-distance communication the ground wave and the direct wave. Sometimes a combination is used.

The simplest means of propagation is the direct wave. The transmitter and receiver must be in sight of one another and the straight line joining them must remain well above the ground in relation to the wavelength. Examples are frequency modulation broadcasting, television, communications between aircraft in flight, or communication relays between mountain tops. The amount of power needed to communicate with direct waves is relatively small and the electro-magnetic field is more or less inversely proportional to the distance. Atmospheric turbulence may cause the signal to fade.

The second method of propagation is by means of ground waves. These waves travel near the ground and the loss of energy is greater than in the case of direct waves. Since this loss is inversely proportional to the conductivity of the soil, communication by a ground wave is better over water than over land. Although ground waves are stable and do not show daily or seasonal variations, intensive study of the terrain lying between the transmitter and the receiver is necessary for accurate prediction. In contrast to the direct wave, the ground wave is

diffracted around the globe and thus can provide communication between points hidden from each other by the curvature of the earth. High power and tall antennae are necessary if long-distance communication is to be conducted by ground waves. However, the area covered by ground waves is covered thoroughly.

The third method of propagation is by means of the sky wave, usually called ionospheric propagation. In the outer atmosphere, there exist several ionized layers which reflect waves of a certain frequency back to the earth. These layers are at various heights and of varying densities. By taking advantage of the phenomenon of multiple reflection, one may obtain extremely long ranges, which are in fact sufficient for communication between any points on the earth's surface. If these layers remained constant, it would be relatively easy to predict the proper frequency which would give any desired circuit or coverage.

The ionosphere is subject, however, to tides and currents, some predictable and some not. Among the predictable phenomena are changes in the ionosphere due to the influence of the sun. For example, the density of the ionosphere varies during the day, and is greater at noon than at night. There is also a seasonal variation and an 11-year cycle obviously related to the solar (sun-spot) cycle. Other variations are less predictable: the formation of new layers, called sporadic layers, or changes in the geographical limits or general conditions of the normal layers. While these variations are much less persistent than the normal ones, they can cause a rupture of communication.

When setting up a sky wave broadcast or communication circuit one must find the optimum frequency to carry the signal to the receiver. This frequency is not the same for all of the conditions of the ionosphere. To ensure adequate service, it is therefore necessary to have available several frequencies which will permit a change according to the time of day, season, or particular period of the sun-spot cycle. The need to keep as many as five or even more frequencies in reserve for such conditions limits the number of frequencies available for other users.

The above methods of propagation more or less dominate various parts of the spectrum. In frequencies below about 300 kc/s (VLF and LF), the ground wave predominates. On these frequencies relatively long-distance communication can be conducted. To give the transmitted signals stability, which is one of the great advantages of these frequencies, a great deal of power is required to overcome natural radio noise. From about 300 to 3,000 kc/s (MF), there is a combination of ground and sky waves. At the lower end of this band, day-time ground-wave transmission is good. Over the whole band, transmission over water by ground waves can be carried out without great difficulty. At night transmission via the sky wave is usual, especially for frequencies above 700 kc/s. In the frequency band from 3,000 to 30,000 kc/s (HF), the sky wave predominates. Distances of thousands of miles are obtained with relatively low power. Night-time transmission is most effective from 3,000 to 12,000 kc/s and day-time transmission from 6,000 to 25,000 kc/s. Sky-wave propagation extends beyond 25,000 kc/s but in general it is not a reliable means of service. From 30,000 kc/s to 300 Mc/s (VHF) transmission is limited to short-range services and the transition to direct waves increases as the frequency is increased. Frequencies above 300 Mc/s (UHF, SHF and EHF) are limited in their use to distances not greatly exceeding the range of sight.

Although a general view of radio propagation is necessary to an understanding of frequency allocation problems, it should be remembered that the science of propagation is fairly new. Important discoveries are being made with remarkable rapidity. For instance, it has been discovered that direct waves can be deflected under certain circumstances and long ranges achieved. At the other end of the spectrum, it has been found, surprisingly, that by using a very low frequency

and relatively low power one may obtain world-wide coverage. Consequently, as the study of propagation continues, new uses for various parts of the spectrum may be expected.

Radio Services

The services of radio which require operational space in the spectrum are many and their needs diverse. If the allocation of frequencies to broadcasting and the other radio services was only a question of finding the best frequency for the particular service, the task would be relatively simple. It is complicated, however, by the fact that in addition to scientific efficiency, there are other important reasons why radio stations use the frequencies they do. Pure chance has played a role. The limitations of transmitters and receivers have sometimes determined the frequency which a service started to use. Sometimes only certain groups of frequencies were available at the beginning or the expansion of a service. Economic considerations are also important. Services using a particular band of frequencies are often reluctant to spend funds for the modification of equipment to permit a change in frequencies that would give a better level of service or would effect a saving in spectrum space. In addition, rivalry between the radio services has had its influence on the use of the spectrum.

Complicated as it may seem, use of the spectrum by the various services has taken a definite shape over the years. From 10 kc/s to 10,500 Mc/s the spectrum is divided into bands of frequencies, each allocated to a particular service. The manner in which this distribution has been achieved through international co-operation and the resultant position of broadcasting are reviewed in the following sections of this chapter.

international action

The proper use of the spectrum is an international problem and has been recognized as such since the beginning of radio. There are various reasons why it is an international problem. First, radio waves do not respect frontiers. A high-frequency station in the Americas can cause harmful interference to an African high-frequency station which uses the same frequencies. In Europe, where frontiers are close together, a broadcast on even a low or medium frequency may be received in several countries. Secondly, for many services, such as the maritime mobile and aeronautical mobile services, one of the major advantages of radio is international communication. If ships or aircraft of different flags used different bands of frequencies it would be difficult to establish communication, or even to be certain that a distress message would be answered. Thirdly, there is the question of economy. For example, if broadcasting stations used any or all parts of the spectrum, the cost of manufacturing a receiver which would pick up all of the desired transmissions would be prohibitive. Fourthly, and perhaps most important, it is essential that the different services should use the frequencies which are the most efficient for their functions. International problems demand international solutions.

The International Telecommunication Union is the focal point for co-operation by all countries in their struggle to assure a rational use of the frequencies available for radio communication. The ITU is not, however, the only international organization interested in the allocation of frequencies, although it is the major one and the only agency able to deal with the spectrum as a whole. The following list of agencies which were represented at the eighth Plenary Assembly of the ITU's International Radio Consultative Committee (Warsaw, 1956), indicates the wide range of international organizations which have an interest in the radio spectrum: Association Internationale des Intérêts

Radiomaritimes (AIIRM); Bureau International de l'Heure (BIH); European Broadcasting Union (EBU); International Broadcasting Organization (OIR); International Chamber of Shipping (ICS); International Civil Aviation Organization (ICAO); International Radio Maritime Committee (CIRM); International Scientific Radio Union (URSI); International Special Committee on Radio Interference (CISPR); and the World Meteorological Organization (WMO).

Frequency Allocations

Through the efforts of the ITU and its predecessor, the International Radiotelegraph Union, the countries of the world have divided up most of the usable parts of the spectrum among the various radio services. The result of these decisions is the Frequency Allocation Table of Atlantic City (1947) contained in the Radio Regulations of the ITU. This table allocates all of the frequencies from 10 kc/s to 10,500 Mc/s. To clarify the position of broadcasting in this table, the history of frequency allocation is here briefly reviewed.

The first attempt at frequency allocation was made at the Berlin radiotelegraph conference in 1906, when the Radio-telegraph Union was founded. Maritime radio communication had advanced to the point where it was felt necessary to provide means for intercommunication (for two stations to communicate they must know one another's frequencies): it was also necessary to eliminate interference as far as possible between users of maritime radio. Two frequencies, 1,000 kc/s and 500 kc/s (300 and 600 metres) were chosen for general public correspondence, and 1,000 kc/s was designated as the normal communication frequency. Long-distance public correspondence, and non-public transmissions, such as shipping communication systems, were to be kept in regions below 188 kc/s (1,600 metres) or above 500 kc/s (600 metres). The band between 188 and 500 kc/s was reserved for use by military, naval and government experimental stations. The frequencies selected in 1906 reflected the primitive state of the science of communication at that time and the accompanying technical limitations, such as the size of ship-borne antennae.

The London radio-telegraph conference in 1912 was also dominated by the needs of maritime radio. Advances in techniques and expansion of the maritime service in the six-year interval led to an inter-service dispute. The public maritime service requested a greater range of public correspondence frequencies, especially in the lower portion of the then usable spectrum. The downward spread of public correspondence stations was immediately blocked because the frequencies between 500 and 188 kc/s had been effectively occupied by the military and maritime radio services, especially those of France, Germany and the United Kingdom. The downward expansion of military and naval services was, in turn, blocked by the long-range maritime service which had found that the frequencies around 188 kc/s provided the best long-distance communication. As a result of these conflicts, no major change was made in the frequency assignments of 1906.

If the third and fourth regular radio-telegraph conferences had been held in 1917 and 1922 as envisaged, the Radio-telegraph Union might have been able to keep pace with the inauguration of new services and the expansion of the maritime service. As it happened, however, 15 years were to elapse before the next conference met. Countries were then faced with the task of finding room in the spectrum for a greatly expanded maritime service and for the new services which had been created, including broadcasting.

Of these, the long-distance fixed radio-telegraph service was the first to make its appearance. Although experiments in point-to-point radio had been begun as far back as 1907, its real expansion occurred only after the experiences of long-range maritime services with the use of larger antennae became known, and

apparatus capable of creating a continuous (undampened) wave was available. By 1917, when the third radio-telegraph conference was to have met, sufficient knowledge was available to permit the fixed services to organize their operations. In order to take advantage of the longer distances made possible by the use of lower frequencies, the point-to-point service began to move into the available frequencies below 286 kc/s. By 1927, operations were being planned on frequencies as low as 10 kc/s.

World War I saw the inauguration of land and aeronautical mobile services. The armies of all the belligerent powers were quick to recognize the value of radio, and special portable sets were adapted for military use. Receivers for aircraft were also designed and were in general use by the time of the armistice in 1918. In the years immediately following World War I, scheduled commercial air services, both national and international, were initiated on a regular basis. As in the case of ships using the maritime service, radio alone could enable an aeroplane to keep in communication with the ground and with other aircraft in flight. Information concerning weather, landing facilities, air traffic, and the like, given to an aeroplane in flight, were all-important for safe operation. In 1919, operating airlines of various countries established the International Air Transport Association (IATA), which entered the many-sided and continuous struggle for the division of the radio spectrum. Since several years were to elapse before amateurs were to open up high frequencies for communication, the new land and aeronautical services found their place in the lower portion of the spectrum, along with the maritime and fixed services.

The fourth major service to be developed was broadcasting. As in the case of the other new services, broadcasting was unable to choose the frequencies which seemed best suited to its task. Rather than force its way into the lower frequencies which it desired, the broadcasting service accepted what seemed to be the next best area, 550 to 1,500 kc/s, in the medium-frequency band. The one major exception was the band of frequencies from about 160 to 285 kc/s, which was pre-empted for broadcasting in Europe. The reason for this exception probably originated in the European attitude toward the role of broadcasting. Many European countries deemed it essential to provide for an integrated national broadcasting service. Since such a service called for at least one station with nation-wide coverage, the use of a low frequency was necessary because of its long-range propagation characteristics. In the United States the situation was different. Broadcasting was there carried out by commercial companies which used a large number of medium- and short-range stations. An integrated national service in the United States, even if it had been contemplated, would have been further complicated by the large geographical area to be covered.

Prior to the 1927 conference, there was a further development which the Radio-telegraph Union had to take into account in its work on the spectrum. This was the discovery by amateurs of the communication potentialities of the high-frequency (short-wave) bands. Long-distance communication could be achieved with the use of relatively little power and short antennae. Time was insufficient, however, for the full effects of this new development to be immediately realized. With the exception of the frequencies used by amateurs and by one new ship service, the use of the high-frequency band had only begun by the time of the conference.

Advance of Broadcasting

The first Radio-telegraph Union conference held after World War I opened in Washington D.C. on 4 October 1927. Eighty countries sent delegations and observers from 64 private companies, and private and public international organizations also attended. The effect of the 15-year delay was evident in the 2,000 proposals submitted before the opening session.

An important achievement of this conference was the creation of a frequency allocation table containing allocations for services from 10 kc/s to 60 Mc/s. There was considerable controversy over the problem of finding space in the lower frequency band for broadcasting and long-distance maritime communications. After the lower frequency bands had been allocated, however, the conference had little difficulty in dealing with the upper portions of the allocation table. From around 2,000 kc/s up to 60 Mc/s, it used the simple expedient of allocating alternate bands of frequencies in series to the broadcasting, amateur, mobile and fixed services. Although the top of the table reached 60 Mc/s, the conference made only two allocations from 23,000 kc/s to 60 Mc/s; these were 28,000 to 30,000 kc/s and 56 to 60 Mc/s, for amateurs and experimental use respectively. Propagation data available and the status of equipment led the conference to the conclusion that the upper limit of useful frequencies lay somewhere between 23,000 and 25,000 kc/s.

The Madrid radio-telegraph conference of 1932 was the last to be preoccupied with allocation problems in the lower parts of the spectrum. Requests for more frequencies for aeronautical services were made by Hungary, the International Commission on Air Navigation (CINA), the International Air Transport Association (IATA), and the conference of aeronautical radio experts which had been organized under the auspices of CINA. Requests for more space for broadcasting were presented by Czechoslovakia, Greece, Lithuania, Morocco, Poland, Rumania, Switzerland and the International Broadcasting Union (UIR). Each of these requests affected allocations to the maritime mobile services and, to a certain extent, the fixed services.

Although the maritime service presented no new request for frequencies, it made it clear that it would oppose further encroachment on its bands. The maritime interests were fighting a losing battle, because ranged against them were the smaller non-maritime countries whose interests lay primarily in the broadcasting and aeronautical services.

Not all of the conference participants actively supported requests for single services. Representatives of some countries, interested in all types of radio services, sought to find an adequate balance. The statement by the United Kingdom delegate is typical of their approach to the allocation problem.

'We have almost 5 million licensed broadcast listeners, and the BBC, supported by public opinion, is asking for an enlargement of its frequency band; in the same manner, the maritime navigation service is asking for the enlargement of the band allocated to radio-beacon stations; the aircraft navigation interests, in their turn, are asking for new wavelengths because of the rapid expansion of the aircraft services. The British amateurs are asking for an extension of their frequency band; the commercial communications services complain of frequent interference; the police are asking for a wavelength.

'We understand very well the reasons for all of these requests, but it is impossible to satisfy them.'

The problem was further complicated by the existence of certain broadcasting stations already operating outside their proper service bands. One group of these stations belonged to the U.S.S.R. which, since it had not been invited to the Washington conference, was not bound by its decisions on allocations.

After the aeronautical requests had been provided for by exchanges with the maritime service and in some cases by transfer, the conference reached a deadlock on broadcasting.

A solution was finally reached by means of two expedients which were used more extensively by succeeding conferences. Firstly, most of the low and medium bands were divided into two parts, a European region and 'other regions'. In this way the United States and Canada could continue operation as before, while Europe could re-allocate its frequencies to take into account its increased broadcasting needs. This expedient was only possible because the low

and medium bands had regional propagation characteristics rather than the world-wide characteristics of some of the higher frequency bands. Secondly, it was agreed that the European countries should jointly review the broadcasting band on a station-by-station basis to determine the use of the individual frequencies. This and subsequent attempts to organize the use of allocated frequency bands on the basis of individual frequency users is the subject of the next chapter.

Little difficulty was encountered with the remainder of the allocation table. An important aspect of this plan as a whole was the agreement that, in future, countries would be bound to respect allocations. The Washington plan had been described as merely a 'guide'. It is also significant that the Madrid conference of 1932 made more specific allocations in the upper reaches of the spectrum, from 23,000 to 28,000 kc/s.

The Cairo radio conference of 1938, the last to be held before World War II, was primarily concerned with the problem of finding space in the table for the ever-increasing demands for additional frequencies by the aeronautical and broadcasting services. This time the area of difficulty lay in the high-frequency band.

The aeronautical service obtained satisfaction much more easily than broadcasting. The conference agreed to set aside seven bands of frequencies between 6,500 and 23,380 kc/s, totalling 685 kc/s in all, for intercontinental air routes. Specific bands were allotted to specific air routes, both those in operation and those scheduled for future use. These allocations were especially important because they reflected one of the first attempts to plan scientifically for the future development of a service.

The International Broadcasting Union, representing most of the world's broadcasting services, submitted a plan to the Cairo conference for more broadcasting frequencies in the low-, medium-, high- and very high-frequency bands. Although the request for more frequencies in the low-frequency bands was rejected, 60 kc/s were allocated in the medium band. One group of requests in the high-frequency band was supported by the argument that the frequencies in question were very effective in certain tropical regions, where atmospheric conditions made broadcasting on other frequencies extremely difficult. The conference met these requests almost entirely. The 2,300 to 2,500 kc/s, 3,300 to 3,500 kc/s and 4,770 to 4,965 kc/s bands were allocated to tropical broadcasting and conditions for their use elaborated.

The union also requested the extension of six regular high-frequency broadcasting bands, a request which reflected the growing use of high-frequency international broadcasting before World War II. Opponents of the plan pointed out that if the additional 950 kc/s requested were granted, it would mean the dislocation of at least a thousand stations in the fixed point-to-point and mobile services. A compromise was finally reached whereby the broadcasting services were given an extra 500 kc/s in the bands requested. Administrations undertook to place all high-frequency broadcasting stations within the enlarged bands and to remove stations conducting other services.

The conference's final allocation problem concerned frequencies above 25 Mc/s. European countries held that all frequencies between 25 and 200 Mc/s should be allocated on a world-wide basis for specific services. Countries in the Western Hemisphere expressed opposition. They first pointed out that the countries of Europe and the Western Hemisphere were using these frequencies for different purposes. Second, they considered that the use of frequencies above 25 Mc/s was still in such an experimental state that only temporary allocations were advisable.

The compromise used at the Madrid conference in the lower bands was again employed to eliminate a deadlock. Frequencies above 30 Mc/s were divided into two parts, a European region and 'other regions'. For the European region,

specific permanent bands were allotted to meteorological aids, television, broadcasting, air services, amateurs, and fixed and mobile services. No allocations were made for the 'other regions', but an experimental table for frequencies from 30 to 300 Mc/s, which had been drawn up a year previously by an inter-American radio conference, was annexed to the Cairo Radio Regulations by the American States as a possible guide for further development.

Wartime and Post-war Developments

World War II had widespread repercussions on the allocation table, and on almost every level a new or expanded service put a strain on the Cairo allocations. A long-range navigational aid, Loran, had made its appearance in the medium band. This new system, which employed a large band of frequencies, was used by Allied shipping in the Atlantic and Pacific to establish their positions continuously without interference from magnetic phenomena and the aurora borealis. In the high-frequency band, always difficult because of its long-range propagation characteristics, the use of radio for the aeronautical services and high-frequency broadcasting had been greatly extended. In the formerly unused upper reaches of the table, new inventions such as radar were making their presence felt.

Pressure on the Cairo allocations did not diminish when the war ended, and the adaptation of many new wartime developments to civilian needs only served to increase this pressure. Aircraft, equipped with the most modern radio equipment, were converted to civilian use in all parts of the world. Television, profiting from wartime research in allied fields, developed in a number of countries. And, as international relations again became strained, the use of radio for military and propaganda purposes continued to expand.

In contrast to the delay after the first world war, only one year elapsed between the end of World War II and the convening of another International Radio Conference. To amend the allocation table and revise other parts of the Radio Regulations, delegates from 76 countries met in Atlantic City from May to September 1947.

In the low-frequency and medium-frequency bands, considerable controversy arose over a request from the United States for authorization of the Loran system, which, as already mentioned, had developed during the war. This consisted of 13 stations in the Atlantic area whose operation centred on 1,950 kc/s, and 24 stations in the Pacific whose operation centred on 1,850 kc/s. The United States delegate requested that frequencies be allocated to this sytem and the additional band of 200 to 280 kc/s be assigned for the future development of another radio navigation system. In support of this request, the United States declared that the Loran system had proved extremely useful for both air and surface craft over a period of years and that an international aviation meeting had recognized its value.

Opposition to approval of Loran for the Atlantic area came from a group of countries which operated fishing fleets in the North Sea. The allocation was finally granted under an agreement whereby the operator of the system undertook to minimize harmful interference and to replace existing equipment with more modern apparatus. Since no countries were directly affected by the Pacific system, the 1,800 to 1,900 kc/s band was allocated to it without dispute.

Some difficulty arose over a request that the 200 to 280 kc/s band be allocated for an experimental radio-navigation system. The frequencies concerned lay across the European low-frequency broadcasting band. Since European countries were not willing to risk interference from an Atlantic system, the United States was obliged to select the 90 to 110 kc/s band, which was occupied by the fixed and maritime services. In addition, the European low-frequency broadcasting band and the world-wide medium-frequency band were considerably enlarged.

At Atlantic City the high-frequency band again bore the brunt of new requests

by the aeronautical and broadcasting services. The aeronautical service made impressive gains in this band, as well as in the upper limits of the medium-frequency band. In the area between 4,500 kc/s and 24,000 kc/s, for example, the aeronautical service almost doubled its Cairo allocations, while the number of bands which it had to share with other services was substantially reduced. High-frequency broadcasting won an increase of some 35 per cent over its allocations under the Cario regulations. This gain, all in exclusive frequencies, was second only to that of the aeronautical service. As would be expected, these gains by broadcasting and the aeronautical service were made at the expense of other services. While the maritime service maintained about the same number of frequencies, the fixed and amateur services lost proportionately to the gains of their rivals. Furthermore, only the intervention of the United States delegation saved the amateurs from being completely excluded from this world-wide band.

Significantly, the Atlantic City conference found it necessary to extend the allocation table up to 10,500 Mc/s. The Cairo conference, it will be recalled, made allocations only up to 200 Mc/s. Television and broadcasting services received fairly generous allocations in this area, as well as certain radio-navigation aids such as radar, which had developed during the war. Amateur services which had lost frequencies in the lower world-wide band received small bands of frequencies throughout the newly extended upper limits of the table.

For the table as a whole, the conference extended the expedient of breaking down allocations in non-world-wide bands into regions. In addition, the former twofold classification was replaced by a threefold one: Region 1, approximately comprising Europe, Africa and the U.S.S.R.; Region 2, the Western Hemisphere; Region 3, the remainder of the world (Near East, Asia and Oceania).[1] Provision was also made for further subdivisions where propagation characteristics permitted.

The delays in changing over to the new table, and the extraordinary means by which it was hoped to provide for the services of all countries, are described in the next chapter.

the present position of broadcasting

The position of broadcasting in the spectrum is best illustrated by the broadcasting allocations in the various bands of frequencies of the Atlantic City table. Allocations in each band vary as regards propagation characteristics, sharing with other services, and sometimes use by region. In addition, the Radio Regulations allow a great number of derogations to almost every allocation. These derogations will be mentioned only when of major importance.

Starting at the bottom of the spectrum, one finds that the frequencies 160 to 255 kc/s in the low-frequency band (LF) are allocated exclusively to broadcasting in the European area. This band is not shared with any other service. European broadcasting may also be carried out in the shared bands 150 to 160 kc/s and 255 to 285 kc/s. The former band is shared with the maritime mobile service, which must not, however, cause harmful interference to broadcasting within the boundaries of the countries where the transmitter in question is located. The latter band, 255 to 285 kc/s, is shared with both the maritime mobile service and the aeronautical navigation service.

The 150 to 285 kc/s band is dominated by ground-wave propagation. With special antennae and equipment capable of producing a fairly high power, European countries can maintain effective coverage over a relatively wide area. Where an integrated national service is considered important, the use of these frequencies is desirable. Because this band is of limited extent, the number of channels available is small. Frequencies above and below the band are occupied

1. See Pictograph 5, facing page 105.

by the maritime mobile, fixed, aeronautical mobile and aeronautical navigation services.

The next broadcasting allocation is in the medium-frequency (MF) band from 525 to 1,605 kc/s. While the 535 to 1,605 kc/s band is a world-wide allocation, the 10 kc/s from 525 to 535 kc/s are reserved for European broadcasting. The Radio Regulations also permit, under strict conditions, a limited use of 415 to 490 kc/s and 510 to 525 kc/s for European broadcasting. The over-all band 525 to 1,605 kc/s is surrounded by allocations to the maritime mobile, general mobile, fixed and aeronautical navigation services.

The chief characteristic of this band is a combination of ground- and sky-wave propagation. Good reception is general up to a distance of 40 or 50 miles during both daylight and evening operations, and fairly good reception at night up to several hundred miles. An important characteristic of this band is the existence of a zone of poor reception at about 50 to 75 miles from the transmitter; this is caused by interference between the ground wave and sky wave which are of about equal strength. The fact that greater area coverage can be obtained in the lower portion of this band is substantiated by the number of stations in this section and by the progressive downward expansion of the band over the years.

The next area with allocations for broadcasting is in the high-frequency band (HF). As mentioned earlier, frequencies in this band are in great demand by almost all services because the predominance of sky-wave propagation makes them especially suitable for long-distance communication. The struggle for additional frequencies in this band has continued unabated since amateurs discovered their usefulness.

Although most of the broadcasting allocations in the high-frequency band are necessarily world-wide, there are four exceptions: 3,900 to 3,950 kc/s, allocated to Region 3, where it is shared by the aeronautical mobile service; 3,950 to 4,000 kc/s, allocated to both Region 1 and Region 3, where it is shared with the fixed service; 7,100 to 7,150 kc/s, allocated to Regions 1 and 3, where it is shared with amateurs but with a priority for broadcasting; and 7,150 to 7,300 kc/s, allocated exclusively to broadcasting in Regions 1 and 3. In the Western Hemisphere both the 7,100 to 7,150 kc/s and the 7,150 to 7,300 kc/s bands are allocated exclusively to amateurs. When frequencies in the high-frequency band are not allocated on a world-wide basis, interference between the services of different regions is always possible.

The remaining and by far the largest of the broadcasting allocations in the high-frequency band are all world-wide. These allocations are: 5,950 to 6,200 kc/s; 9,500 to 9,775 kc/s; 11,700 to 11,975 kc/s; 15,100 to 15,450 kc/s; 17,700 to 17,900 kc/s; 21,450 to 21,750 kc/s; and 25,600 to 26,100 kc/s. These exclusive and world-wide allocations to broadcasting comprise some 8 per cent of frequencies in the high-frequency band. The remainder of the space is filled with allocations to the aeronautical mobile, maritime mobile, land mobile, fixed, amateur, and standard frequency services.

The unpredictable behaviour of sky waves affecting HF broadcasting places a much greater strain on the listener than in other broadcasting services, as is indicated by the decline in the number of listeners to high-frequency broadcasts since World War II. Nevertheless, countries continue to build new high-frequency broadcasting stations. To provide for continuous operation, these stations, as well as stations for other services, must be given a series of allocations throughout the high-frequency band and thus permit selection of the best possible frequency for the distance required, time of day, and solar activity. With regard to solar activity, the lower end of the band is more useful during minimum sun-spot activity and the upper part during maximum activity. Although the high-frequency band is fairly large, the number of stations which can be effectively accommodated is consequently restricted.

Before we turn to broadcasting in the very high-frequency band, some attention should be given to frequencies in the high-frequency band which are reserved for tropical broadcasting. These special bands were established on the assumption that they would be more reliable for short-distance broadcasting than the lower frequencies, which are seriously disturbed by conditions peculiar to the tropical zone. The bands thus allocated are: 2,300 to 2,498 kc/s for Region 1; 2,300 to 2,495 kc/s for Regions 2 and 3; 3,200 to 3,400 kc/s for all regions; 4,750 to 4,995 kc/s for all regions; and 5,005 to 5,060 kc/s for all regions. Although each of these bands is shared with other services, priority is granted to the tropical broadcasting services.

In the remainder of the spectrum, propagation is dominated by direct waves. The Atlantic City table furnishes a series of allocations in the very high-frequency band and the ultra high-frequency band for broadcasting. With only a few exceptions, most of these allocations have been divided among the three regions according to their actual or anticipated use. Regional allocation, rather than world-wide allocation, is possible in these bands because direct waves generally travel short distances. While all the allocations in these bands are labelled 'broadcasting', they include both radio and television. The use to which these bands are put depends on regional agreement. So far only one major agreement, the European Broadcasting Agreement of 1952, has been negotiated, to decide whether these frequencies should be used for sound broadcasting or television. This agreement reserved the band from 87.5 to 100 Mc/s for sound broadcasting, the remainder of the very-high-frequency broadcasting allocations being transferred to television.

In summary, we find that broadcasting is firmly in possession of frequencies in the low, middle, high, and very high bands. Perhaps not all of the allocations to broadcasting are the best possible for its needs, but they do provide for a wide range of operation on a national and international basis. The share of the spectrum enjoyed by broadcasting has steadily increased over the years. This increase is due primarily to the fact that broadcasting is considered to be an essential service of mass communication. While a country might be willing to continue without an international fixed circuit, it will not forego a broadcasting service.

frequencies: fair shares for all

6

With the rapid increase in the use of broadcasting and other services of radio, the mere allocation of bands of frequencies to the various services proved an inadequate means of achieving a rational use of the spectrum. Although allocation helped to prevent interference between services, it did not eliminate the possibility of interference between stations of the same service within their allocated bands.

The present chapter deals with one attempt to solve this additional problem of interference: if there are insufficient desirable frequencies to meet the world's requirements, those that are available must be allocated to individual countries according to their needs. As will be seen, this solution was much more complicated than at first appeared. A general agreement between nations can usually be reached as to the relative value of the different radio services, since most countries permit the operation of more than one service. But the assessing of one nation's needs against those of another has proved far more difficult. This involves, for example, the comparison of a radio network in one country with that in another country on the basis of its importance. Yet how can this importance in one country be determined by representatives of other governments?

After 1947, efforts to reach a solution to this long-standing problem were further hindered by the fact that international relations had become seriously strained. Not only did this trend militate against international co-operation in general, but many of the frequencies under review were those which, in time of crisis, were the most desirable.

the international frequency list

When radio was still in its development stage, the problem of interference between stations performing the same service was minimal.[1] The number of

1. As noted earlier, there are many causes of unwanted noise in a radio communication, e.g., sun-spot activity, electrical discharges from machinery and transmissions by other radio stations. It is the latter, noise from another transmitter, which is usually known as 'interference'. By international definition, such interference is considered harmful if it obstructs or repeatedly interrupts a service. Whether an unwanted emission actually results in obstruction or interruption depends upon the service to be protected. Some services, such as manual radio-telegraphy, can operate efficiently despite considerable background noise. Other services, such as broadcasting, require a great deal of protection if they are to carry out their operation in a manner acceptable to the user.

unused, desirable frequencies was ample. If necessary, a quick monitoring of the desired frequency band was usually sufficient to find space in which to start a new transmission. If by chance the new transmitter did cause interference with another station, it was a simple matter to find another usable frequency. As more and more transmitters began operation, the procedure became more and more complicated. Only too often, deliberately or accidentally, stations began transmitting without making the necessary advanced calculations. As a result, the incidence of harmful interference assumed alarming proportions. A method had to be devised to help eliminate such incidents.

The solution was found by the bureau of the International Telegraph Union, which had undertaken administrative duties for the Radio-telegraph Union. In 1928 the bureau began publishing a cumulative list of the frequencies in use by all countries. Up to World War II, an administration, by consulting this list, could choose a frequency to inaugurate a new station with a fair prospect that no international interference would result. The development of the International Frequency List was an outstanding example of enterprise by an international administrative organ, and was to have far-reaching consequences when a new solution to the problem was attempted after the war.

The move to establish a frequency list was inspired by decisions of the 1906 Radio-telegraph Conference and the 1927 Radio-telegraph Conference. First, Article 8 of the Radio-telegraph Convention (1906) pledged all national administrations to operate their radio stations in such a manner as not to interfere with other stations. Article 6 of the same convention pledged administrations to notify each other of ship and shore stations under their auspices which were open to public correspondence. The purpose of Article 6, according to the debates of the conference, was merely to provide telegraph offices with a list of ship and shore stations through which public telegrams could be routed. The bureau of the International Telegraph Union immediately began publishing a nomenclature of maritime ship and shore stations, including frequencies used, times open to public correspondence, and tariffs charged. Naturally, administrations began to consult the nomenclature before putting almost any station into operation.

The 1927 Radio-telegraph Conference carried these provisions one step further and made an important innovation. Article 6 was expanded to include all stations in the public service and all stations conducting 'special services' covered by the Radio Regulations. The bureau was instructed to prepare nomenclatures for fixed, special service, aircraft and broadcasting stations in addition to those engaged in the maritime service. The innovation concerned the troublesome group of frequencies below 37.5 kc/s. Under the 1927 Radio Regulations (Article 5, paragraph 17), administrations were obliged to notify the bureau of any decision authorizing a new station to use a frequency below 37.5 kc/s. This notice was to reach the bureau four months before construction of the station 'in order to dispose of objections which any of the administrations might raise against the adoption of the proposed frequency'. Furthermore, paragraph 16 of the same article contained the following provisions: 'The frequencies assigned by administrations to all new fixed land or radio broadcasting stations which they may have authorized or of which they may have undertaken the installation must be chosen in such a manner as to prevent so far as practicable interference with international services carried on by existing stations *the frequencies of which have already been notified to the International Bureau.*'

The next step was taken by the bureau. In 1928 it announced that, at the suggestion of one administration and after consulting European administrations, it had decided to publish a cumulative list of *all* the frequencies according to information received since 1906. The first international frequency list, 24 pages in length, was published in December 1928 and contained about 2,000 entries.

It is significant that the list was not confined to frequencies under 37.5 kc/s, as might be assumed from the decision of the 1927 conference, but included entries for almost the entire usable radio spectrum from 14.99 to 60,000 kc/s.

The next step in the evolution of the frequency list was its official acceptance by the Radio Consultative Committee of the Radio-telegraph Union. At its first meeting at The Hague in 1929, the committee adopted an 'opinion' requesting certain changes in the form of the list, and urged member administrations to notify the bureau of all the frequencies they were using and wished to use. In 1930 the bureau began publishing the list as amended by the committee. At the second meeting of the Radio Consultative Committee, the bureau announced that, at the suggestion of an administration, it had begun to include the date of notification in the list so that it would be possible to determine 'to which administration the priority appertains, in case of dispute or interference.'[1] The committee, without discussing the principle of 'priority', adopted a new opinion that the date of registration should be included in the list. In addition, while recognizing that the 1927 Radio Regulations did not authorize the publishing of such a list, the committee declared that it was of great practical value and should be considered an official union document.

The International Frequency List was made an official union publication by the 1932 Madrid Radio-telegraph Conference. Its scope was expanded to include 'all the frequencies assigned to stations intended to carry on a regular service' and capable of causing international interference. Furthermore, members of the union were obliged by the 1932 Radio-telegraph Regulations to notify all such stations to the bureau for inclusion in the list.

As the spectrum became more and more crowded, administrations found the list increasingly valuable. They accordingly took care to notify the bureau of all frequencies in use, including those employed by the armed forces. On the other hand, when a new station was put in operation the list became of primary importance in selecting a frequency which would not cause interference to other stations and which could be used without interference from others. By the outbreak of World War II, the bureau had published nine editions of the list and numerous supplements.

'*Right of Priority*'

From 1928, when the first edition of the list appeared, there has been controversy as to the importance of the date on which a frequency was registered with the international bureau for inclusion in the list. Did notification of the use of a frequency give a country a legal, proprietary interest in the frequency so registered in the face of claims of other administrations which might subsequently wish to use the same frequency, or one close enough to cause interference? In view of the importance which some countries at the Atlantic City conference placed on an affirmative answer on this point, referred to either as the 'right of priority' or 'right of previous usage', a review of relevant early discussions may be useful.

The first reference to a right of priority is found in records of the 1927 Radio-telegraph Conference. At that meeting, both Switzerland and Lithuania proposed that such a right be granted to the earlier user of any given frequency. The records of the committee which considered the proposals state only that a discussion was held and that the United States delegate asserted that his government would not subscribe to any provision in the regulations which would give any country, administration or private company an absolute control over the use of any particular frequency. The committee finally decided that the articles adopted earlier (concerning the selection of frequencies in a manner to avoid

1. *Liste des Fréquences des Stations Radioélectriques* (Liste No. 1), Berne, 1930.

interference) covered the question of priority sufficiently. Accordingly, there was no need to make priority the subject of a special paragraph of the Radio Regulations.

Although the bureau had announced in 1930 that it had begun to place the date of notification of a frequency in the list so that it would be possible to determine 'to which administration the priority appertains in case of dispute or interference', there was only one reference to priority in the preliminary documents of the Madrid Radio-telegraph Conference in 1932. This reference, which appeared in an advance statement from the Czechoslovakian administration, read: 'The rules concerning the priority of frequencies notified to the bureau must be established.' According to the Czechoslovakian administration, it was necessary to (a) decide how priority was actually obtained; (b) clarify the rights appertaining to that priority; and (c) decide how to eliminate rapidly the litigations which arose between administrations over the subject of priority.

Despite the directness of the statement by the Czechoslovakian administration, the 1932 conference made no real effort to discuss the problem raised or to reach a definite answer. At one point in the documents there is a declaration by the Japanese delegate in the report of the technical subcommittee to the effect that the chairman of the technical sub-subcommittee had assured him that 'the notification (of a frequency) was purely and simply for information; there was no relation between the notification and the right of priority'. The sub-subcommittee, he continued, had given its unanimous approval. The Japanese delegate's remarks were included in the subcommittee's report but no further discussion was held. Neither the technical committee proper nor the plenary assembly made any comments.[1]

The special committee appointed to examine the usefulness of the list also refused to be drawn into a discussion on the 'right of priority', but in its final report stated: 'If a question of priority should be submitted to a court of arbitration, it is clear that the court must take into consideration not only the date of notification but also related questions such as the date that the station in question was put into operation, the power of the station, the importance of the service carried out, the engineering techniques practised by the station and numerous other questions of equal importance.'

After a thorough examination of the question, Franz Schwill, then vice-director of the bureau, came to the conclusion in 1934 that a frequency could not become the object of 'ownership.' In case of arbitration, however, an administration which had notified a frequency to the bureau and used the frequency in conformity with the convention and regulations, could invoke those facts in its favour when requesting the right to continue to use the frequency without interference. This would be clearly 'a privileged position which one could consider as a priority, but above all of the order moral rather than juridic'. In conclusion, he added: 'The fact that the administrations scrupulously observed the directions for the notification of frequencies to the bureau of the union, and that they attached the greatest importance to the correct reproduction of all the details required, notably the dates of notification, proves that the directives are not devoid of all value.'

He referred here to the known but unpublished fact that despite the talk about a right of priority, administrations continued to use the date of registration of a frequency in discussions with other administrations on cases of harmful interference, and that this date was usually a determining factor in the settlement. The bureau of the union was often used as the intermediary in such disputes. The procedure was as follows: (a) An administration which discovered

1. For a full account of this incident see G. A. Codding, *The International Telecommunication Union*, Leiden, E. J. Brill, 1952, pp. 188–90.

that one of its stations was suffering interference from a newly notified station would so inform the bureau, stressing the notification date in its complaint. (b) The bureau would then send an extract of the complaint to the administration concerned. (c) If the second administration recognized the validity of the complaint, it would notify the bureau of the action it would take, e.g., moving its station off the frequency in question, lowering the transmitting power, or installing a directional antenna.

As will be seen later, this procedure began to break down when the use of radio increased even more rapidly after World War II. Another method of preventing harmful interference had to be found.

the european broadcasting experiment

It is not surprising that a new experiment in combating harmful international interference should have been attempted first in Europe, nor that the radio service involved should be broadcasting. The proximity of frontiers and the high concentration of population created a problem almost as soon as broadcasting was introduced. While many of the earlier radio services could operate under relatively difficult conditions of noise, broadcasting required a higher degree of protection to carry out its function as a medium of mass communication. It soon became clear that it was necessary to determine exactly which frequencies individual European stations could use without causing interference with each other and to provide a formula that would permit the orderly inauguration of new transmitters in the future. As early as 1925 the chief engineer of the BBC commented: 'Harmful interference to broadcasting is being recorded daily, and only mutual adjustments can restore order to what is rapidly becoming a chaotic situation.'[1]

The European experiment of assigning individual frequencies to individual broadcasting stations was carried out before the war along three general lines. First, there was an attempt at voluntary co-operation between the various operators of broadcasting services, public and private, under the auspices of the International Broadcasting Union. Two plans were produced and put into operation by this method, the Geneva Plan of 1926 and the Brussels Plan of 1929. Second, there was an attempt, inspired by Czechoslovakia, to make frequency distribution more official by convening a special European conference attended by representatives of national administrations concerned with broadcasting. This conference, which met in Prague in 1929, produced a new plan based on modifications of the Brussels Plan. Thirdly, the International Broadcasting Union itself convened two conferences of administration representatives, the conference of Lucerne, 1933, and the conference of Montreux, 1939. These conferences assigned European broadcasting frequencies in conformity with the Madrid and Cairo frequency allocation tables, the International Broadcasting Union being designated to carry out the preliminary work.

The first European allocation plan, known as the Geneva Plan, was drawn up by the union and went into effect on 14 November 1926. This plan allocated 83 exclusive and 16 shared frequencies in the 510 to 1,500 kc/s band. Allocations were determined with reference to the following major considerations: (a) older stations should be changed as little as possible; (b) stations of major national and international importance should have a priority over others, even if they happened to be newer; (c) each country should have at least one exclusive allocation in the more desirable frequencies between 600 and 1,000 kc/s; (d) all stations of more than two kilowatts power should be separated by at least 10 kc/s from the frequency of any other station operating within a distance of

1. *Journal télégraphique*, Berne, 25 August 1925.

1,500 kilometres. The plan, which was being applied by 80 per cent of the European stations when it went into effect, resulted in an immediate reduction in interference.

In addition, the union established a technical checking centre at Brussels in 1926 to contact every European station once daily; intervene in the case of a maladjusted transmitter; keep up with technical advances; publish the results of its work.

The plan was revised in 1928 by the new technical committee of the union to take into account new stations which members had put into operation since 1926, and the first frequency allocation table drawn up by the Washington Radio-telegraph Conference of 1927. Under the new Brussels Plan, 90 exclusive and 10 shared frequencies were allocated in the 550 to 1,500 kc/s band and seven exclusive frequencies in the low-frequency band. Although the Washington Radio-telegraph Regulations permitted derogations to the allocation table, only two stations of members, one in Hungary and one in Denmark, were allowed to operate outside the broadcasting bands. To find sufficient frequencies, however, it had been necessary to lower the separation between allocations from 10 to 9 kc/s in the 550 to 1,000 kc/s band. Of particular interest in the Brussels Plan was the method by which the technical committee, with the approval of members of the union, arrived at the number of exclusive frequencies to be allotted to each member. The following formula was used:[1]

$$N = \left(\frac{A}{At} + \frac{B}{Bt} + \frac{C}{Ct}\right)\frac{Nt}{3}$$

Equivalents of the symbols were: N = number of exclusive frequencies allotted to the country under consideration; A = population of country; B = area of country; C = telegraph and telephone traffic of the country according to data of the International Telegraph Union for the year 1923; At = total population of zone of application of the plan; Bt = total area of zone of application; Ct = total telegraph and telephone traffic of zone of application; Nt = total number of exclusive frequencies available.

Under this formula, only three countries received more than ten exclusive frequencies: Germany (14), France (12), and the United Kingdom (11).

For various reasons, however, the plan proved inadequate. First, many broadcasting stations did not hold to their assigned frequencies because of poor technical operating conditions. Second, some European broadcasting enterprises were not members of the union and their needs had not been met in the plan. Third, some enterprises, although members of the union, ignored the plan. As a result, severe interference continued.

Continued Pre-war Difficulties

The second phase of the pre-war experiment began with an invitation by Czechoslovakia to all 'telegraph administrations' interested in European broadcasting to meet in Prague to work out common problems. The International Broadcasting Union was invited to help prepare the conference. Representatives of 28 'administrations', together with observers from some non-European countries, from eight private companies, and three international organizations met in Prague on 4 April 1929.

The Prague conference was more official than previous meetings because of the presence of representatives of administrations, and more universal because of the attendance of a delegate from the U.S.S.R., which was then operating some forty stations and had not been a member of the union. However, the conference was plagued by various difficulties. First, several countries insisted that they be

1. Bureau International de l'Union Télégraphique, *Documents de la Conférence radio-électrique européenne*, Prague, 1929, p. 30.

permitted to operate broadcasting services in bands which had been allocated by the Washington conference to the mobile and direction-finding services. The U.S.S.R., in requesting six frequencies in the 224 to 550 kc/s band, maintained that since it had not participated in the Washington conference, it was not bound by the allocation table. Secondly, additional room had to be found in the table for new participants.

Through a series of compromises, the Prague conference was able to draw up a new allocation plan. Nine countries were permitted to operate outside the proper bands on the understanding that they would not interfere with the services to which the bands had been allocated by the Washington regulations. The separation between frequencies was reduced to 9 kc/s for the remainder of the band up to 1,400 kc/s and no uniform separation was attempted in finding a place for the Soviet stations. In the end only six administrations registered reservations to the plan; none of these reservations were serious.

The Prague Plan soon proved inadequate and in 1930 the Council of the International Broadcasting Union suggested that it should be revised. However, it was decided to postpone action until the next radio conference, due to be held in Madrid in 1932, when the allocation table would perhaps be changed.

The final phase of the experiment began at the Madrid Radio-communication Conference of 1932. To break the deadlock over frequency allocations in the low and medium bands, the conference decided that the European countries should meet and work out a new formula under which the Madrid allocations would be used on a regional basis. Although the low and medium bands allocated to broadcasting were not greatly enlarged, the Madrid Radio Regulations also provided that the European conference would have the right to permit derogations to the Madrid allocations under certain specified conditions. The countries of the European region, with the exception of Luxembourg,[1] signed an additional protocol to the regulations in which arrangements for the conference were made, and in which they agreed not to make any important changes in their broadcasting services between the signing of the protocol and the end of the proposed conference.

As requested in the additional protocol, the International Broadcasting Union undertook to prepare a draft frequency plan. The union's technical committee, in which over twenty members from different countries took part, first made an inventory of all existing stations in the European area, all stations under construction or planned, all power increases, and recorded instances of interference between stations. The committee then drew up a list of technical and general considerations to be recognized in making frequency assignments. Among the general considerations, the following illustrate the difficulties attending any attempt to determine a country's needs: (a) special needs where broadcasting is either non-existent, only beginning to develop, or in the course of expansion; (b) technical and physical conditions, e.g., propagation characteristics, topography, geography, longitude, latitude, and climate; (c) political and social characteristics, e.g., importance of broadcasting as an instrument of government, customs, languages, political subdivisions, and existence of minorities.

The committee warned that, because of the small number of frequencies available and the numerous demands, the criteria used would not be unanimously approved. Some considerations were entirely relative, and even diametrically opposite reasons could be used in support of claims for preferential treatment in the allocation of frequencies. For instance, one could justify the operation of a very good broadcasting service equally well in a country with a large and cultured population and in a country where the population is less educated

1. In the face of criticism for contemplating starting a high-powered commercial station on a low frequency and transmitting in several languages, the Luxembourg delegation failed to sign the additional protocol.

since in the former case it is a natural concomitant of a high level of culture, and in the latter case it could play a very important part in educating the population. In the same way, a country with a difficult terrain and a small population could maintain that broadcasting was essential because its people lived in isolated groups.

The committee finally drew up a draft frequency plan and submitted it to the interested countries. The resulting comments more than justified the committee's pessimism. Nearly every government found fault with the plan. In addition, complaints were received from the International Shipping Conference, the International Radio-maritime Committee, the International Commission for Air Navigation, and the Committee of Aeronautical Radio Experts to the effect that the derogations would most certainly cause harmful interference to their respective services.

Lucerne and Montreux Plans

Delegates from 35 European countries met in Lucerne, Switzerland, in May-June 1933 to draw up a new assignment plan on the basis of the union's work. The problems arising at this meeting were similar to those which had confronted the union's technical committee.

In an attempt to forestall purely political difficulties, preparation of the new plan was assigned to a subcommittee composed of the chairman of the union's technical committee and three of his colleagues. The subcommittee, which met behind locked doors, produced two versions of a plan, both of which were attacked by most of the delegations. Demands for particular frequencies, and the protection requested, were too great for the space available. The most frequent complaints were: (a) all of the frequencies requested were not assigned, especially in the more desirable lower bands; (b) the plan provided for sharing of frequencies where it was not clear that the geographical separation would eliminate interference; and (c) the derogations to the Madrid allocation table would cause interference with the maritime and aeronautical services.

The most serious difficulty arose from requests by the U.S.S.R. The U.S.S.R. had made a reservation to the Madrid table, stating that it would continue to operate in lower bands which were not allocated to broadcasting and requesting the European conference to recognize its right to do so. Although the U.S.S.R. during the conference lowered its total out-of-band requests in the lower bands from 15 to 10, it refused to reduce the power of its remaining stations. One of these stations was Moscow I, operating on 500 kc/s, which was the strongest station then in existence. The site of Moscow I was moved three times before agreement was reached. The most telling argument of the U.S.S.R. was that since it had made reservations to the Madrid allocation table, it would not be bound by any actions of the Lucerne conference if it considered that its interests were not being protected.

After certain concessions by the U.S.S.R., and the realization that an imperfect plan was better than none, the revised plan was accepted by 27 of the 35 participants. Nineteen signatories made declarations criticizing various aspects of the plan, five non-signatories made statements concerning their reason for not signing, and Greece, Luxembourg and the Netherlands neither signed nor made statements.[1] Twenty-four signatories signed a collective reservation to the effect that if the measures described in the individual declarations caused harm to their services, they would remain free to take steps to protect their frequencies.

Despite the 'quasi-unanimous' character of the Lucerne Plan, and the many

1. Shortly after the Madrid conference, a high-powered commercial Luxembourg station began transmitting in the low-frequency band (not on the frequency assigned to it at Prague) in French, German and English. After again being criticized, and realizing that its frequency request would not be granted, the Luxembourg delegation withdrew.

reservations, not too much difficulty was experienced in the exclusive broadcasting frequencies between 500 and 1,500 kc/s. Furthermore, many of the problems in the lower, shared frequency bands were worked out through the efforts of the International Broadcasting Union, which had been entrusted by the Lucerne convention as the expert body for all technical questions concerning broadcasting.

The last pre-war attempt to assign frequencies to European stations was made at Montreux in March-April 1939. This conference, which was overshadowed by major political events in Europe, also prepared a 'quasi-unanimous' assignment plan. Conference work followed the same general pattern as at Lucerne. The Cairo Radio-communication Conference of 1938 had authorized the holding of a European broadcasting conference. At Montreux, the International Broadcasting Union was given the task of drawing up a preliminary plan and communicating it to European countries. On the basis of the union's plan, the conference made two major revisions and many minor ones before most of the delegates were satisfied. Of the 31 signatories, 24 made reservations as to various parts of the plan.

The Montreux Plan was to have come into effect on 4 March 1940. In February 1940 the chairman of the conference and an expert committee of the International Broadcasting Union requested the countries concerned to postpone action to a more favourable time.

It should be noted that each succeeding conference or meeting had a heavier task. Although the broadcasting bands were not greatly enlarged by the radio-communication conferences, the number of stations continued to increase. According to the International Broadcasting Union, the number of European stations and their total power increased from the Geneva Plan of 1926 to the Montreux Plan of 1939 as shown in Table 5.[1]

TABLE 5

	Geneva Plan 1926	Prague Plan 1929	Lucerne Plan 1933	Montreux Plan 1939
Number of stations	123	200	257	351
Total power in kilowatts	116	420	3,260	10,790

Although these plans were acceptable to a majority and not to all, they did represent a bold new attack on an extremely serious problem. And they permitted much better reception than would have been the case if no attempt at improvement had been made.

Post-war Efforts

The first European broadcasting conferences held after the war met at Copenhagen in 1948 and at Stockholm in 1952. They mark an important step forward in the European experiment, the first conference in regard to its form and the second in regard to its content.

There were two essential differences between the Copenhagen meeting and the previous European conferences. First, the preparatory work was entrusted to a small committee of national representatives which included the three largest users of broadcasting in Europe, rather than to an organization of broadcasters.[2] Second, the conference itself was composed of 'representatives of countries'

1. Bureau de l'Union Internationale des Télécommunications, *Documents de la Conférence européenne de radiodiffusion*, Montreux, 1939, p. 28.
2. The committee consisted of representatives from Belgium, France, Netherlands, Sweden, Switzerland, U.S.S.R., United Kingdom and Yugoslavia.

rather than representatives of radio administrations as had been the case at Prague, Lucerne and Montreux. The purpose of the arrangements, therefore, was to bring governments directly into the problem of assigning frequencies. While governments might be tempted to permit administrations to ignore a plan as long as the government itself was not bound, this, it was hoped, would not be the case where the final document had the form of a treaty.

The work of the Copenhagen conference followed the same pattern as at pre-war meetings. There were again too many stations for the size of the broadcasting bands. The number of stations in actual operation in the low and medium bands had increased to some four hundred, with a total of over 12,000 kilowatts of power. Even after numerous revisions, the plan prepared at Copenhagen was not accepted unanimously. Seven countries of the 32 represented (Austria, Egypt, Iceland, Luxembourg, Sweden, Syria and Turkey) refused to sign the final documents because their requirement were not fully met. It is significant that most of the dissenters came from the periphery of the European region where the assignment of shared frequencies is usual.

The final Copenhagen Plan provided for 13 exclusive allocations and five shared allocations in the low-frequency band from 150 to 285 kc/s, and 225 allocations in the middle-frequency band from 525 to 1,605 kc/s. These allocations were as follows: (a) 48 exclusive assignments; (b) 78 assignments of 39 channels (each channel shared by two stations); (c) 87 assignments of 29 channels (each channel shared by three stations); (d) 12 assignments of three channels (each channel shared by four stations). Two additional channels were designated as international common channels to be shared by a number of countries and three derogations were permitted. In addition, the plan specified which stations should use directional antennae.

Two years after the Copenhagen Plan went into effect, the European Broadcasting Union's technical centre reported that the number of European stations operating in the low- and medium-frequency bands had increased to some 675, with a total of almost 17,750 kilowatts of power. Of these stations, about 40 per cent were operating contrary to the Copenhagen assignments. It would be easy to attribute the partial breakdown of the Copenhagen Plan to the Allied occupation authorities in Germany, such as those of the United States, who operated stations contrary to the provisions of the plan, or to the non-signatory States, such as Spain and Austria. It should be kept in mind, however, that the low and medium bands are not large enough to contain all of the broadcasting services which the European countries wish to operate within them. That has been clear since the Lucerne conference of 1933.

In contrast to its predecessors, the European Broadcasting Conference held at Stockholm in 1952 was as a breath of fresh air. This conference was called to draw up an assignment plan for television and very high-frequency broadcasting, neither of which had as yet been widely adopted, in the bands between 41 and 216 Mc/s as allotted under the Atlantic City Allocation Tables, namely 41 to 68 Mc/s, 87.5 to 100 Mc/s, and 174 to 216 Mc/s. Within five weeks the conference prepared a plan giving bands 41 to 68 Mc/s and 174 to 216 Mc/s to television, and band 87.5 to 100 Mc/s to very high-frequency broadcasting. Within the sound-broadcasting band, which concerns us here, the conference processed some 2,000 assignments. Certain Eastern European countries refused to sign the final documents, a refusal which was much less important than in the case of low- and medium-frequency broadcasting because of the short-range propagation characteristics of very high frequencies. It will therefore suffice to quote some of the reasons given by the European Broadcasting Union for the 'ease' with which the conference reached its conclusions:[1]

1. 'The 1952 Stockholm Agreement and Plans', in: *EBU, Documentation and Information Bulletin*, 15 September 1952, pp. 471–2.

'1. The first is a technical reason. It is easier to make an *international* plan for very high frequencies than for long, medium or short waves, because of the "regional" range of VHF waves. On VHF, the difficulty resides rather in working out *national* schemes. Once these are finalized, there remains only the problem of putting them together and of trimming them. This problem is certainly much less difficult than that of building up a complete plan from first principles.

'2. On the other hand, the Stockholm Agreement was made easier to achieve because (an important point) the discussions were in very many cases quite theoretical. When, at Lucerne, Montreux, or Copenhagen, the preparation of a plan encountered difficulties, it was over the allocation of existing stations or over the reconciliation of real and immediate opposing interests. It was obviously quite different at Stockholm. The plans provide for some 2,000 VHF stations in all, whereas in fact there exist at present fewer than a hundred in the whole of Europe; consequently it is no wonder that the task proved less complex than that of accommodating 350 existing stations in a plan which can provide space for only 300!

The discussions at Stockholm aimed at reconciling schemes which everyone knew would be put into effect, at the earliest, only in several years' time, and it is obvious that, in such circumstances, concessions and agreements are more readily forthcoming. It is to be noted, too, that those countries which have the best chances of developing their television systems immediately proved to be the more difficult to satisfy.

'3. The third reason, it is pleasant to be able to report, was the general atmosphere in which the Conference was held. The political differences that still exist in Europe and in the world were not in evidence at Stockholm, and certain points which formerly and even recently have given rise to interminable arguments were here settled very quickly. Even when no agreement was possible ... only moderate debates and reasonable statements resulted.'

the atlantic city decisions

The first post-war Plenipotentiary Conference and International Radio Conference of the ITU were held at Atlantic City in 1947. The ITU made two important decisions concerning the radio spectrum. First, it was decided to create a special international organ which would examine each request for the use of a frequency, no matter where it lay in the spectrum, to assure that its use would not cause harmful interference. Second, the ITU decided to draw up a completely new international frequency list which would reflect the actual needs of all the radio services of all countries. In view of the difficulties which had been encountered in Europe over assigning a small band of frequencies, with only a few hundred stations to be considered, this would indeed seem to be a heavy undertaking. Nineteen hundred and forty-seven, however, was a year of international good-will and optimism.

Formation of Registration Board

The first decision, and the easier, concerned the formation of the International Frequency Registration Board.

The original United States proposal, which had been submitted to a preliminary meeting of the 'big five' victorious powers the preceding year, envisaged a small group of experts selected on an individual basis from panels of candidates submitted by member countries of the ITU, somewhat resembling the International Court of Justice at The Hague. Almost immediately, however, the

principle of regional representation was advocated. 'An advantage of this principle', stated the Indian delegate, 'would be that the member from a particular region would be experienced in the problems peculiar to that region, and would therefore be well qualified to give advice.'[1] In view of the strength of the partisans of regional representation, the supporters of the United States proposal withdrew so as to facilitate a 'temporary' solution, but expressed the opinion that the next ordinary Administrative Radio Conference of the ITU should reconsider the question.

On another point the Atlantic City conference adopted an expedient which changed the form of the original proposal. Whereas the proposal envisaged an election of *individuals* of outstanding ability to serve on the board, the conference decided to elect countries which would, in turn, nominate individuals. This was agreed only because the board was needed immediately and the procedure first proposed would have taken too long. The chairman of the working group dealing with this question observed: 'It is purely because of present circumstances that our working group consented to recommend this procedure, as an exception, since it does *not* consider it satisfactory. When the IFRB (International Frequency Registration Board) becomes an effective and normal organization of the ITU, we believe that the candidates should always be individuals and not countries.'[2]

The conference then elected, on a regional basis, the countries to be represented on the board. Countries elected were: Region A (the Americas)—Argentina, Cuba, United States; Region B (Western Europe and Africa)—France, Union of South Africa, United Kingdom; Region C (Eastern Europe and Northern Asia)—Czechoslovakia, U.S.S.R., Region D (remainder of the world)—Australia, Republic of China, India. Thus constituted, the IFRB held its first meeting on 30 September 1947 at Atlantic City.

The conference readily agreed on the board's functions and procedures. Its functions were: (a) to effect an orderly recording of frequency assignments with a view to ensuring their formal international recognition; (b) to furnish advice to the members of the ITU with a view to the operation of the maximum practicable number of radio stations in all portions of the spectrum where harmful interference may occur.

Procedure of Registration Board

The procedure established for the board was fairly complex. First, the Atlantic City Radio Regulations required all members of the ITU, before using a new frequency, or modifying the use of an existing frequency, to notify the proposed usage to the IFRB. The board in turn was to circulate the notification to all members of the union for comment, and to examine the notification for: (a) its conformity with the Frequency Allocation Table and the rules for allocation of frequencies; (b) its conformity with the other provisions of the International Telecommunication Convention and the Radio Regulations; (c) the probability of harmful interference to any existing station already notified to the union.

The next step involved preparation of a master list of all the frequencies in use throughout the world. If the board found that a new frequency assignment fully conformed with all the criteria listed above, it was to be immediately recorded in the 'Registration' column of the master list. Once so registered, an assignment was given 'the right of international protection from harmful interference'.

If the board found an assignment to be unfavourable with respect to (a) above (conformity with the Frequency Allocation Table), it was registered in a

1. Atlantic City Radio Conference, Document 270 RE, p. 3.
2. Atlantic City Telecommunication Conference, Document 458 TRE, p. 11.

'Notification' column. The board then ascertained whether use of the frequency would cause harmful interference with any station already operating according to the table. If such interference could be caused, the new station 'must immediately suspend operations upon receipt (of advice) of this harmful interference'.[1] If no interference could result, the assignment remained in the 'Notification' column without 'a right of protection', but the board was obliged to warn any new station not to establish itself on the same frequency.

If the board found an assignment unfavourable with respect to (b) above (conformity with other provisions of the convention or Radio Regulations) it was to return the notice immediately to the notifying country, with reasons for its finding. Finally, if an assignment was found to be unfavourable with respect to (c) above (harmful interference), the notice was to be returned to the notifying country with the board's reasons and possible suggestions for a solution to the problem. If the notifying country resubmitted the notice with modifications which resulted in a favourable decision by the board, the notice was to be transferred to the 'Registration' column where it would have the right of protection. However, should the notifying country insist upon reconsideration of the original notice without revision, and should the board's findings remain unchanged, the assignment was to be recorded in the Master Frequency Register under the 'Notification' column. The reason for this decision, according to the chairman of the committee which established procedure for the board, was that 'we felt that it was proper to guarantee to such a country the possibility of following up its attempt as long as no complaint because of interference was raised against it'.[2]

At any time the board could be requested to reconsider a finding by a notifying country, or by another country on the grounds of anticipated or actual interference by a station. Prior to reconsideration, the board was to circulate such requests to other members of the union for the filing of objections or comment. The board, in the light of the data received, was to make such further findings as the circumstances warranted. If the finding with regard to 'probable' harmful interference was still unfavourable, the notice was left in the 'Notification' column. If, on the contrary, the board found that harmful interference actually existed, 'it shall be *prima facie* evidence that the operation is in violation of the Radio Regulations'.[3] Finally, if after not more than six years of operation the board found that interference did not exist, the notification was to be transferred to the 'Registration' column.

The board's second major duty was to investigate, if one or more countries so suggested, the possibility of an adjustment in the frequency of a notified assignment where such adjustment might eliminate an interference problem, free additional frequencies for other uses, or facilitate a more effective use of a portion of the spectrum. If the countries concurred in the recommendations, the board had the right to make the necessary changes in the master register without altering the recorded date.

The board was given another major function. After consulting the notifying country, it could cancel the recordings of any assignment if it found that regular operation had not begun within two years following the date of receipt of the first notice, or if the frequency had been completely out of use for three years. If the circumstances warranted, the board could allow the entry to remain in the master register for a further period of one year. Exceptionally, however, and only in the case of a frequency assigned to a service for use during years of high or low sun-spot activity, the board could permit an unused frequency to remain in the register for an additional period of three years. In addition, it was agreed

1. Atlantic City Radio Regulations (1947), Article 11, paragraph 10.
2. Atlantic City Radio Conference, Document 475 RE, p. 10.
3. Atlantic City Radio Regulations, Chapter IV, Article 11.

that frequencies reserved for use in periods of sun-spot activity could be used by another service on an interim basis and without prejudice to the station which had made the earlier registration. The object of this decision was to discourage countries from keeping a large number of frequencies inactive, but still under their control, before the actual need arose. The board was to establish a procedure for returning the frequency to the original claimant if that should be found necessary for operation at a different level of sun-spot activity.

Although the board's procedure was hedged around by many safeguards, its general character was one of innovation and novelty. For the first time an international body was empowered to evaluate, make recommendations and even pass judgement on the proper use of frequencies by the nations of the world.

New Frequency List

The Atlantic City conference's second major decision affecting the radio spectrum was to revise the international frequency list. There were three fundamental reasons for this decision: (a) many frequency assignments would have to be shifted following revision of the Frequency Allocation Table; (b) the old frequency list contained many frequency notifications which were incomplete or no longer valid; (c) the old system of registration had resulted in an inequitable distribution of frequencies, especially for those countries in which development of a comprehensive national radio system had been delayed.

Decision on principle proved far easier, however, than execution of the decision. The first point of difference to be resolved concerned the extent to which the international frequency list was to be revised. The most ambitious plan was that presented by the United States which, in a report submitted to the conference's International Frequency List Committee, proposed the following method:

1. Compile a list of the requirements of all countries, on the basis of actual operations.
2. Compile estimates of new frequencies needed to reactivate services discontinued during the war and to provide for all new services planned for activation before 1 January 1948.
3. On the basis of requirements under 1 and 2, determine by employing agreed engineering principles the number of frequencies needed by each country.
4. Devise a plan for sharing of frequencies wherever possible.
5. On the basis of results of measures 1, 2, 3 and 4, make specific assignments within the service bands of the new Frequency Allocation Table.

The final result, according to the United States report, would be 'a completely new international frequency list which will, in so far as spectrum space is available, meet the requirements of all countries, which will conform to the new allocation table, and which will be based upon sound engineering principles insuring the maximum utilization of the available spectrum space'.[1]

No fundamental objection was made to the United States proposal. The U.S.S.R., however, while 'agreeing that from a technical point of view, with the object of better utilization of frequencies and of eliminating mutual interference, it is generally advisable to accomplish this work', maintained that the task would be long and tedious, especially in view of the difficulties encountered in Europe over assigning frequencies to broadcasting stations. The conference nevertheless approved the United States plan and called on administrations to submit their requirements.

1. Atlantic City Radio Conference, Document 78 RE, pp. 1–11.

Implementation of the plan proved more difficult than had been expected. Two months after its acceptance, the delegates were forced to reconsider their plan of action. Since it was manifestly impossible to draw up a new plan in the time available at Atlantic City, the conference decided to convene another body to complete the task. A fundamental division arose over the method to be used by this new agency. One group, led by France, Switzerland and the U.S.S.R., urged that, because of the time needed to draw up a completely new list, the agency should proceed in two phases. First, an interim list should be drawn up in which the stations displaced as a result of the new allocation table would simply be fitted into the correct frequency bands. Second, on the basis of this revised list a committee could prepare a completely new list in adequate time. This method would permit immediate implementation of the long overdue new allocation table, giving administrations time to reach agreement on the final change-over to the list and, in general, prevent any precipitate action which might cause difficulty and confusion.

The opposing group, led by Canada, the United Kingdom and the United States, urged that the list be prepared in a single phase. This method, it was argued, would be less expensive since only one special conference would be necessary to approve the list; the entire list would in any case have to be revised, since even an attempt to re-assign only those stations which had been displaced by the new allocation table would make a general review necessary; and, finally, the one-phase method would hasten the day when the radio spectrum would be efficiently used and harmful interference would cease.

Forty-one delegations voted for the one-phase method, 14 for the two-phase method, and 23 abstained. Following the vote, the U.S.S.R. announced that, 'in view of there being 14 countries who were in opposition, the decision of the vote could not be accepted by the U.S.S.R.'.[1]

The conference then considered how the one-phase method was to be implemented. It decided first that a Provisional Frequency Board, in which all countries would have the right to participate, should be established. The board would continue the work of the International Frequency List Committee in drawing up plans for the fixed, tropical broadcasting, aeronautical (land), and maritime (coast) stations within the frequency band 10 kc/s to 30 Mc/s. Second, the International Frequency Registration Board was to be immediately activated to aid the Provisional Frequency Board in its task. Third, a high-frequency broadcasting conference would be convened to make assignments for the exclusive high-frequency bands. Fourth, special international conferences would be called, if necessary, to make assignments in the exclusive maritime mobile and the exclusive aeronautical mobile bands, and special regional conferences would be held to make assignments of a strictly regional character. Fifth, all of the assignment plans drawn up by the special conferences would be submitted to the Provisional Frequency Board for incorporation in the new draft international frequency list. Furthermore, the board would complete any plans that such conferences failed to draft.

Finally, a special Administrative Radio Conference was to be convened on 3 March 1949, if possible, or at the latest, two months after the general draft list was completed by the board. This conference would study the plan and give its approval.

progress, 1948-58

Much effort was spent in implementing the Atlantic City decision to establish a new international frequency list. The Provisional Frequency Board itself

1. Atlantic City Radio Conference, Document 653 RE, p. 11.

worked for over two years; in addition, special administrative conferences were convened to deal with certain world-wide frequency bands, and regional conferences to take care of regional assignments. The following meetings were held in the period 1948 to 1958 to help prepare the new list:

Provisional Frequency Board, Geneva, January 1948 to February 1950.
High-frequency Broadcasting Conference:
  Technical Planning Committee, Geneva, 22 March to 10 June 1948.
  First Session, Mexico City, 22 October 1948 to 10 April 1949.
  Technical Planning Committee (second part): Paris, 16 June to 5 December 1949; Florence, 1 March to 31 March 1950.
  Second Session, Florence and Rapallo, 1 April to 19 August 1950.
Administrative Aeronautical Radio Conference:
  Preparatory Committee, Geneva, 26 April to 15 May 1948.
  First Session, Geneva, 15 May to 25 September 1948.
  Second Session, Geneva, 1 August to 14 October 1949.
Administrative Radio Conference for Region 1, Geneva, 18 May to 17 September 1949.
Administrative Radio Conference for Region 2, Washington D.C., 25 April to 9 July 1949.
Administrative Radio Conference for Region 3:
  Preparatory Committee, Geneva, 19 October to 19 December 1948.
  Conference, Geneva, 18 May to 4 November 1949.
Third North American Regional Broadcasting Conference:
  Technical Preparatory Committee, Havana, 1 November to 6 December 1947.
  First Session, Montreal, 13 September to 9 December 1949.
  Second Session, Washington D.C., 6 September to 15 November 1950.
European Broadcasting Conference and Maritime Regional Radio Conference, Copenhagen, 25 June to 15 September 1948.
Conference for the Reorganization of Maritime Radio Beacons in the European Area, Paris, 16 July to 3 August 1951.
Extraordinary Administrative Radio Conference, Geneva, 16 August to 3 December 1951.

This list does not include the work of the International Frequency Registration Board, nor the other conferences which dealt indirectly with questions affecting frequency assignments. Among these were the Special Administrative Conferences for the North-east Atlantic (Geneva 1949), and the ITU Plenipotentiary Conference (Buenos Aires, 1952).

Most of the conferences were well attended. For example, 50 countries participated in the Provisional Frequency Board meeting, 69 in the Mexico City session of the High-frequency Broadcasting Conference, and 36 in the Region 1 conference. The fact that so many countries did send delegates who remained absent from their home administrations for long periods indicates the importance attached to the preparation of a new frequency list.

Despite this heavy concentration of effort, involving over ninety months of conference work, the Atlantic City conference's objective was not fully realized. The Provisional Frequency Board suspended work in February 1950, without having drawn up a satisfactory assignment plan for 10 of the 30 frequency bands which had been assigned to it. Even if the board had completed its assignment work, it would have had great difficulty in carrying out the rest of its mandate. The High-frequency Broadcasting Conference, after almost twenty-four months of work, had closed without completing an assignment plan of any kind. No plan was drawn up by the Region 2 Administrative Radio Conference. Most of the other conferences completed assignment plans, but in several cases a fairly important group of delegations refused to accept them. The ITU finally

decided to call an Extraordinary Administrative Radio Conference in 1951 to seek a solution. Before we review this conference, however, it might be useful to consider why efforts to implement the Atlantic City decisions broke down.

Obstacles to Success

The reasons for the difficulties met in preparing a new frequency list are not hard to find. First, in many of the more desirable bands requests for frequencies far outnumbered frequencies available. In an article in the *Telecommunication Journal* of July 1950, Captain Richard of the French delegation described conditions in 10 of the important bands which the Provisional Frequency Board had to consider. In four of the bands, the situation was as shown in Table 6.

TABLE 6

Bands	kc/s available	Number of requests	kc/s required
K (5,060 to 5,250 kc/s)	190	834	2 950
M (5,450 to 5,480 kc/s)	30	733	3 500
N (5,730 to 5,950 kc/s)	220	2 512	11 900
O (6,765 to 7,000 kc/s)	235	3 236	16 100

'It would seem', Captain Richard observed, 'that the temper of the Atlantic City conference had been misinterpreted; either that, or else administrations had notified large number of requirements in the hope that some at least of them would be met.'

Allowance can be made for exaggerated requests for frequencies. But the subsequent refusal of delegates to reduce their requirements to the point where a workable plan could be drafted was fatal. In both the meeting of the Provisional Frequency Board and of the High-frequency Broadcasting Conference, special committees were set up to secure a reduction in individual requirements. Although these committees were in some cases successful, too often nothing could be done. For the first three of the bands mentioned above, it proved impossible, after months of work and consultation, to establish a plan of any kind; for the fourth band, the plan drawn up exceeded the spectrum by 180 per cent!

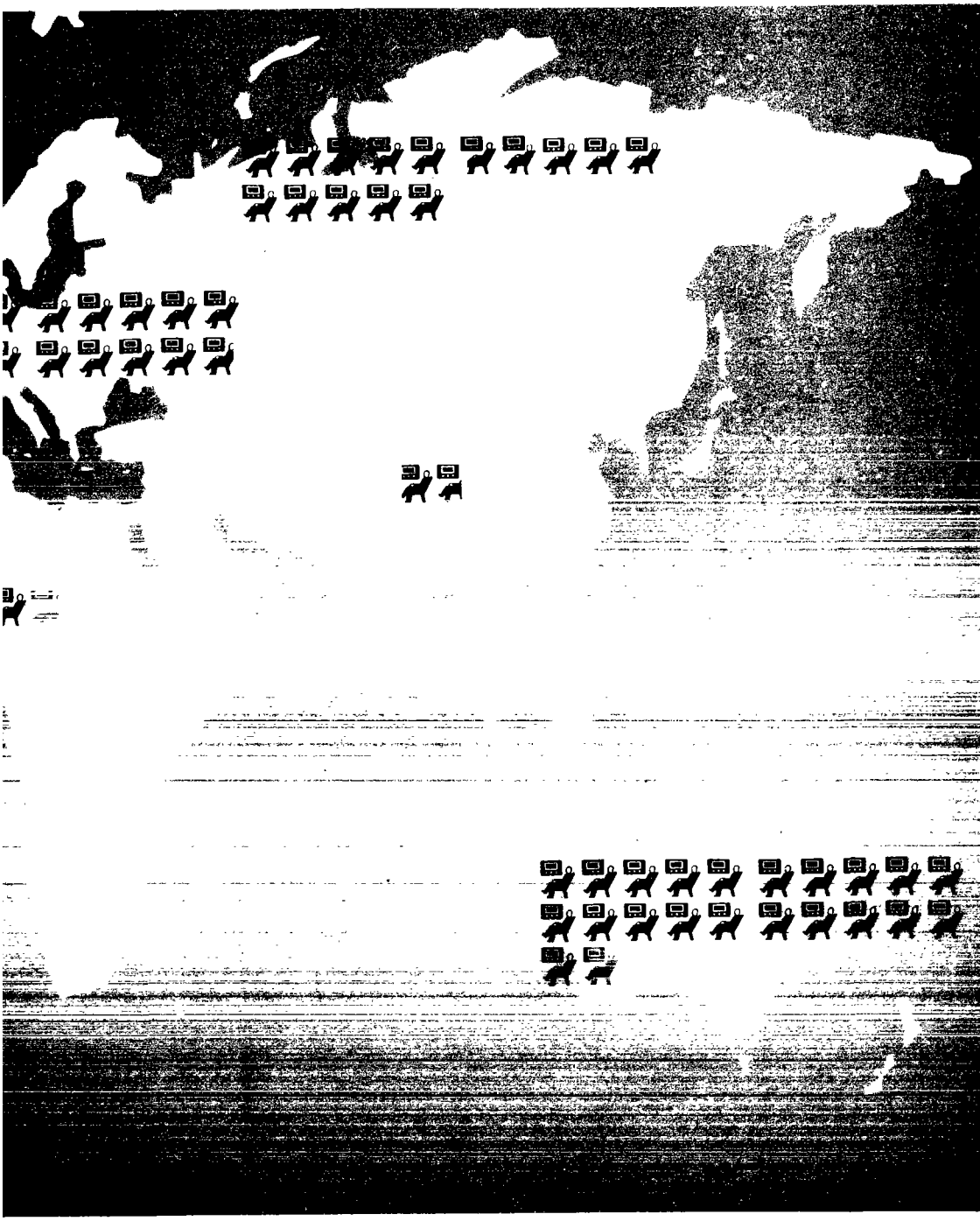
A second source of difficulty was that in preparing assignment plans the conferences were hampered by a lack of agreed technical data. This applied especially to the Provisional Frequency Board and the High-frequency Broadcasting Conference, which worked on lists in the portions of the spectrum where sky waves predominated. Consequently, much of the technical calculation which could have been done in advance by technicians had to be completed during the conferences themselves. The time available for reaching agreement on the actual allocations was thus heavily reduced. This task alone consumed some eighteen months of the life of the Provisional Frequency Board. The High-frequency Broadcasting Conference produced several volumes, amounting to several thousand pages, of propagation curves (for different sun-spot periods) necessary for proper frequency assignment.

The third problem was the existence of two radically different and apparently incompatible approaches to the method of preparing the list. The Atlantic City conference had accepted the principle that a new list be established. But soon after the opening of the assignment conferences a group of delegations, including the U.S.S.R., insisted that the method adopted was incorrect and urged that the list be based on a revision of the old list to fit the new allocation table. The dates of registration of frequencies in the old list were to be the deciding factor in all cases of priority. In addition, this group criticized attempts to assign frequencies on the basis of circuits and areas of reception rather than on individual stations.

pictographs

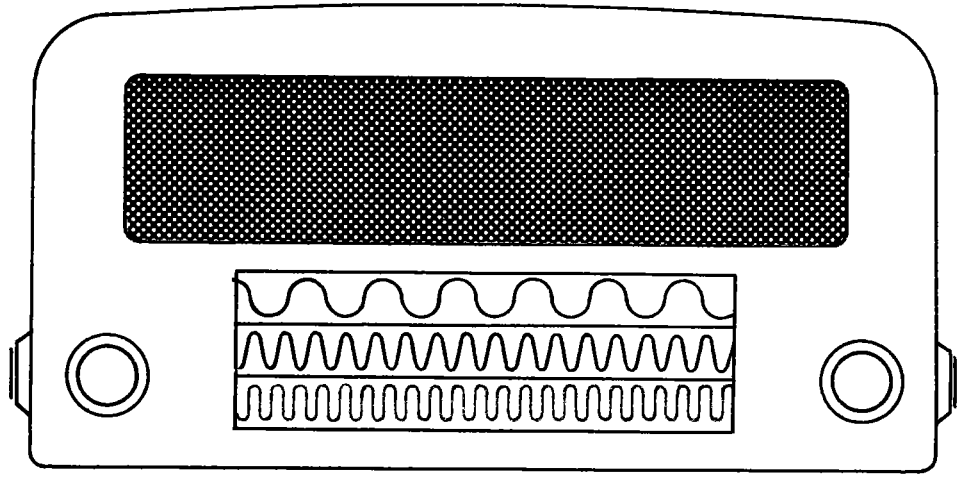
1. Radio's world-wide audience

1 radio receiver per 100 people.
Symbols in red indicate increases between 1949 and 1956.



Pictographs by Unesco

2. The internationally allocated spectrum has three major divisions



Low- and medium-frequency band

(10 kc/s–3,000 kc/s)

In the lower frequencies, effective coverage can be obtained over a wide area. The medium frequencies, combining ground and sky-wave propagation, generally offer good reception up to 50 miles by day and night, and fairly good reception at night up to several hundred miles. Allocations are on a regional basis.

High-frequency band

(3,000 kc/s–30,000 kc/s)

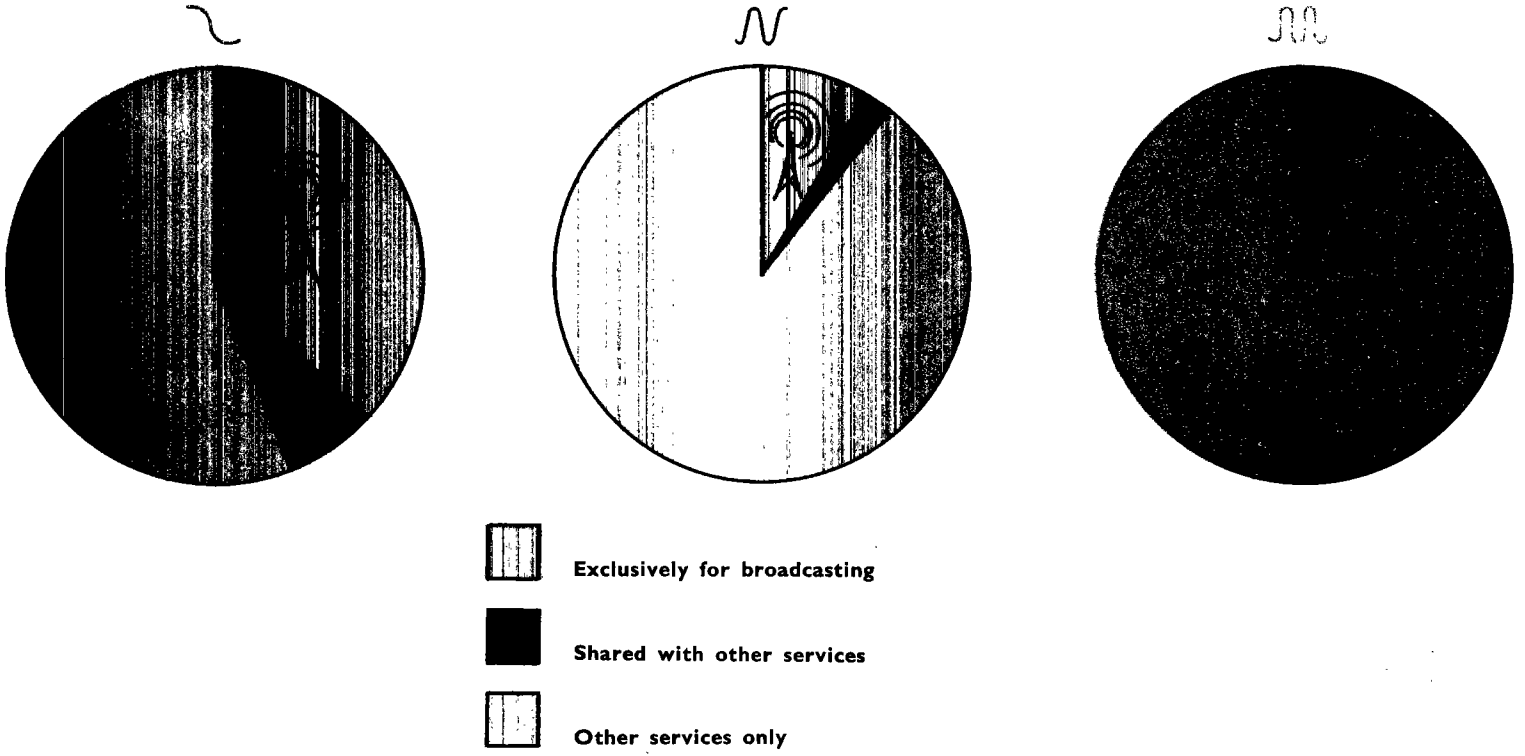
This band is particularly suitable for long-range communication. Although in high demand, frequencies are limited. Most broadcasting allocations are world-wide. Six major bands are reserved for general broadcasting, and several minor ones for tropical broadcasting.

Very, ultra and super high-frequency band

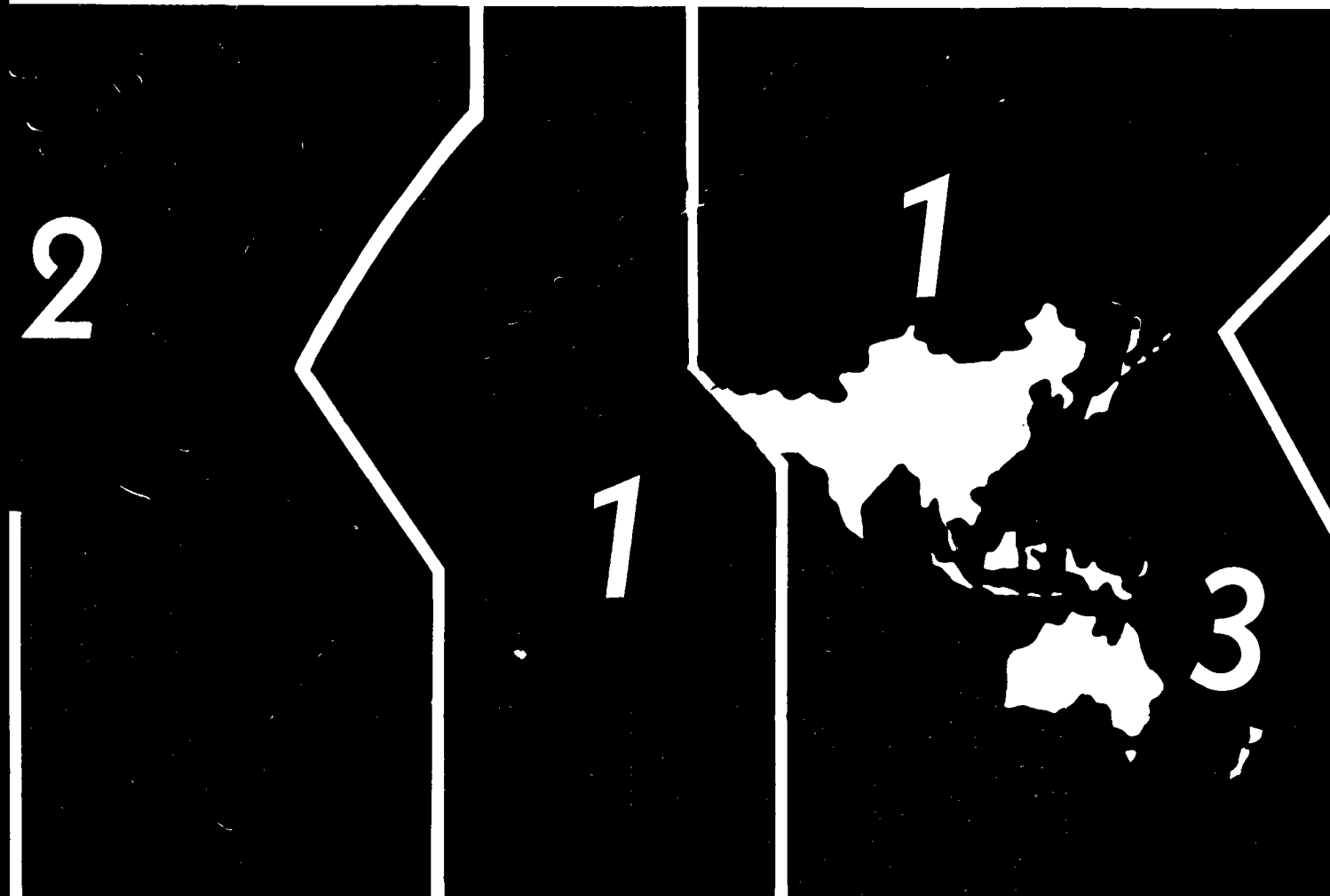
(30,000 kc/s–10,500 mc/s)

These frequencies are usually employed for short distances. Hence their use is possible on a regional rather than a world-wide basis. Allocations for 'broadcasting' in these bands do not differentiate between radio and television.

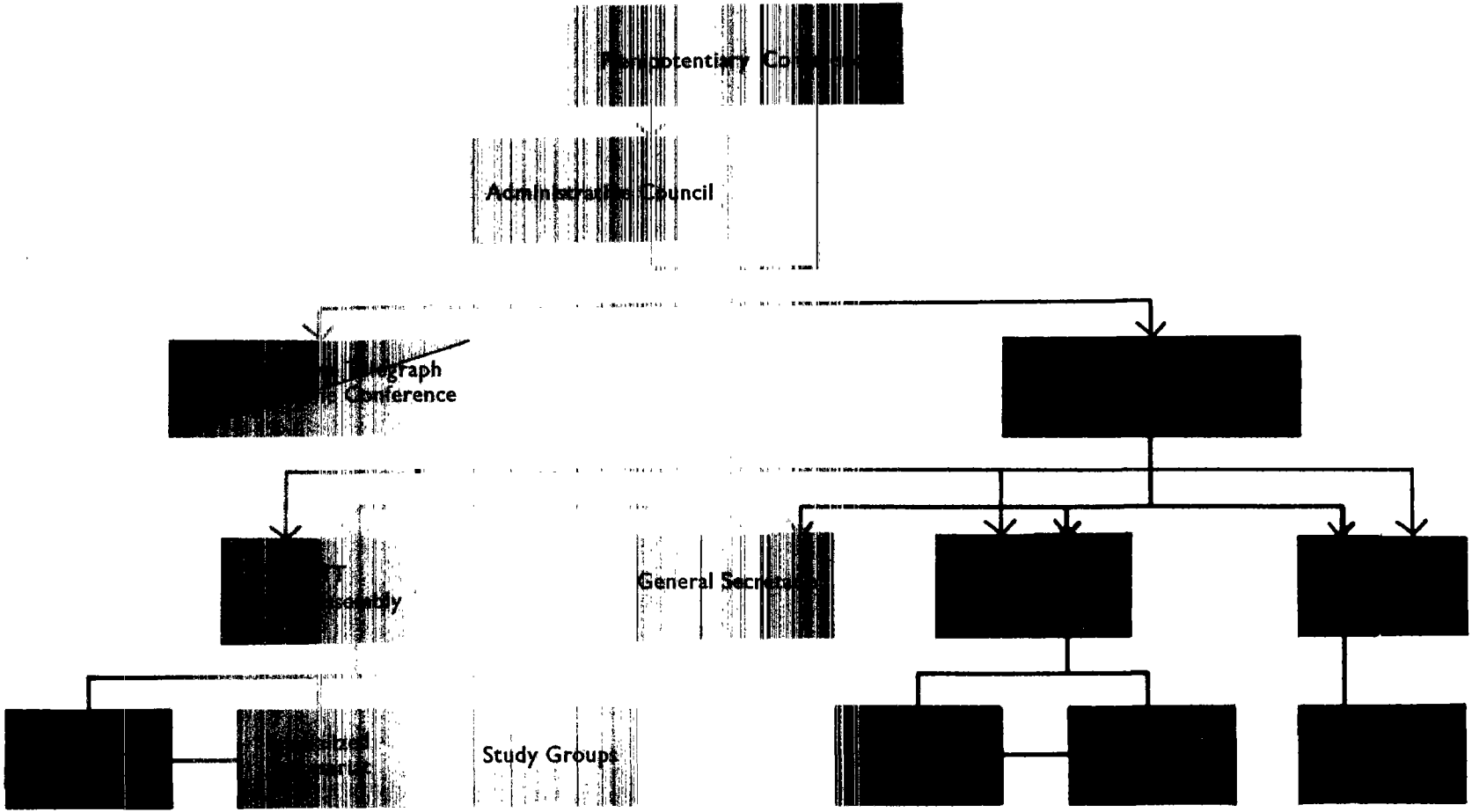
3. In each division a share is set aside for broadcasting



hree regions for international frequency allocations



5. ITU organizational structure



The opposing group of delegations, which in all cases represented the great majority, supported the Atlantic City decision that a new list was necessary. 'In short, it was realized that in order to permit an equitable use of the available radio spectrum space by all nations of the world, distribution of frequencies must be made on the basis of actual needs of each country, as opposed to notifications made years ago when there were enough frequencies for all and when operating practices were notoriously wasteful of spectrum space.'[1] With regard to the basing of assignments on circuits or areas of reception, the majority felt that only if that information were known could distribution plans to assure maximum use of the spectrum be devised.

Whenever the minority urged the alternative approach, as occurred several times in almost every conference, the will of the majority prevailed. Rejecting these decisions, the smaller group left the conferences. Albania, Bulgaria, Czechoslovakia, Hungary, Poland, Rumania and the U.S.S.R. withdrew from the meeting of the Provisional Frequency Board in October 1949 and from the High-frequency Broadcasting Conference in April 1950.

The fourth and perhaps most important reason for the failure to draw up a complete new list was the deterioration in the international political climate. Little by little, after 1947, relations between certain important groups of States became more and more strained. During the High-frequency Broadcasting Conference a climax came with the outbreak of war in Korea. The task of allocating a limited number of frequencies to the needs of many nations is far from easy in times of international good-will: in a period of international tension it becomes extremely difficult if not impossible, since countries then tend to increase even further their use of high-frequency broadcasting for the purpose of explaining their national policies to the world.

Compromise Plan of 1951

An Extraordinary Administrative Radio Conference met in Geneva from 16 August to 3 December 1951 to discuss the Atlantic City decisions in the light of subsequent attempts to draw up a new frequency list. Delegations from 76 countries were present, as well as observers from the four German occupation zones. Representatives from 15 private companies and eight international organizations also attended. Although this conference considered the possibility of completing the work of the Provisional Frequency Board and of the other conferences, it soon became clear that there was neither the time nor the will to meet this objective. Consequently, the conference worked out a compromise plan to (a) bring into effect the new allocation table; (b) implement some of the plans that had been drafted; and (c) establish a procedure for the drafting of plans for the frequency bands for which previous efforts had failed.

First, the conference adopted lists and plans which had been prepared by the Provisional Frequency Board (14 to 150 kc/s) by the Region 1 and Region 3 Administrative Radio Conference (150 to 3,950 kc/s) and by the Extraordinary Administrative Radio Conference itself (150 to 4,000 kc/s for Region 2). The meeting then decided that the portion of these plans between 14 and 2,850 kc/s (2,000 in Region 2) would come into effect on certain specified dates between 1 May 1952 and 13 November 1953. The portion between 2,850 and 3,950 kc/s (2,000 to 4,000 in Region 1) would come into effect officially only by decision of the next regular Administrative Radio Conference (Geneva, 1959). Meanwhile, however, administrations were permitted to begin shifting frequencies as early as 1 February 1952.

Arrangements for the major portion of the spectrum, 4,000 to 27,500 kc/s, were more complicated. The conference adopted plans for the bands allocated

1. Provisional Frequency Board, Document 43 (revised), p. 22.

to the coast stations of the maritime mobile service, which had been drawn up by the Provisional Frequency Board, and the plans for the aeronautical mobile service, as prepared by the Aeronautical Administrative Radio Conference. No plans had been completed for the fixed, land mobile, tropical broadcasting, and high-frequency broadcasting services. The task of drawing up or completing plans for these services was given to the International Frequency Registration Board for submission to the next Administrative Radio Conference. The conference decided that, in view of the difficulty of implementing the two adopted plans while the remaining services were unaccounted for, implementation in the band 4,000 to 27,500 kc/s should be postponed until all plans had been drawn up and adopted.

To ensure, however, that radio services should have the advantages of the revised Frequency Allocation Table as soon as possible, it was agreed that countries should begin moving their stations into the appropriate new bands as from 1 March 1952. Each administration was responsible for finding space for its out-of-band frequencies by exchanging frequencies within national services, by 'trading' frequencies with other administrations, or by finding holes in the spectrum through the use of monitoring facilities. The sponsors of this plan hoped that through good-will and co-operation administrations would find an adequate number of frequencies to meet their needs pending completion of the list. They also hoped that this approach would discourage the hoarding of frequencies because only those in actual use would be immune from usurpation. In addition, the conference directed the International Frequency Board to begin its regular work of examining new frequency requirements in the lower frequency bands where plans had been adopted and implemented.

The final acts of the 1951 Radio Conference were signed by 63 of the participating delegations. Four delegations did not have the necessary powers to sign, but expressed no fundamental disagreement. Nine countries, Albania, the Byelorussian S.S.R., Bulgaria, Czechoslovakia, Hungary, Poland, Rumania, Ukrainian S.S.R. and U.S.S.R., refused to sign the final acts and declared that they would not be bound by them.

Achievements by 1957

The coming into effect of the final acts on 1 March 1952 marked a new phase in the effort to draw up a frequency list. In a report to the Administrative Council of the ITU in 1957, the International Frequency Registration Board outlined the progress accomplished. The work of moving stations into the proper frequency band had begun well, with the board consulting directly with administrations. Wherever an assignment plan had been prepared, the board suggested that the administration move into the assigned frequencies. As a result, the number of out-of-band assignments between 3,950 kc/s (4,000 in Region 2) and 27,500 kc/s had been reduced from 15,627 in 1955 to 4,886 in 1957. The maritime service still suffered most from out-of-band operation by other services, while the fixed service trespassed most on the bands of others. However, the Administrative Council had decided on 1 June 1957 as the beginning of the final seven-month adjustment period and considered that work in this field might well be completed before the next Administrative Radio Conference in 1959.

The board was less optimistic concerning completion of the assignment plans which were yet to be prepared. It believed it would be able to draw up plans for the very difficult high-frequency broadcasting bands for some of the phases of the sun-spot cycle, but, to quote its own words, 'the situation will largely depend upon progress in the preparation of plans for this service and the degree of acceptability of the plans to the administrations'. The magnitude of the task that confronted the board is apparent from Table 7 dealing with the requirements that had been treated for the plan for only one phase of the sun-spot cycle.

TABLE 7. Statistical summary of requirements treated by the International Frequency Registration Board for draft of high-frequency broadcasting plan for sun-spot Phase June 70

Requirements	Frequency hours								Total frequency hours	Per-cent[1]
	6 Mc/s	7 Mc/s	9 Mc/s	11 Mc/s	15 Mc/s	17 Mc/s	21 Mc/s	26 Mc/s		
Incl. in Mexico City Basic Plan (1949)	2 097	1 140	1 676	1 294	909	486	720	854	9 176	100
Revised (1952)	3 834	1 622	2,462	2 318	1 733	964	782	636	14 101	153
Revised (1954)	3 077	1 326	1 804	1 931	1 477	866	596	598	11 675	127
Incl. in Draft Reference Plan(1957)	3 291	1 463	2 020	1 793	1 679	799	829	1 148	13 022	142

1. Taking Mexico City Basic Plan as 100.

The board considered there was little hope of preparing plans for the fixed, land mobile, and tropical broadcasting bands. However, it believed that following the moving of services into the proper allocations, these bands would reflect 'to the greatest possible degree the actual radio operations of the world'.

The board had been assigned additional tasks which occupied much of its time. First, it was required to compile a Radio Frequency Record containing all the frequency assignments in use, or contemplated for use, throughout the world. This document was to serve as a working basis for the board and for administrations in bringing their assignments within the Atlantic City allocation table. The board issued four editions of the record between 1952 and 1957, the last edition consisting of three volumes totalling 3,877 pages. To keep up with changes resulting from the shifting of frequencies and the introduction of new services, the board had to process 61,990 changes in 1954 alone.

The board was also plagued with the problem of drafting technical standards applicable to frequency assignments in the higher frequency bands. Nineteen volumes of technical standards were published in 1957 alone. In its report the board emphasized the difficulty involved in the drafting of up-to-date acceptable technical standards in an area where so little is known. The board there stated that just as the last calculations for the first edition had been completed, it learned that the International Radio Consultative Committee had issued a report in which it proposed a revised method of calculating certain aspects of the standards. This change, if accepted, would necessitate revision of almost all the work done.

Apart from the board's efforts to bring the allocation table into use and to prepare the new frequency list, the years 1952 to 1957 provided an important trial period for its basic task—to supervise the placing into operation of new frequency assignments and the modification of old ones. In the small band of frequencies from 14 to 2,850 kc/s (2,000 in Region 2) where plans had been approved and implemented, the board estimated that it had received a grand total of 14,662 modifications. These modifications necessitated a detailed examination to make certain that harmful interference would not result. Many modifications involved the examination of five to six recorded assignments on the same and neighbouring frequencies. In general, the board considered that its work in this important field had been satisfactory.

This chapter can have no definite conclusion for the simple reason that the effort to divide the spectrum among the various users has not yet been completed. There is no doubt that it is technically possible to draw up a new frequency list. At the same time however it is evident that every request for a frequency cannot be honoured because there is not enough desirable spectrum space. If the list is to be completed, nations must be prepared to modify their demands. If this

willingness should become evident, the International Frequency Registration Board, or a special conference, could complete the task in a relatively short time.

Whether international willingness to co-operate will manifest itself in the near future is open to question. The international political climate may improve. Perhaps the nations of the world will realize that a flexible, provisional plan is essential to the future of radio communications, and that if their requests are not entirely honoured there will be an occasion for future revision. The future of broadcasting depends on the good-will of governments to resolve this problem in the coming years.

the quest for better techniques

7

The listener to a broadcast should be able to hear his programme as clearly as possible, free from extraneous noises of any kind. Unfortunately, interference to broadcasting has steadily increased throughout the world, owing largely to emissions from other radio stations as well as from electric appliances such as X-ray machines, vacuum cleaners and dentists' drills, to mention but a few.

In the last two chapters we have considered two approaches to the problem of interference: the allocation of bands of frequencies specifically to broadcasting, in order to eliminate interference from other services; and the assignment of protected frequencies to specific stations so as to eliminate interference between broadcasts. While these two approaches are essential to the future of broadcasting, they do not cover all phases of the effort to eliminate interference.

An important corollary is the search to provide the listener with the best possible signal. The most drastic solution so far suggested is to transmit by wire instead of radio and to feed programmes to individual receivers over a system similar to or forming part of a telephone network, thus eliminating unwanted signals almost completely. Many countries, again, have turned to frequency modulation (FM), a system of transmission which has an inherently high immunity to all types of interference and employs a hitherto unused part of the radio spectrum. In addition, there have been attempts to improve both the reception and transmission of regular amplitude modulation radio in an endeavour to avoid unwanted signals, and laws have been passed to limit interference from electrical machines. So far this work to produce a better signal has not kept pace with the growth of interference, Moreover, as the broadcasting bands have become overcrowded, these efforts have been increasingly directed toward protecting only national broadcasting systems rather than broadcasting in general. From the point of view of the free flow of information between countries, this trend is to be regretted.

With the development of high quality frequency modulation, however, a new avenue of approach has become available. As more stations turn to FM to provide a high quality local service, more frequencies in the amplitude modulation (AM) bands can be made available for medium-range international broadcasting. This in turn should have a salutory effect on the high-frequency broadcasting bands, making assignment plans easier to achieve. This and alternative approaches to better broadcasting will also call for a considerable measure of international good-will and co-operation. But the results, in the form of a more enlightened and informed citizenry, would be well worth the effort.

frequency spectrum conservation

'Danger! The Radio Spectrum is Bursting at the Seams', is the title of an article by Donald G. Fink, Director of Research of the Philco Corporation.[1] This article is a call to arms to the radio industry to make a better use of the spectrum before it is too late. The spectrum, according to Donald Fink, must be considered as 'a natural resource, a public domain of limited extent, which must be administered as wisely and guarded as jealously as if it were mineral wealth, water power, or forest land'. A complete public programme of frequency conservation, he asserts, must be drawn up and enforced by the responsible frequency-allocating and policing agencies throughout the world with singular wisdom and courage 'against organized pressures that fought conservation measures, in favour of special interest, since governments began'. The only hope of providing for new and expanding radio services is to use frequencies more efficiently.

What can be done to meet the steadily increasing demand for frequencies? One of the simplest methods is 'time-sharing', which enables several users to share the same frequency on a time basis. In cases where a user intends to transmit for only a short period, it is wasteful to assign him an exclusive frequency which would go unused during the major part of the day. One frequency can be assigned to several such users who, between themselves, ensure a reasonable degree of occupancy of the frequency concerned. This practice is not unusual in domestic communication but is rarely used internationally. Time-sharing can be carried a good deal further. For instance, the distances covered by high-frequency transmitters vary considerably between day-time and night-time operation. Consequently, it would be possible to give the same frequency during the day to several stations, each serving a rather restricted area, and at night assign the same frequency to a single station transmitting over a long distance. Planning for the most efficient use of the spectrum, even with such primitive methods as time-sharing, can obviously be extremely complex.

Using a similar principle, a frequency may also be shared among stations on a geographical basis. There is no point in reserving a greater area coverage to a frequency than is absolutely necessary for the satisfactory operation of the service in question. Wherever possible, such a frequency should be shared with other stations serving different areas or territories. 'Co-channel sharing', as this type of operation is called, demands an even greater degree of skill. It is necessary to determine correctly the relationship between the strength of the signal at a given point and the strength of any possible interfering signal. Unfortunately, the medium through which radio waves are propagated may cause signal strengths to vary greatly, not only between night and day, but also with the season. Depending on the place of the frequency in the spectrum, signal strengths may also be affected by the humidity of the air, the ground over which the signal must pass, and the geographical location of the transmitter and receiver. The great variability of the medium makes it very difficult to evaluate and convert into practical data the results of experiments and measurements on radio propagation, especially in the high-frequency bands. Consequently, it is extremely difficult to predict accurately, what proportion of the co-channel shares will be satisfactory for any given time. After much effort, the International Frequency Registration Board has established the best available technical standards for use in evaluating interference.

Despite the work that has been done, the limit to what can be accomplished by these conventional, one might say traditional, methods of sharing is rapidly being reached in many frequency bands. Other means must urgently be found to make better use of the available spectrum space.

To take an extreme situation, there are instances where procedures developed

1. *Journal of the Franklin Institute*, Philadelphia, Vol. 261, No. 5, May 1956, pp. 477–93.

in the quest for a better service, have resulted in the complete abandonment of the use of frequencies. The North Atlantic telephone cable offers a striking example. Telephone users and administrations on both sides of the Atlantic have long desired to have a completely reliable service, free from fading, interference and other interruptions affecting the frequencies used for transatlantic communication. The new cable, laid between 22 June 1955 and 25 September 1957, supplies 36 interference-free channels for transatlantic telephone calls and operator-to-operator service without the intermediary of the operating staff at transmitting and receiving ends. This cable represents a frequency economy equal to 12 broadcasts each way across the Atlantic.

For various reasons, however, the channels thus liberated cannot be made available to broadcasting. On the one hand, transatlantic telephone channels were already suffering interference from stations occupying the same frequency in other parts of the world. On the other hand, the fixed service is large and expanding and constantly seeks new frequencies to carry its traffic. If the fixed service can obtain additional frequencies by means of economies within its own bands, it may be less tempted to look elsewhere, such as in the broadcasting bands.

The introduction of frequency modulation in broadcasting provides an interesting example of a conservation procedure which should be increasingly used in the future; that is, the selection of frequencies best suited to the transmissions for which they are intended. Why operate on a frequency which can be used to cover considerable distances when local broadcasting is the main objective? It is undoubtedly wasteful to cause interference over a range of hundreds of miles, and suffer interference in turn, when another frequency will provide a better service and not be subject to long-range interference.

As frequency modulation replaces amplitude modulation in local broadcasting, as it is now doing in Europe, medium waves will become available for national and intermediate-range international broadcasting, which in turn can make lower high-frequency bands available exclusively for long-distance services.[1]

Considerable economies in frequency space may also be achieved through the use of better or more advanced transmission techniques. Before we go on to consider some of these techniques, it should be emphasized that such improvements usually call for a considerable capital outlay beyond that which might be required for simple radio communication. Further, there is no such thing as a 'useless' frequency: frequencies can be used for one purpose or another. The most that any new system can do is to provide additional space for a service that is having difficulty in finding room in the frequency bands appropriate for its operations. Above all, new techniques should not be considered as 'cure-alls' before their practical evaluation has been completed. There are examples where theoretical improvements have involved such complexity of equipment in practice that they have failed in their objective.

Improved Types of Transmission

The logical first step is to improve the types of radio transmission now in use. One means of doing this is to install directional apparatus. The rule to be observed, as stated in the above-mentioned article by Donald Fink, is as follows: 'Signals should be transmitted only in the directions of the intended users and signals should be received only from the direction of the desired station.' This rule can be applied to almost any type of radio communication, including broadcasting.

It is also possible to design directional receivers which can better discriminate

1. Frequency modulation and its importance to the more rational use of broadcasting frequencies are dealt with in greater detail in pages 116 to 121 of this chapter.

against interference from unwanted transmissions. Although directional apparatus is in use, there is still a wide range for further application.

Much is also being done to reduce the band-width of transmissions to a practical minimum. Notable improvements in this direction have been made in the short-range mobile services employed by fire prevention, police, public utilities, taxis, and the like. In the past few years the frequency spectrum required for one channel of this service has been reduced by a quarter. Equipment is now becoming available which will allow a further reduction of one-half, and developmental work is to reduce the required band-width to a sixteenth or perhaps even a thirty-second of what was originally considered necessary. Corresponding improvements must also be made in receivers, since there is little use in restricting the width of a transmission if a receiver cannot confine itself to receiving the transmission of the desired station. It should be noted that in addition to the original investment, the resulting strict tolerances must be maintained despite the ageing of the components, the effect of the climate, vibration, rough handling, etc., if the saving of spectrum space is to continue.

For a given transmission, there is already a known theoretical limit below which it is not possible to reduce the amount of spectrum space occupied. The problem is how close to this theoretical limit one can get equipment to work As already stated, radio engineers are now working close to this limit.

Once the search moves out of the area of common radio transmission, however, real technological advance begins. An example is the new technique of single side band transmission, which economizes about half of the frequency space required by normal radio communication. A single side band system operates in the following manner. The process of transforming the radio signal to an audible signal at the receiver (detection) requires the presence of certain signals which are not strictly necessary for the transmission of information. In ordinary communication these signals are inserted at the transmitter, and are then used and suppressed at the receiver. In single side band transmission, the transmitter is so arranged that these extra signals (which occupy about half of the frequency space of the transmission) are used but not transmitted; the receiver has the necessary equipment to re-insert these signals for the purpose of detection Because of the difficulty of suppressing the unwanted signals at the transmitter, and the very high precision required in re-inserting the suppressed frequencies at the receiver, single side band transmission was for a long time only economical at major installations operating long-distance radio-telephone circuits. As a result of recent technical innovations, however, this technique can now be profitably used on low-power fixed circuits and in the mobile service. Even more recent developments make it possible to transmit a signal which, even though resembling a single side band signal from the point of view of frequency spectrum conservation, is perfectly receivable on a normal receiving-set without equipment for restoring of the unnecessary frequencies. This development is likely to have a considerable impact on regular AM broadcasting in the future.

Since spectrum conservation has only recently become a serious preoccupation of radio users, many new methods of reducing congestion in the frequency spectrum are still in their infancy. There is, for example, a scheme for placing some types of radio communication on a telephone exchange basis, which combines some elements of time and co-channel sharing with the addition of new technical devices. Contrary to general belief, a telephone exchange does not provide a connexion for each individual subscriber. Since it would be too expensive to install equipment which would remain idle most of the time, the telephone company estimates the maximum load which the exchange is likely to carry at any given moment and then installs only the corresponding amount of switch gear. The same system could be used when there is a larger number of radio stations wishing to use frequencies at odd times. These stations could be

linked, the maximum number of frequencies to be used at any given time calculated, and, through an automatic selection device, be provided with frequencies as the need arises. Thus the number of frequencies used by the group of stations would be limited only to that required to handle the maximum traffic load. As this technique is an elaborate type of time-sharing, it would be subject to the same limitations.

The so-called 'scatter-transmissions' have recently been attracting much attention. Scatter-transmissions, or 'over-the-horizon' transmissions as they are often called, make use of what may be described as 'brute force' methods. Formerly it was thought that 'direct' radio waves had no utility outside line-of-sight transmission because they were not reflected by the ionized layers. Research has proved, however, that on certain frequencies a few of these waves are scattered by atmospheric irregularities (in a manner similar to that in which the light from automobile headlights is scattered by minute particles in the air thus becoming visible long before the actual headlights come into sight). Consequently it was found that extremely sensitive receivers with very large directional antennae could collect signals from a very powerful transmitter over the horizon for distances of from 200 to 1,000 miles. This means that where economy is not a paramount factor, scatter transmission may be used for intermediate distances. Frequencies in the high-frequency bands will then, in turn, be freed for reassignment to operators who for practical reasons cannot operate the large installations needed for scatter transmission.

Planned Use of Frequencies

Although various past improvements in communication techniques have resulted in an economy of spectrum space, it is important, even imperative, to realize that future improvements will not automatically and necessarily do the same. The radio frequency spectrum is a scarce commodity and is becoming more so as the world's standard of living increases. It is only logical that a richer and more complex society should demand more and better telecommunication facilities. This tendency is already manifest in those areas of the world where the standard of living is the highest. As this phenomenon increases it is essential that, while not ignoring the search for pure economy, radio services should concentrate on the 'dynamic' aspect of frequency conservation; that is, the use of careful planning to make certain that no frequency stands idle at any time. In addition, radio services should employ only those frequencies that are best suited for their actual needs, especially as concerns the distances to be covered.

It may appear that this chapter has moved far from the field of broadcasting, but one must not forget that broadcasting shares the radio spectrum with other services which feel that they have as much right to their share as broadcasters. The other services have, in fact, made considerable contributions toward spectrum conservation on both the national and international level. Dynamic spectrum conservation means additional expense for every service, and broadcasting must make its contribution.

Broadcasters and listeners alike will benefit directly by a spectrum conservation programme. First, the better use of broadcasting bands for the purpose for which they are best suited can provide additional channels which, in turn, may mean alternative programmes. Second, the listener may enjoy clearer and better broadcasting. Unfortunately, most listener research is devoted to discovering the programme 'likes and dislikes' of the listener; little has been done to determine whether he is satisfied with the quality of reception. Third, broadcasters may be able to provide more realistic sound reproduction. The recent introduction of stereophonic sound recordings, on tape and on records, may well bring with it a demand for stereophonic broadcasting. Research is already being made in this direction. In some recent developments, the normal

single-channel transmission of an ordinary broadcast is replaced by two independent channels fed from two microphones. The two transmissions are received on two receivers, placed some distance apart in the listener's room to permit judging of distance and depth. Working on the same principle as the human ears, this new technique very closely approximates the original sound produced in the studios. It should be noted that such transmission calls for twice the spectrum space of a simple broadcast.[1] If the demand for this and similar improvements increases, the necessary spectrum space must be found.

Broadcasters should not fail to make every effort to reorganize and improve their transmissions. Unless they too are willing to join with other services in securing the most efficient use of frequencies, they may find before long that all services except broadcasting will have been adjusted into the frequency bands best suited to their needs. With the optimum distribution of frequency bands among the different services having thus been nearly achieved, there will no longer be the necessary liberty of movement within the spectrum to assure the optimum distribution of frequencies among the various forms of broadcasting.

wired broadcasting

Radio broadcasting has been haunted since its introduction by a competitive service called variously wired wireless, wired broadcasting and relay exchange. Although the total number of listeners to such systems has remained relatively small through the years, the wired service has more than once been seriously considered as a substitute for radio broadcasting. This could, conceivably, occur again should broadcasters fail to provide the listener with the service he desires.

There are three major systems for the dissemination of wired broadcasting. The more primitive type is known as 'high-level, low-frequency distribution'. This system may be compared to a loudspeaker in the kitchen, or some other room of a house, operating from the radio in the living room. The signal coming through a wire attached to the radio in the living room is powerful enough, without further amplification, to operate the loudspeaker. If we extend this principle to a city, or even a region, we have high-level, low-frequency distribution. A powerful central amplifier picks up a programme and sends it by wire to the home of the subscriber. No power supply is needed at the receiving point, the only requirements being a simple loudspeaker with an 'off-on' switch and a volume control. As long as the loudspeaker is in working order and the line connecting it to the central amplifying station is intact, the listener will have good reception.

The high-level, low-frequency system requires special equipment. In addition to the powerful central amplifier, special cables or wires must be installed from the main amplifier to distribution points for districts and individual streets. These wires or cables must be substantial to keep power losses low. Once a cable has been laid, however, the connexion of subscribers is as simple as linking a home to the electrical supply. To provide the listener with a programme it is only necessary to connect his loudspeaker to the nearest point on the cable. If alternative programmes are desired, additional distribution networks, one for each programme, must be installed. In that case, a switch is installed in the listener's home to permit him to select the desired programme. In view of the special equipment needed for distribution, this system is economical only in areas where subscriber density is high.

The next step in refinement is the system known as 'low-level low-frequency

1. A number of schemes have been put forward to transmit both channels on the same frequency, but they entail some loss of performance. Whether this can be tolerated or is desirable must yet be determined.

distribution'. In this system, a low-frequency signal is transmitted over the wire at about the same intensity as a telephone signal. To bring the signal up to a sufficiently high level to operate the loudspeaker, an amplifier is required, together with some type of electric power (mains or batteries) to activate the amplifier. Since much less signal power is needed, however, much smaller wires may be used. By means of a switching system, existing telephone lines may be used to carry broadcasts. An additional refinement, which resembles the automatic telephone, enables the listener to choose a number of programmes. A major limitation when the telephone network is used to distribute the signal, is that the telephone and the receiver cannot be used at the same time. If a telephone call comes to the subscriber, the broadcast is cut off. The system is mainly of interest in areas where extensive telephone networks already exist.

The third type of wired broadcasting is the so-called 'high-frequency' or 'carrier' distribution system. In this system, a programme is sent out by wire to the subscriber on an amplitude modulated frequency of about the same order as is used for normal long-wave broadcasts. The system may be considered a normal broadcasting transmission, except that the transmitter is directly connected to the receiver by means of a wire circuit. Since amplitude modulated frequency waves are being received at the listener's end of the wire he must use a normal receiver, or something closely approximating one. In cases where the system offers alternative programmes, the listener chooses the programme desired by tuning his receiver in the normal way. To prevent interference from radio stations transmitting on the same frequencies as those used in the wired broadcast network, the listener is provided with a switch so that he can connect his receiver to the wired network or to an antenna. The advantage of this system is that if telephone wires are used, a telephone call will not affect the broadcast. This system can be used in conjunction with electric power cables as well as telephone lines.

There are several methods of picking up programmes in wired broadcasting. They may be fed to the central control station either by direct wire from their source of origin, such as a special studio, a broadcasting station, or concert hall, or they may be received over the air from other broadcasting stations, 'cleaned up' and retransmitted over the wired network. In the latter case, the special receiving installation takes the place of the usually less refined antenna and set of the ordinary listener.

The principal advantages which wired broadcasters claim for their systems cover almost every situation where regular broadcasters have failed in their duty to the listener. Perhaps the major current advantage claimed for all wired systems is 'the complete absence of interference, since the signal is refined at the central control station, and a resulting high quality of tone'.[1] In cases where a programme is received directly from the place of origin by wire, this claim can be taken at face value. But if a programme is captured by means of a special receiving station interference may still be possible. However, an expensive, technically accurate receiver, operated by trained technicians, can undoubtedly assure a better signal than that obtained from the average individual set.

A second major advantage of wired broadcasting, in the simplest form, is its low general cost. The receiving station and wired network is much less expensive to build and maintain than a medium-wave transmitter. The subscriber pays only a small monthly fee and the equipment is installed and maintained by the operating company. In the West Indies Federation, for example, the fee for such a service is no more than 3 pence (3.4 U.S. cents) a day. Even where more complicated systems are used, the cost to the subscriber is low. In Switzerland, where five programmes are offered, the subscriber pays only about 4 Swiss francs (94 U.S. cents) a month.

1. Central Rediffusion Services Limited, *Commercial Broadcasting in the British West Indies*, London, 1956, p. 49.

The third major advantage is that wired relays may often be used where radio broadcasting cannot. All three types of wired broadcasting provide good reception in areas where static, interference and poor soil conductivity are hindrances. The more refined system can, of course, be used only in areas with a telephone network or electric power. However, if broadcasters adopt the necessary innovations to ensure that radio remains an effective means of mass communication, the element of lack of programme choice in wired broadcasting will effectively keep it from becoming a serious competitor.

frequency modulation broadcasting

The development of frequency modulation provides the basis for the first real improvement in broadcasting since the invention of the vacuum tube or valve. First, this system guarantees the listener, the consumer of broadcasting, a high-fidelity signal, free of interference, which has never before been offered. Second, the adoption of FM for local broadcasting in the very-high-frequency band demonstrates one of the primary concepts of dynamic frequency spectrum conservation, namely, the use of frequencies which are best suited to the service in question. Third, the widespread move to FM for local broadcasting could provide the basis (a) for a re-arrangement in Europe of the low-, medium- and high-frequency broadcasting bands which would greatly reduce interference in that zone, and (b) for the orderly expansion of broadcasting in other areas. In view of the importance of frequency modulation, the first two of the above concepts will be treated in detail in this section and the third in the following one.

To ensure appreciation of frequency modulation and its merits, a brief review is here given of modulation in general and the principles of communication by radio waves. The first necessity for radio communication is, of course, a transmitter and receiver. In the more primitive type of communication the transmitter is switched on and off according to a prearranged pattern, such as the Morse code. When it is desired to transmit more complex signals, such as speech or music, complications develop. First, one must have a continuous carrier wave on which to superimpose the different levels of sound. Second, it is necessary to transform the pressure waves of speech and music received by the studio microphone into electrical waves. These waves are, in turn, used to modify the continuous carrier wave in such a manner that it can be reconverted into electrical, and then sound waves at the receiver. The process of modifying the radio waves, or superimposing the sound, is known as 'modulation'.

Amplitude modulation and frequency modulation are the two methods currently used in broadcasting. In amplitude modulation, as the name implies, the amplitude or strength of the transmitted radio wave is varied in sympathy with electrical waves which are fed to the transmitter from the studio microphone. The louder noises will cause a considerable fluctuation in the strength of the radio wave, while a whisper will make only a small change.

Frequency modulation, on the other hand, makes use of a radio wave which is constant in strength and intensity, but whose frequency of transmission has been changed in sympathy with the sound signal. The changes which appear as changes in the strength of the radio wave in AM appear as frequency changes in the FM system.

The FM broadcast has two major advantages over AM. First, the receiver concentrates on frequency changes and is thus able to reject the amplitude changes which are characteristic of most interference from man-made sources and weaker AM transmissions. Second, when two FM transmitters located within the range of a receiver are operated on the same frequency, the stronger signal suppresses the weaker one almost entirely and prevents its modulation from appearing at the receiver.

Although its principle had long been understood, frequency modulation appeared for many years to have no practical value. The credit for demonstrating its significance to the world is due to Edwin Armstrong. Professor Armstrong started from the premise that since natural static could not be filtered out of a regular receiver because it was practically identical in nature with the radio waves used, a new type of wave for broadcasting would have to be found. He eventually discovered the desired wave, and in 1927 filed a patent application for 'a new method of transmission in which the frequency of the transmitted wave (not its amplitude) is varied in accordance with the voice frequency to be transmitted'.[1] At that time Armstrong was not certain which band-width should be used. When it was found that FM was more effective when permitted to operate on a very wide wave band, almost ten times that needed by regular AM, the difficulty of finding such space in the medium-wave bands prevented its adoption for broadcasting. By 1933 Armstrong had discovered that the system operated most effectively in the very high-frequency band; where, in addition, much less static was present.

Despite the apparent advantages of the new system, Armstrong found it difficult to convince broadcasting organizations of its value. Finally, he himself built an FM transmitting station by way of demonstration. The gamble was successful and a few years after his station opened, more than 150 applications were filed with the United States Federal Communications Commission for similar stations. However, by the time the commission had allocated sufficient frequency space in the higher frequency bands to contain the new FM stations, World War II halted further advances in this field.

Despite Armstrong's predictions, FM broadcasting did not enjoy the immediate post-war success which it merited. After reaching a peak of 737 in 1949, the number of FM stations in the United States dropped to 691 in 1950. The downward trend continued each year to the point where only 530 stations were operating on 1 January 1957. During this same period, the number of amplitude modulation medium-wave broadcasting stations rose from 2,127 to 3,125.

There were various reasons for the failure of FM to take hold in the United States, the introduction of television being perhaps the most important. This new medium developed rapidly after World War II and attracted much of the attention and financial resources of broadcaster and listener alike. For those who still preferred radio, or who wanted to listen to it occasionally, the regular AM stations provided a fairly wide choice of programmes under reasonable listening conditions. This in turn could be credited to the powerful influence of the Federal Communications Commission, especially effective because of the large geographical area of the United States. Furthermore, many of the new FM stations were built merely as adjuncts to existing AM stations. In other words, the listener was not given an additional programme which might have justified a change to the new system. Finally, the manufacturers of radio equipment failed to provide the listening public with an inexpensive, high-fidelity receiver capable of picking up both systems. Under a commercial broadcasting system such as the American one, there must be a public demand to support any new expenditures such as are entailed by frequency modulation. For the above reasons, that demand was not forthcoming.

Success in Germany

Although FM broadcasting suffered a set-back in the United States, it eventually made headway in Europe. The various aspects of this development may be briefly reviewed. To begin with, the position of Europe after World War II was

1. U.S. Patent 1,941,447 (1927–33) quoted by J. H. Hammond Jr. and E. S. Purington in *Proceedings of the Institute of Radio Engineering*, New York, Vol. 45, No. 9, September 1957, p. 1208.

fundamentally different from that of the United States. The immediate need was to reconstruct war-devastated broadcasting networks. Rather than introduce a new system which had not yet proven itself, resources were used to reconstruct the pre-war long- and medium-wave system, employing facilities that had remained intact. Any other available resources were used to explore television. Few countries were in a position like the United States, where the economy was strong enough to support an expansion of medium-wave AM broadcasting and to explore and introduce both FM broadcasting and television. Furthermore, although the problem of interference in the long and medium bands had risen before the war, most European countries were confident that a European broadcasting conference could reach a solution. Consequently, frequency modulation was not immediately given serious consideration.

While the majority of Western European countries were continuing reconstruction work, exploring television and looking for improvement in the long and medium bands, West Germany (later the Federal Republic of Germany) was forced by circumstances to turn to frequency modulation and the very high-frequency bands for the immediate salvation of its broadcasting system. In one of the earlier plenary assemblies at Copenhagen, a resolution was adopted stating that the conference should assign 'to Germany the minimum of technical means allowing for the reception in each zone of the single programme allocated for each zone'. The final allocation under this formula was not considered satisfactory by the West German authorities.

After the Copenhagen conference, West German authorities began to seek an alternate method to meet the basic need for a coverage of areas not attainable by medium-wave transmissions and give all of West Germany a second, more locally produced, programme. Among the systems investigated were: (a) wired broadcasting distributed over telephone circuits; (b) wired broadcasting distributed over electricity mains; (c) a combination of methods (a) and (b); (d) low-power shared-wavelength broadcasting on medium waves (a very large number of very low-power transmitters on each frequency); (e) high-frequency (HF) broadcasting; (f) very high-frequency (VHF) broadcasting with amplitude modulation; (g) very high-frequency broadcasting with frequency modulation.

After exhaustive tests, the authorities unanimously decided on system (g), very high-frequency broadcasting with frequency modulation.

The solution to the German problem entailed far more than a decision on policy. A major problem was to persuade manufacturers of radio equipment to produce the necessary FM receivers at a price to suit the average listener. The answer was found in careful planning and in the particular conditions of German broadcasting following the war. The German administration first began installing FM transmitters and consulting with manufacturers on the production of an inexpensive, good quality set equipped to receive FM. With regard to sets, the authorities were aided by the fact that after the war West Germany had no more than some 8 million receivers, all many years out of date. Consequently, and particularly after the German currency reform in 1949, a heavy demand for new receivers developed.

In addition, the first FM transmitters were operating by 1949. By 1951, much of West Germany was within the range of FM stations, and almost all German manufacturers had begun producing combined AM and FM receivers. It should also be noted that television did not compete for West Germany's attention or economic resources because the occupation authorities did not permit German officials to begin work in this field until 1952.

As a result, the Federal Republic by 1955 possessed more than a hundred new FM stations, making it possible in nearly all parts of the republic, to receive at least one regional programme on metric waves with technically irreproachable quality. In frontier regions between the territories of the various broadcasting organizations, it was sometimes possible to receive under good conditions up to

four or five programmes. And, it should be noted, the Germans were able to achieve such coverage after installing only half the number of transmitters permitted to them by the Stockholm conference of 1952.

Action by Other Countries

In 1954, FM broadcasting became a serious preoccupation of other European administrations. By that time, the pre-war AM stations had been reconstructed and it had been found that the Copenhagen assignment plan had not solved the problem of interference. On the contrary, interference had generally increased. In addition, since the future development of television had been decided in most European countries, engineering and financial resources could now be directed to frequency modulation. A major influence was the successful German experiment.

The Germans had proved that FM broadcasting was superior in tonal quality, that there was less interference and that under ideal conditions FM coverage was as good as that of many AM stations. Furthermore, not only had the German listener welcomed FM enthusiastically, but there was a tendency among listeners in neighbouring countries within range of German transmitters to purchase sets capable of receiving FM so as to take advantage of the German service.

In October 1954, the Administrative Council of the European Broadcasting Union adopted a proposal urging the early and widespread utilization of the very high-frequency band which had been transferred to broadcasting by the Stockholm conference as the only practical means of arresting the 'rapid deterioration of broadcasting reception conditions in Europe'. In pursuance of this decision, the union's technical centre sent out a questionnaire to all members requesting information on the possibilities of very high-frequency broadcasting. Replies were received from 15 countries.[1]

In view of the importance to all countries of the use of the very high-frequency bands and frequency modulation, some of the major considerations in the replies merit review. It should be noted that the first four points set out below deal exclusively with the superiority of very high-frequency broadcasting over broadcasting in the low- and medium-wave bands. The fifth deals with the superiority of FM over AM in very high-frequency broadcasting.

First, there was almost unanimous agreement that the long- and medium-wave bands allocated at Atlantic City were not large enough to ensure the proper distribution of existing programmes. The Copenhagen Plan had failed for this reason. Not only were too many stations crowded into too small a space, but many were working on unassigned frequencies, causing interference and confusion. The Swiss broadcasting organization, for instance, stated that there had been no satisfactory service to 11 per cent of the area of Switzerland since the Copenhagen Plan had entered into force. This situation was not the result of political or technical factors but had arisen simply because the needs of European broadcasting were greater than could be contained in the long and medium bands. Very high frequencies alone could provide the additional space needed.

Second, there was a desire by many administrations to achieve a flexibility in programme distribution arrangements which could not be achieved in the long and medium bands. Desired modifications included extra programmes, regionally oriented programmes, special programmes for cultural and political groups and the like. Through the addition of the very high-frequency band, such modifications could be achieved.

Third, the long and medium waves were characterized by unsatisfactory

1. EBU, Technical Centre, *The Present Position and Perspectives of VHF Sound Broadcasting in Europe*, Brussels, Vol. I, August 1955, and Vol. II, September 1956.

conditions of reception. In view of the overcrowding and special reception conditions inherent in the lower frequencies, little could be done to give the listener better service. Use of the higher wave bands would make this improvement possible. 'However,' it was warned, 'before any actual improvement in the over-all quality of transmissions can be achieved, improvements in other related fields also have to be accomplished, notably in the fields of studio acoustics, audio-frequency equipment, programme circuits, receiver audio-frequency performance and recording technique. The adoption of VHF broadcasting therefore does not automatically and of itself provide superior quality, but rather provides a setting in which superior quality can in fact be obtained. It opens a door which, under existing conditions, is securely closed.'[1]

Fourth, the cost of using very high-frequency bands would be low. The Danish member stated that the cost of providing the whole of Denmark with two different programmes on VHF was the same as that which would be required to add one supplementary programme on medium waves.[2] The German reply added that in considering the transmitting equipment only, a comparison was made in the first place between a 10-kW VHF transmitter and a 100-kW medium-wave transmitter, both of which would serve, taking into account the aerial gains, approximately the same area. The cost of the medium-wave transmitter was eight times greater.[3]

Fifth, the 15 countries unanimously agreed that FM was much superior to AM for use in the very high-frequency band. The Swiss reply sets forth three basic points of superiority: (a) the reception of FM was much less sensitive to the various forms of interference caused by electrical machinery and appliances; (b) it was possible with FM to achieve a dynamic range nearly twenty times greater than with AM; and (c) the minimum protection ratio of the desired signal was smaller for FM, thus making it easier to work out a plan assigning to each transmitter a sufficiently wide channel to permit the integral transmission of the full audio-frequency band.[4] The United Kingdom reply added that the over-all cost (transmitters and receivers) of an FM system would be less than an AM system with wide or narrow band receivers.[5]

Another point raised by several administrations was that in view of the similar technical requirements, broadcasting organizations could develop FM broadcasting and television networks simultaneously. It is interesting to note that at the Stockholm conference, when preferences between AM and FM were requested, only the United Kingdom and Belgium were not prepared to state their preference for FM, and that both were using AM for the sound part of their television circuits.

One major point on which the broadcasters were not completely agreed concerned the way in which the listener might be induced to buy the new receivers that would make the introduction of frequency modulation successful. There was no disagreement on the need for careful planning to put the new stations into operation, for appropriate publicity and for low-cost receivers capable of receiving both the FM very high-frequency transmissions and AM. The difference of opinion arose over the question of whether it was necessary to offer a completely new programme or whether a repetition of the regular medium-wave broadcasts would be sufficient. The latter view was maintained by the United Kingdom, which stated: 'It is believed that the fact that all three programmes will be available from each VHF station will help to encourage listeners to purchase VHF receivers.'[6] 'The BBC has been careful to

1. ibid., Vol. II, General Report, p. 3.
2. ibid., Vol. II Danish reply, p. 8.
3. ibid., Vol. I, p. 26.
4. ibid., Vol. I, p. 18.
5. ibid., Vol. I, p. 17.
6. ibid., Vol. II, United Kingdom reply, p. 5.

make it clear to the public that the new transmissions are additional to the existing transmissions on long and medium waves, so that the need to purchase a new receiver or a VHF adapter for use with an existing receiver falls only on those who are unable to obtain satisfactory reception on long and medium waves.'[1] To some extent this thesis was supported by the Radiotelevisione Italiana (RAI) which intended at first to put its third programme on very high frequencies only. In view, however, of the non-availability of suitable receivers, the RAI decided to broadcast this programme on medium waves as well so that it would reach as many listeners as possible.

The opposite view was supported by France and the Federal Republic of Germany. The French administration held that merely to radiate the existing services on very high frequencies would not satisfy the public. It therefore intended to radiate a fourth programme service, of a high cultural standard, only on very high frequencies. This attitude was supported by the Germans who stated: 'In fact, public interest in VHF was not particularly marked in the beginning, as fairly satisfactory reception on medium waves was still possible, and even with the worsening of reception conditions that followed the implementation of the Copenhagen Plan, the expansion of VHF was at first rather slow. The decisive change took place only when the broadcasting authorities radiated a second programme service on VHF. From that time dates the steady increase in the percentage of receivers having provision for VHF reception.'[2] The Moroccan and Netherlands broadcasters shed some additional light on the problem when they reported that the existence of receivers equipped to handle very high-frequency broadcasting helped to foster a desire for the service before it was actually installed.

Despite the differences in method of introducing very high-frequency broadcasting, it seems clear that this new service has captured the imagination of most European countries and that within the not too distant future the average listener will be able to take advantage of it. The opinion expressed in 1941 by Edwin Armstrong, the father of frequency modulation, has proved correct: 'If in the future the demand for broadcast channels exceeds the facilities of the channel space now practically available, the engineering world is prepared to open up new bands in that space technically known as the ultra-high and microwave region, where the ratio of the unused channel space compares to that now in use as the unsettled to the settled parts of the earth. The trend of radio inevitably will be upward into the higher frequencies.'[3]

an integrated broadcasting system

The outstanding result of the development of frequency modulation in the very high-frequency band is that it makes possible a workable integration of the European broadcasting service—an integration which would assure the rational use of the spectrum space available to broadcasting. The primary aim of such a plan would be to provide each European country with an effective local broadcasting system, one or two clear national programmes and a long distance international service if desired. By a judicious allocation of frequencies it would be possible to achieve the second and perhaps the most important objective: to give the listener better quality reception, greater freedom from interference and a wide choice of programmes including those originating outside his country.

The reason why the European area has been singled out for purposes of demonstration are as follows: (a) interference in Europe has reached chaotic proportions; (b) most European countries are considering the adoption of very

1. ibid., Annex II, p. 2.
2. ibid., Vol. I, p. 6.
3. Edwin H. Armstrong, 'Frequency Modulation and its Future Uses', *Annals of the American Academy of Political and Social Science*, Vol. 213, January 1941, p. 161.

high frequencies for broadcasting; and (c) there is evidence that European broadcasters are beginning to consider the impact which very high-frequency broadcasting may have on conditions in the lower broadcasting bands.

Most European countries are now preparing for the adoption of frequency modulation. Some of them are looking beyond the mere establishment of additional services, as is illustrated by the following quotations from the European Broadcasting Union's document on very high-frequency broadcasting in Europe. In stating its reasons for the adoption of very high-frequency broadcasting the Austrian administration commented: 'The assumption is that the development of VHF in Europe will bring about the conditions required for a favourable revision of medium-wave allocations. Such revision would permit Austrian medium-wave transmitters to play their proper role, that is to say, to broadcast a national programme which could be received in other countries as well.'[1] In the Swiss reply, W. Ebert, Principal Engineer of the Swiss Post, Telegraph and Telephone Administration, stated: 'In view of the fact that in time the FM transmitter will handle all the local or regional functions of broadcasting, it will be possible to bring some order into the field of medium-wave broadcasting. A new medium-wave allocation plan could allocate to each country a number of exclusive frequencies sufficient to permit it to make its voice heard throughout Europe and even beyond.' Conversely, '... it is hoped that in this way it will be possible to receive, under satisfactory conditions, foreign transmissions on medium waves'.[2]

Although the remainder of this chapter is devoted largely to Europe, it should not be overlooked that the interference problem is rapidly becoming critical in other continents. If the European countries can co-operate to ensure better broadcasting in their own area, they will set a valuable and enlightening example for the rest of the world.

A plan for an integrated broadcasting system for Europe would consist basically of the use of the new very high-frequency bands for local broadcasting needs, low- and medium-frequency bands for nation-wide and regional broadcasting and the high-frequency bands for long-distance international broadcasting.

Frequency-modulated very high-frequency transmitters should be used to replace the present local service medium-frequency transmitters wherever possible. The Stockholm Plan provides for a total of 1,924 transmitters in the very high-frequency band II (87.5 to 100 Mc/s) and an additional 151 transmitters for 10 Eastern European countries in the very high-frequency band I (41 to 68 Mc/s). These allocations range from a maximum of 246 for the Federal Republic of Germany to one each for Malta and Cyprus.[3] These 2,075 transmitters would suffice to provide the basis of national networks for short-range, high quality local broadcasting for almost every country in Europe. The word basis is used advisedly, because no plan should be considered as being static. As more and more experience is gained, the Stockholm decisions will doubtless have to be modified, just as were all the plans which preceded it.

A warning is, however, necessary. If the very high-frequency band is to be protected from the adverse conditions which have developed in the low and medium bands, it must be impressed both on administrations and listeners that the latter have the 'right' to receive only signals from local transmitters. This would include, for example, only those stations which provide a satisfactory service for some 99 per cent of the time to a listener with a normal receiving installation. If administrations should succumb to popular pressure and attempt to guarantee the listener's demand for reception from distant, very high-frequency stations, the same chaotic conditions would develop in very high

1. EBU, Technical Centre, *The Present Position and Perspectives of VHF Sound Broadcasting in Europe*, Brussels, Vol. II, September 1956, Austrian reply, p. 1.
2. ibid., Vol. II, Swiss reply, pp. 1 and 4.
3. See ITU, *European Broadcasting Conference, Stockholm 1952, Final Acts*, Geneva 1952.

frequency bands as have arisen in the low and medium bands. If a listener wishes to receive distant transmitters, those of his own country as well as those of neighbouring ones, he should be instructed to turn to the low- and medium-frequency bands.

The second phase of the plan therefore requires that the low- and medium-wave bands should be cleared of all local broadcasting. There are some thirty-five European countries, large and small, which desire a national radio programme that can be heard throughout their territories, and in neighbouring countries. For this purpose there is available a low-frequency band of from 150 to 285 kc/s and a medium-wave band of from 526 to 1605 kc/s. The Copenhagen Plan of 1948 assigned some 18 stations to the low-frequency band, some 333 in the medium-frequency band, and provided for two internationally shared frequencies. Most countries do not have more than two or three national programmes. Consequently, more than 150 of these assignments, as well as several hundred additional unauthorized stations, are being used only for local 'repeats' of national programmes. It is therefore evident that much of the overcrowding in the low and medium bands would be eliminated if local broadcasting were moved to the very high-frequency band.

Once the move to FM is completed, the countries of Europe would be able to draw up a rational European broadcasting plan for the low- and medium-frequency bands. Using a straight 10 kc/s separation (long abandoned because of overcrowding) the low and medium bands as they now stand would provide for 120 transmitters which would not interfere with each other. Going one step further, and using only the low band and the more desirable part of the medium band, 525 to 1,000 kc/s, there would still be room for 58 transmitters with a 10 kc/s separation. With a minimum of geographical sharing and the use of directional antennae to prevent interference with other regions of the world, and by substracting one frequency from the very small countries whose needs have never been so great, the vast majority of countries would have two interference-free frequencies for their nation-wide and regional services. This, of course, in addition to the local services which would be provided by FM stations in the very high-frequency band. The remainder of the frequencies from 1,000 to 1,605 kc/s could be employed for additional uses, such as the provision of evening programmes to cover neighbouring countries or of short-range day-time educational broadcasts in heavily populated areas. If such a plan is to work, it must be definite and binding on all users.

The third phase of the plan concerns high-frequency long-range broadcasting. Requests for frequencies are now too numerous to permit a logical and workable assignment plan. Many of these requests are for regional, international or even national use, where low and medium frequencies would suffice. If these users were removed from the eight high-frequency bands, sufficient frequencies would remain to permit the preparation of a workable assignment plan. Countries would no longer feel it necessary to make exaggerated requests for frequencies in the hope that some, at least, will be met. Such a plan, instead of requiring years for such work, could be completed in a matter of months by either the International Frequency Registration Board or a special administrative conference of the ITU.

An integrated broadcasting system for Europe is possible if broadcasters keep the consumer, the man with the receiver, foremost in mind. He wants good quality sound; it is not now available to him. Wherever he tunes his receiver in the low-, medium- and high-frequency band, his enjoyment is spoiled by interference. The world's broadcasters must keep the listener's legitimate desires foremost. With the development of FM broadcasting on very high frequencies, the means of satisfying those desires is available If that opportunity is not seized willingly by the broadcasters of all nations, the door to effective broadcasting may be again closed, and this time for ever.

the challenge of television

8

Although this study has been primarily concerned with sound broadcasting, it would be incomplete without consideration of the challenge made to radio by the rapid expansion of television. Radio and television are adaptations of the same medium, since they both employ the broadcast principle. Television, like radio, also employs transmitters and receivers, and its message is sent out on Hertzian waves. The basic difference is, of course, that television has added vision to radio's sound. Consequently, the two are necessarily rivals. The listener cannot hold over a radio or a television programme for a more convenient time, as he could postpone reading a book or a newspaper; he must normally choose one at the expense of the other. Since it is on the basis of this choice that the broadcaster, whether government or private, decides how funds for the development of broadcasting are to be apportioned, the future of radio is inextricably linked with that of television.

Although the final outcome of the rivalry between television and radio for the attention of the world public will not be known for many years to come, television has made sufficient headway in a number of countries to permit some tentative conclusions to be drawn as to the effects of its challenge to radio.

how television developed

Television had its beginnings as far back as 1817 when Jöns Berzelius discovered a new substance which he named selenium. In 1873 Joseph May found that selenium could convert the energy of light into electrical energy. In other words, it was theoretically possible to transmit pictures by means of an electric signal.

The next step was the development in 1884 of Paul Nipkow's 'scanning disc', by which an object was scanned and its image, element by element, was converted into electric signals by the use of a selenium photo cell. This invention led to the introduction, in 1926, of the first practical mechanical television system by John L. Baird. By 1929 Baird's system was so well advanced that the BBC concluded an agreement with him for regular experimental transmissions from its London station.

Although mechanical television was successfully developed in a number of other countries, pictures were not transmitted clearly until the advent of electronic television. An essential element of electronic television is the cathode ray tube, which had started life in 1897 as Ferdinand Braun's cathode ray

oscilloscope and was perfected in 1907 by Boris Rosing, creator of the first electronic picture viewer.

The next development was the invention of a television camera to replace the unwieldy scanning disc. Both V. K. Zworykin and Philo Farnsworth succeeded in the search for an electronic camera tube and their work, backed by the resources of modern industry and the discoveries of other scientists, resulted in electronic television as it is known today.

Electronic television was demonstrated in various countries, including France, Germany, Italy, Japan, the U.S.S.R., the United Kingdom and the United States during the early 1930s. To the United Kingdom, however, goes the honour of transmitting the first regular programmes. Public trial broadcasts began in London in 1936, when both a mechanical and an electronic system were used. Within a year, the electronic system was officially adopted and a permanent service was established. The United States followed suit in 1939, and in 1941 the Federal Communications Commission approved a commercial television system.

At this point World War II halted the expansion of television, just as the first war had put a temporary stop to broadcasting. Although television was to benefit from many wartime electronic advances, they could not be put into effect until after 1945.

The end of the war found the public ready for the long-awaited electronic miracle. The United States, and here again there is a parallel to the situation of radio after the first war, was the only country economically able to promote the immediate expansion of the television industry. Ten stations were operating in the United States by the end of 1946, and by 1950 the total had risen to 107 and to 529 by late 1957. The number of television receivers increased from 10,000 in 1946 to 3,950,000 in 1950, and to 48,500,000 at the end of 1958.[1]

Largely because of post-war difficulties, the expansion of television elsewhere was much slower. Only three other countries were able to boast of a regular television service in 1948: France, the U.S.S.R. and the United Kingdom. By 1950, however, most of the major countries had stations in operation, and, by 1957, television systems had been established in over fifty countries throughout the world. Most of these countries were planning to expand their systems and an additional 25 were preparing to establish a television service.

television throughout the world

Television receivers were numbered in millions in six countries by the end of 1958. The United States, which maintains a transcontinental network of 538 transmitters, had over 48 million sets, as already mentioned. The other five were the U.S.S.R. with 63 transmitters and some 3 million receivers, the United Kingdom with 27 transmitters and over 9 million sets, Canada with 53 transmitters and 3 million receivers, the Federal Republic of Germany with 107 transmitters and 2,100,000 sets, and Japan with 26 transmitters and 1,600,000 receivers. Both Canada and the United Kingdom were approaching the United States in the proportion of receivers to population.

The remaining 7,500,000 receivers were concentrated mostly in Europe and the Americas. Fifteen countries had 100,000 or more sets. Eight of these were countries located in Europe: Belgium (300,000); Czechoslovakia (250,000); Denmark (150,000); France (990,000 including 20,000 in Algeria); Democratic Republic of Germany (300,000); Italy (880,000); the Netherlands (350,000); and Sweden (200,000). Six were in the Americas: Argentina (300,000); Brazil (over 500,000); Colombia (140,000); Cuba (320,000); Mexico (400,000); and Venezuela (200,000). The remaining country was Australia (320,000). Countries

1. These and the following television statistics were tabulated by Unesco.

with smaller totals of receivers were located in Europe (17 countries), Asia (9, including 3 in the Middle East), North America (5) and South America (2).

It should be noted, however, that, as in the case of radio, in many countries the number of television sets has no direct relation to the size of the viewing audience. When television first makes its appearance, many sets are installed in bars, cafes and other public places. In addition, in areas where living standards do not permit the average person to buy a set, public or private educational and civic groups, as well as governments, promote collective viewing either by the public purchase of sets and their installation in public places (as in Iraq), or by encouraging collective purchase on credit (as in France, Italy and Japan). As as result, the number of viewers per set may be many times higher than in the United States or the United Kingdom. For example Italy, with no more than 880,000 sets, has an estimated audience of over 13 million.

Regulation and Financing

In the early years of television, it appeared that the pattern of its structure and financing would parallel that of radio. In the United States, television was developed almost entirely through the resources of private industry for commercial profit, and financed from advertising revenue; a rather loose system of control, based primarily on licensing power, was introduced. The countries of Latin America began to follow the United States example. In the United Kingdom, the British Broadcasting Corporation was originally given a monopoly on television in addition to radio. In countries with a mixed system of broadcasting, such as Canada and Japan, private commercial television stations were permitted to develop alongside a government-sponsored public corporation which conducted television services. In countries where radio had been strictly controlled by governments, television also became a State monopoly.

Almost without exception, the countries whose governments participated directly in maintaining a television service adopted the licence fee as the major means of financing.[1] Other sources of revenue included direct government grants and sales taxes on sets, paralleling in general the financing pattern developed for sound broadcasting.

Before long, however, the high cost of establishing and running television services caused certain governments, traditionally supporters of public service broadcasting, to consider seriously the possibility of permitting commercial exploitation of television. It is interesting to note that many of these countries had permitted commercial development of sound broadcasting in its early stages, but later eliminated commercial control.[2]

There is no questioning the fact that the cost of a television service greatly exceeds that of a comparable sound broadcasting service. The equipment necessary for a successful television service, transmitters, antennae, relays and studios, is expensive. Even if initial costs can be absorbed without difficulty, there still remains the continuing expense of running and maintaining the complex electronic equipment, as well as the high cost of programme produc-

1. Where licence fees were levied, the usual practice was to charge considerably more than for a simple radio licence. In 1958 the annual radio licence in Switzerland was 26 francs ($6) as against 84 francs ($20) for a television licence. In France the radio fee was 1,500 francs ($3.57) and that for television 4,500 francs ($10.70). In the United Kingdom, on the other hand, there were two basic charges, £1 ($2.80) for radio and £4 for a combined radio and television licence. Some countries levied an extra fee if a set was to be used in a public place, such as a cafe, with charges to customers. In France, for instance, the fee for public use, without charge to customers, was 18,000 francs in early 1957, while that for public use with charges was 36,000 francs. See *EBU Bulletin*, Vol. VIII, No. 44, July–August 1957, p. 425.
2. For a discussion of the movement in Europe away from commercial broadcasting, see Jean Gantelme, 'From Private Enterprise to the Idea of Public Service in Broadcasting,' in: *EBU Bulletin*, Vol. 1, No. 1, 15 May 1950, pp. 41–52.

tion. This includes the engaging of talent, of which television is a voracious consumer. The difference in running costs of the two services is illustrated by the figures furnished by the British Broadcasting Corporation for the year 1956–57[1] (see Table 8).

TABLE 8

	Cost per hour[1]	
	Sound broadcasting	Television
Programmes	314	1 538
Engineering	136	1 242
Other	125	476
TOTAL	575	3 256

1. In pounds sterling.

The difficulties which the high costs of television raise for a smaller country were emphasized by Gunnar Pedersen, head of the Radio Technical Division of the Danish Ministry of Posts and Telegraphs, in the following statement: 'The installation cost of providing television throughout Denmark should not be prohibitively high, and the greatest difficulties that the Danish Television Service will have to face in the next few years will be those of the great cost of programme production and of finding sufficient programme material. A country like Denmark, with only a single language and a high density of population, is in a very advantageous situation so far as the cost of technical facilities per viewer is concerned, but the programme expenses are virtually independent of the size of the country. As the public in a small country wants the same quality and duration of television programmes as does the public of a large country, the cost of the programmes per viewer is likely to be correspondingly higher.'[2]

Of the countries which had traditionally supported public service broadcasting, the United Kingdom was the first to turn to commercial television. Although the BBC provided a thorough coverage of both sound broadcasting and television, parliament created in 1954 an Independent Television Authority (ITA) to own and operate additional transmitters and undertake commercial operations. As would be expected, this new television service differed in many respects from the 'free enterprise' system of the Americas. The ITA's governing body consisted of from seven to ten people appointed by the Postmaster-General, subjected to governmental controls similar to those imposed on the BBC. The authority obtained revenue by leasing its facilities to privately financed programme contractors selected competitively. The contractors prepared programmes and sold 'spot' advertisements directly to the advertiser, or through advertising agencies. The content, time and place of the advertisements were all controlled and parliament prescribed that it always should be made clear that the advertisers did not control programme material.

The ITA began operating on 22 September 1955. Almost from the beginning it proved a successful competitor with BBC television among viewers who had converted their sets or had purchased new ones able to receive both transmissions.[3] By 1957, the proportion of time these viewers divided between BBC and ITA programmes seemed to have levelled off at about one-third for BBC

1. *BBC Handbook, 1958*, p. 222.
2. EBU, Technical Centre, *The Present Position and Perspectives of VHF Sound Broadcasting in Europe*, Brussels, 1956, Vol. II, Danish reply, p. 9.
3. According to the 'Sixteenth Quarterly Release of Listening and Viewing Trends', October-December 1957, 11,650,000 adults were able to receive both BBC and ITV transmissions and 9,650,000 could receive BBC television programmes only. BBC, Press Service, January 1958.

and two-thirds for ITA.[1] Near the end of 1957, the ITA was able to report that it was making a profit, much earlier than had been expected.

The first country to follow the British lead was Finland. Finland's experiment differed from the United Kingdom's in that advertising was permitted from the beginning. Veli Virkkunen, head of the Information Services of the Finnish Broadcasting Company, observed: 'It must be noted that the Government and Parliament on whom the financing of the television service ultimately depended, adopted a favourable attitude towards commercials right from the start. Parliament, including the Labour members, understood that advertising was a means of reducing the need to use public funds for the establishment of television. While advertising revenue could not eliminate the necessity for financial assistance from the government, it could help to cover the programme and operating expenses of the television service.'[2] As in the case of the United Kingdom's ITA, advertisements were limited to 'spot' advertising coming before or after the programme itself. A separate agreement provided that advertising fees were to be progressively raised as the number of receivers increased, transmission time extended and the network expanded to include the cities of Lahti, Tampere and Turku.[3]

Discussions concerning the possibility of introducing commercial television have also been reported in Belgium,[4] Germany,[5] Israel,[6] Netherlands,[7] and Switzerland. The case of Switzerland is of special interest. Late in 1957, when the Swiss Government was debating the future expansion of television (the experimental phase was to end in December 1957), a Swiss commercial trust offered to pay the television service 2 to 3 million francs a year for half an hour's advertising time a day. Soon afterwards the Swiss Association of Newspaper Publishers, and other interests, made a counter offer of 2 million francs a year for 10 years if the television service would not resort to advertising during that time. After prolonged discussion, the latter offer was accepted.[8]

Exchange and Standards

Since the early years of television, efforts have been made to follow the example of radio and exchange programmes between countries on the same continent and even between continents. Exchanges are made largely by means of films, kinescope recordings, or direct relays. Facsimile has been used to send programmes across the Atlantic. The direct transmission of programmes across frontiers has grown much more slowly, since this necessitated the introduction of link stations, coaxial cables and converters to permit the transmissions of one system to be geared to those of another. This practice is now becoming more common, despite the usual difficulties concerning performers' rights.

One of the best-known schemes to link television stations of different countries directly and thus permit simultaneous telecasts is Eurovision, which by 1957 had brought together television organizations in 12 Western European countries.[9]

1. EBU, Technical Centre, op. cit., p. 3.
2. Veli Virkkunen, 'Television Advertising in Finland', in: *EBU Bulletin*, Vol. VIII, No. 46, November-December 1957, p. 668.
3. At the beginning of television broadcasts in Finland the number of receivers was numbered at about 5,000 sets. (ibid., p. 668).
4. *Broadcasting*, 13 January, 1958, p. 118.
5. *EBU Bulletin*, Vol. VIII, No. 46, November-December 1957, p. 736.
6. ibid., Vol. VIII, No. 44, July-August 1957, p. 447 and No. 45, September-October 1957, p. 639.
7. ibid., No. 45, September-October 1957, p. 557.
8. ibid., No. 42, March-April 1957, pp. 152–3 and 251; No. 44, July-August 1957, pp. 448–9 and 531; No. 45, September-October 1957, pp. 616–18; and No. 46, November-December 1957, p. 740.
9. Austria, Belgium, Denmark, France, Federal Republic of Germany, Italy, Luxembourg, Monaco, Netherlands, Sweden, Switzerland, and United Kingdom.

Eurovision operates under the auspices of the European Broadcasting Union (EBU) and utilizes its programme committee in Geneva and its technical centre in Brussels. Acting as a clearing house, the programme committee receives notifications from member organizations of the programmes that they have to offer. The committee relays these offers to other members, and collects the affirmative replies which include data on the links required, sound and picture circuits, conversions, and the language in which the commentary is desired. The committee then notifies the Brussels centre, which analyses technical requirements and makes the necessary arrangements with technical centres of the countries concerned. If an organization is not connected directly to the transmission by participating countries, a special transit charge is paid.

An exchange service similar to Eurovision is being prepared by the International Broadcasting Organization (OIR) in Prague, and has been tentatively named 'Oiro-vision'. Although there is no official liaison between the EBU and the OIR, individual members of each association exchange programmes with members of the other group.

The direct exchange of programmes throughout the world is hampered by the fact that several varying standards of broadcast definitions are in use. The United Kingdom alone uses a definition of 405 lines per picture with a band-width of 5 Mc/s. At the other extreme is France with a definition of 819 lines per picture and a band-width of 14 Mc/s. Using the same standards as France are Luxembourg and Monaco. All the countries of North and South America, with the exception of Argentina and Venezuela, use a definition of 525 lines and a 6 Mc/s band-width. Also employing this standard are Iran, Japan, Korea (Republic of), Philippines, Saudi Arabia and Thailand. Other countries use a picture of 625 lines and a 7 Mc/s band-width, with the exception of nine in Eastern Europe which employ 625 lines, but with an 8 Mc/s band-width rather than one of 7 Mc/s.[1]

As the *EBU Bulletin* pointed out some years ago, the difference in standard is more a result of industrial and commercial interests than a technical consideration.[2] The United Kingdom, which had been the first country to start regular television and was the first to resume it after World War II, decided to retain its pre-war standards for the practical reason that equipment was on hand. In the United States, the post-war television industry wished to take immediate advantage of the new medium's potentialities and being unwilling to await further discussions about definitions, also pressed for adoption of the pre-war standards. 'In France, where great progress had already been made in high-definition research' the *EBU Bulletin* further stated, 'the official choice was dictated both by the wish to give the public the best possible quality and also, we must admit, to give the national industry, which would not have been able to compete with its powerful rivals on the simple basis of mass production, the new weapon of high quality.' The decisions of other countries to adopt one or another standard were motivated by similar considerations.

The ITU's International Radio Consultative Committee vainly strove to establish uniformity in television standards. A study group, set up in 1949, toured the United States, France, the Netherlands and the United Kingdom to evaluate the different systems. The group could not, however, agree as to which system was the best. Its report, adopted by the ITU committee in 1951, merely recorded the technical characteristics of the four systems studied, 'for the information of administrations which may wish to use one of these systems'.

There is hope in some quarters that the introduction of colour television,

1. The following countries have adopted the 625 line, 8 Mc/s band-width system: Albania, Byelorussian S.S.R., Bulgaria, Czechoslovakia, Hungary, Poland, Rumania, Ukrainian S.S.R., and the U.S.S.R.
2. 'Recent Work of the CCIR Study Group on Television', in: *EBU Bulletin*, Vol. I, No. 2, 15 July 1950, pp. 132–42 and Vol. II, No. 5, 15 January 1951, pp. 28–37.

and the necessary conversions of equipment that it will entail, will provide another opportunity to establish world-wide standardization of television systems. However, it is difficult to see how the same industrial and commercial considerations can be overcome, despite the desirability of achieving an easier method for the exchange of programmes.

As the expansion of Eurovision demonstrates, the lack of uniformity in standards is not an insurmountable barrier to programme exchanges. Even in the early days of television, film could be used as an intermediary for this purpose. More recently, various methods have been devised to convert electronically one system to a form that can be used by another. If standardization cannot be achieved, better conversion techniques will probably be developed.

television and education

Television has successfully invaded the field of education. In the broad sense that all experience is educational, all television programmes have some educational value. But the educational intention of television varies, and will vary from country to country and in accordance with the nature and purposes of the organizations and individuals operating stations and producing programmes. On the other hand, the use of television for specific educational purposes is rapidly increasing. Educators are concerned with television not only because it is rapidly spreading from country to country, gaining in depth within each nation, and appealing to the aural and visual senses in the intimacy of the home or club, but also because television is still only in its formative stage and educators have a real opportunity to share in its development.

The first and perhaps most effective role of the instructor in adult education is in the reception and use of transmissions. By forming viewing groups or clubs, by arranging for the reception of significant programmes in groups or classes assembled for other purposes, by stimulating discussion of the role of television and of individual programmes in educational centres, in formal classes or within the framework of other leisure-time activities, the educator can constructively incorporate television in his work. His primary task is not so much to impress his own preconceived standards upon others, as to guide viewers towards a discriminative analysis of what they have seen, to get them to discuss television, rather than to swallow passively its seductive offerings.

Use of Tele-Clubs

Since 1951, French villages have actively developed tele-clubs. In 1952 Unesco took an interest in this movement since it seemed to offer a form of reception suitable to less developed countries and a manner of integration between the broadcast medium and local forms of adult education. In 1954 Unesco co-operated with Radio-Télévision Française in the production of a series of programmes entitled 'State of Emergency' (*État d'Urgence*) which dealt with the urgent problems of modernization in rural communities and were addressed primarily to tele-clubs. These programmes led to group discussions on such issues as the introduction of tractors, the role of co-operatives, and the drift of young people from the land. Each programme was based on case histories filmed in the area of the tele-club, and included studio discussions between farmers and agricultural experts.

The project was evaluated by a team of sociologists and judged highly successful. Discussions lasted until late into the night, attitudes were changed and in some cases action followed. One village decided to bring water to the homes (many villages have only a single water pump), another formed a local co-operative. At the same time the programmes served to familiarize city dwellers with the largely unknown problems of their rural neighbours.

The French experience has had its sequel in Italy and Japan. A Unesco aid mission to Italy led to the formation of some 4,000 tele-clubs by adult educational organizations, which seek to use television for the double purpose of attracting a public and stimulating discussion. At the same time, programmes were produced dealing with the conditions which lead young farmers to stream into the cities from their villages in the Apennine mountains. In Japan, Unesco conducted in 1956–57 a project parallel to that executed in France, except that it also included the formation of pilot tele-clubs.

Universities and Schools

In the advanced as well as less advanced countries, television is used as an educational aid. An example is the successful 'Sunrise Semester', a television course on comparative literature broadcast at 6.30 in the morning by New York University and local stations of the Columbia Broadcasting System. Expecting perhaps 200 students to be attracted by the programme, the staff discovered that they had an audience of 120,000 people. New York booksellers were astonished by the demand for books by Stendhal, Balzac, Thackeray, Melville, Dostoevsky, Proust, Gide and other authors publicized in daily lectures. Credits were offered to viewers who proposed to register for the course on payment of $75, to submit a term paper and to undergo a final examination at the university itself.

The success of 'Sunrise Semester' is but one example of the use of television for educational purposes throughout the United States. At least 20 universities are offering 'tele-courses' in university extension, either for credit or certification, in such fields as psychology, philosophy, art, music, history, economics, anthropology, languages and literature. These courses generally aim at three types of viewer; the credit student who undergoes regular examinations at the end of the term, the non-credit student who pays a small fee for books and guides distributed in connexion with the programmes, and the general viewer who follows the course with more or less consistency.

In France, tele-courses are regularly transmitted under the aegis of the Ministry of Education, and today over 2,000 schools are provided with receivers. Teachers receive advance information on the content of programmes. The resources of the nation's museums, the Comédie Française, scientific laboratories and industrial organizations, and the participation of scientists, explorers and specialists of all kinds have been used over the past seven years to bring the outside world into the class-rooms of France, to add new dimensions to class-room teaching.

Another example comes from the United Kingdom, where the BBC broadcast a series of programmes under the general title 'Matters of Life and Death', and another series which demonstrated vividly the 'Limits of Human Endurance'. As a BBC producer stated, the aim of the programmes was threefold: first, to allay groundless fears in the minds of people who thought they were suffering but were afraid to see a doctor; second, to persuade those who had grounds for fear to go to their doctor and to try and create in their minds a confidence in the medical profession; and third, to 'put over' the matter in such a way that it would enable them to gain that confidence.

Reporting on experience in educational television in the United States, a correspondent of the *Times Educational Supplement*, London, noted that 'television can help in two ways. It cannot replace the class-room teacher, but it can, as it were, multiply the brilliant, stimulating teacher by introducing him to hundreds of schools. It can also bring rare and costly equipment for close inspection by children who would never otherwise have the opportunity of seeing it in their class-room'.

Diffusion of Culture

From a more general point of view, television enables millions to be moved by artistic presentations which were largely inaccessible to them.

Here lies the great chance to use television for the wider spread of education and culture. The broadcast can rarely fully exhaust a subject. The personal visit to the opera, the theatre, the museum or the concert, the reading of books and the class-room lesson will deepen the experience and broaden knowledge. But television broadcasts can provide the stimulus, the scope and otherwise inaccessible information. The unique relationship of television to other forms of communication between man and man indicates that it may play a most important role in unifying human knowledge and experience.

Television serves to unify people who live apart and are distinct in habits or in nationality. For seeing others and following them in their normal way of life is perhaps the closest we can come to knowing them. In France, 'Life in the Countryside' is the title of a broadcast which has been an eye-opener for people of the cities. When he meets young men who want to leave the land, or farmers who are seeking to improve their cultivation, when he sees fellow citizens of whose condition he was ignorant, the city dweller gains experience whose impact is not matched by what he may have read or heard. When Englishmen see Paris life through television, their world is broadened beyond the barriers of language and geography. In radio the people of one nation can speak to another, but it will still be in a different tongue; the television broadcast, centring around the picture, can bridge the language gap because its core is seen and understood by all. The opportunities television offers for bringing about a deeper comprehension between peoples, while largely unexplored, are among the most hopeful and constructive aspects of this new medium of communication.

The lecturer, the expert, the specialist on television must know how to adapt himself to his new medium of communication. Inadequate understanding, a certain snobbish attitude towards the medium and ignorance of its techniques and determinants, bar the road to fruitful integration of educational and cultural purposes into television programming. Similarly, lack of appreciation and understanding of educational and cultural subjects by the producers of television programmes limits the output of worthwhile broadcasts. That is why both educators and producers have frequently stressed the primary need for mutual understanding of each other's objectives and problems.

The international study course for educational television producers and directors, organized under the auspices of Unesco and the BBC, which brought together broadcasters from 12 countries in July 1954, in London, was emphatic on this point: 'The fundamental problem of the producer of educational and cultural programmes is that he must translate into the language of television a body of knowledge and experience hitherto communicated through other forms of mass and individual communication.'[1] The producers stressed the ever-present problem of adapting content to the form of television, the difficulty of presenting visually art and information which is not necessarily visual in itself, the need for developing television for the communication of knowledge and cultural achievement.'[2]

Team-work between broadcasting organizations and educational institutions, between producers and individual experts was suggested as the most urgent need for the development of educational and cultural programming. The conclusion was reached that 'the producer must seek to absorb fully what the specialist wishes to put across or what is the essence of the work of art or science which is to be communicated. The specialist on his part must equally understand the

1. *Final Report of the Study Course for Producers and Directors of Educational and Cultural Television Programmes*, Paris, Unesco, 1954, p. 13.
2. ibid., p. 17.

particular requirements of the mass medium and must respect the producer as an equal, who in his own right possesses essential skill and creative ability'.[1]

television versus radio

When one leaves the more factual aspects of television and attempts to draw conclusions about its impact on the radio audience and the content of radio programmes, as will be briefly done in this section, considerable reserve must be maintained. Despite its rapid growth, television is still in the formative stage of programming and organization. Even in the United States, where television has become a part of daily life, there is still no general agreement on the role and form which it should take so that its powerful assets may be fully and most suitably used. The ultimate expansion of television throughout the world will depend upon such unknown quantities as future technical advances and the general improvement of living standards. An important element both in the programming and expansion of television is the form and extent of governmental control. Some countries will permit television to find its place freely as a result of commercial competition with radio, and even between television stations and networks. Other countries will probably exercise varying degrees of control over both television coverage and the content of programmes. The following indications must, therefore, be considered as preliminary and tentative.

The Changing Audience

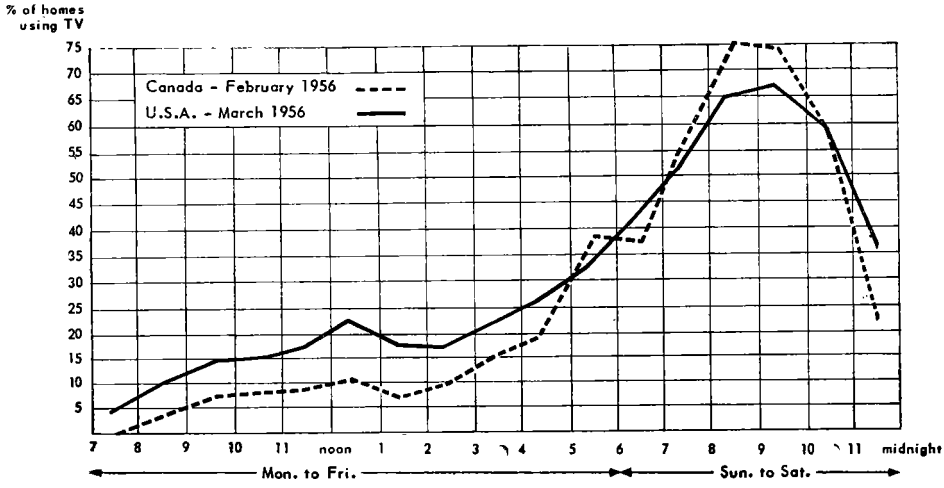
In only two countries, Canada and the United States, has television already advanced rapidly enough to place it within striking distance of coverage by radio, in relation both to geography and hours of operation. In the United States television is within the range of about 97 per cent of the population and in Canada, 80 per cent. The estimated number of families with television sets is approximately 75 per cent in the United States and 60 per cent in Canada.[2] Most important of all, in both the United States and Canada most of the audience can receive television programmes throughout the normal hours of daily life. Many stations transmit from seven in the morning to midnight. In the United States there are even stations which transmit for 24 hours daily. A better view of the impact of television on the radio audience can obviously be obtained in countries where the hours of operation for television equal those for radio, rather than in countries where television is limited to a few hours in the evening and, possibly, at mid-day.

The first tentative conclusion to be drawn from North American experience is that the total number of hours a day which a family with both radio and television spends listening to radio has fallen considerably. According to the United States periodical *Broadcasting-Telecasting*, the pattern in that country has evolved as shown in Table 9 below.

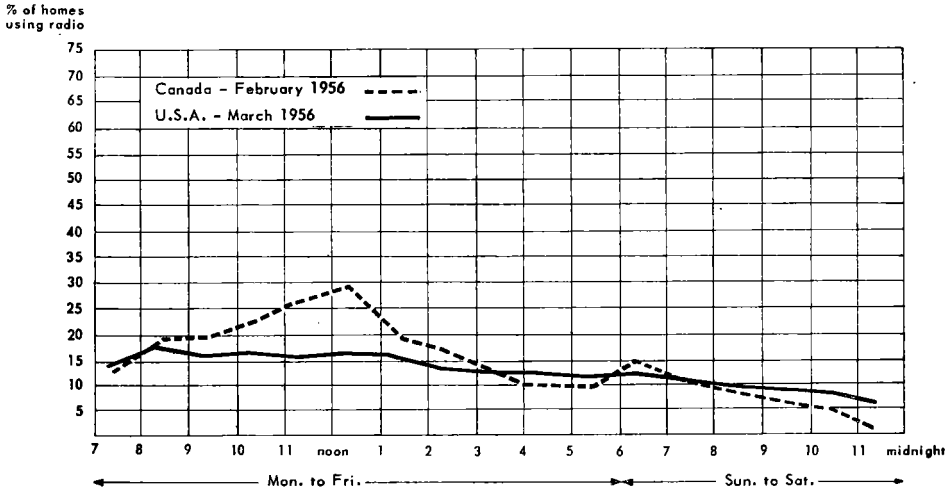
The second possible conclusion is that in areas where television transmissions are made during most of the day, television has its greatest impact in the evening when, it can be assumed, the audience can devote full time to viewing and listening. A comparison made in early 1956 by the A. C. Nielsen research company in the United States and International Surveys Ltd. in Canada gives the results as shown in the graphs on page 134.

1. ibid., p. 17.
2. The leading television countries, in order of ratio of sets to population, are Monaco, United States of America, Canada, United Kingdom, Bermuda, Cuba, Federal Republic of Germany, Belgium, Venezuela, Denmark, Australia, Netherlands, Sweden, France and Italy.

I. *Canada, U.S.A.:* How the television audience varies hour by hour[1]



II. *Canada, U.S.A.:* How the radio audience varies hour by hour[2]



1. Reprinted from *Printer's Ink*, New York, 18 January 1957.
2. Ibid

TABLE 9. Hours of daily television and radio use per home in the United States[1]

	1949	1950	1951	1952	1953	1954	1955	1956
	h m	h m	h m	h m	h m	h m	h m	h m
Radio	4 46	4 19	3 46	3 16	2 58	2 42	2 27	2 16
Television	0 06	0 28	1 22	1 54	2 27	3 03	3 26	4 01
TOTAL	4 52	4 47	5 08	5 10	5 25	5 45	5 53	6 17

The fact that there has been a decrease in the number of hours during which radio is used daily does not necessarily mean that the total size of the audience has also decreased. In the United States, sales of radio sets are increasing along with those of television receivers. The estimate for the United States given in Table 10 illustrates this phenomenon.

TABLE 10

Year	Radio	Television
1947	66 000 000	8 000
1952	114 000 000	15 750 000
1956	143 500 000	42 700 000

In a comprehensive study of United States radio and television habits, the American advertising agency, Batten, Barton, Durstine and Osborn, Inc., concluded that although no more than a small percentage of the people tuned in to a particular radio programme at any one time, 'it is a universal medium, reaching almost everybody at some time during the day and in the course of the broadcasting week'.[2] A similar statement was made by a representative of the Canadian Broadcasting Corporation to the Canadian Royal Commission on Broadcasting in 1956: 'Although there was a reduction in the total audience listening to radio at any one time during the evening hours, the same number of people listen to the radio in any one week as was the case before the advent of television. In their estimation the audience is just as large but it listens less frequently.'[3]

Another interesting aspect of recent radio listening trends in the United States and Canada is the movement of the radio out of the living room into other rooms of the house and into the automobile. This trend reinforces the previous argument that radio is still holding its over-all total audience. According to a 1956 study by Batten, Barton, Durstine and Osborne, Inc., the location of family radio sets in the United States followed this pattern: 25.9 per cent in automobiles; 25.1 per cent in living rooms; 21.4 per cent in bedrooms; 16.0 per cent in kitchens; and the remaining 11.6 per cent in other rooms of the house.[4] A similar study by International Surveys Ltd., showed that radio sets in Canada in July 1957 were distributed as follows: 35.3 per cent in the kitchen, 22.6 per cent in the living room; 17.8 per cent in automobiles; 15.7 per cent in bedrooms; 2.4 per cent in the dining room; and the remaining 6.2 per cent in other rooms of the house.[5] Again, according to the Canadian Royal Commission *Report* of

1. *Broadcasting-Telecasting, Telecasting Yearbook-Marketbook*, New York, 1957–58, p. 429 and *Broadcasting Yearbook-Marketbook*, 1957, p. 383.
2. *A Discussion of Radio*, New York, Autumn 1956 (no pagination).
3. Canadian Royal Commission on Broadcasting, *Report, 1957*, Ottawa, 1957, p. 204.
4. *A Discussion of Radio*, op. cit. supra.
5. International Surveys Ltd., *Seasonal Listening and Viewing Habits in Canada and its Three Major Markets*, Toronto-Montreal, 1957, p. 35.

1956: 'Although radio seems to have moved out of the living room into other rooms of the home and the automobile', the evidence seems to substantiate the claim that very large numbers of Canadians still listen to the radio regularly, although perhaps in a different way. While the family or the social group may now habitually watch television in the living rooms of our Canadian homes, countless individuals still listen to the radio in their kitchens, or bedrooms, or offices, or shops, or automobiles.'[1] A similar trend has been noted in the United Kingdom.[2]

Television's Major Role

There seems to be general agreement in the United States and Canada that, in situations where the visual element is most important, television plays the major role. The Canadian Royal Commission points out that 'in this category would have to be included such things as all forms of drama, variety shows, opera and ballet, musical comedy, sports events and, last but by no means least, all children's programs including music'.[3] That television in Canada is beginning to concentrate on the visual element is apparent in the analysis in Table 11 of the programmes broadcast by the Canadian Broadcasting Corporation's English-language stations during the week of 15 January 1956.[4]

TABLE 11

Programme class	Percentage of total time	Programme class	Percentage of total time
Crime, action or western drama	14.5	Foreign lands and people	2.3
Comedy	8.0	Sports news	2.3
Variety	7.8	Religion	2.2
Sports events	5.5	Romantic drama	2.2
News and weather	5.0	Political and other public affairs	1.9
Canadian activities and heritage	4.9	Family living	1.8
Children's action or crime or western drama	4.7	Serious music	1.8
Children's variety	4.0	Personalities	1.6
Popular or dance music	3.6	Social and human relations	1.5
Serious drama	3.5	Nature and science	1.5
Youth educational	3.5	Fine arts and literature	1.3
Domestic drama	3.4	Other children's drama	1.3
Other drama	2.5	Old-time or western music	1.1
Children's comedy	2.4	Other[1]	3.9
			100.0

1. Other programmes, in the less than 1 per cent total time category included: miscellaneous information, dance, agricultural-fisheries, etc., light music, quiz and contests, fairy tales, children's serious drama, other children's programmes and programme promotion.

The same emphasis on the visual is evident in the corresponding analysis for Canada's private English- and French-language television stations, which are a little more free than CBC to choose programmes that will attract the largest audience. Similar emphasis is found in the programming of the United Kingdom and United States television stations. In the United States, moreover, not only has television become an important outlet for old Hollywood films, but several of the major film studios have been diverted to the almost exclusive production of new films specially suitable for television.

1. Canadian Royal Commission on Broadcasting, op. cit., p. 204.
2. *Manchester Guardian*, 8 June 1959.
3. Canadian Royal Commission on Broadcasting, op. cit., p. 205.
4. ibid., pp. 59–60.

On the other side of the world the trend is the same. The Japan Broadcasting Corporation (NHK) states in its 1957 report that programmes with a primarily visual emphasis, that is, drama, variety, films, cultural and educational productions, represent more than two-thirds of television fare. Programmes not necessarily visual in emphasis, such as spoken news, talks, debates, and music, make up less than one-third.'[1]

In other countries with differing forms of broadcasting control, the visual element likewise plays a major rule in television. In the U.S.S.R., chief place is given to plays, concerts and films. For example, the Moscow station in 1956 transmitted 79 plays, 125 concerts, 226 art films and 515 newsreels, documentary films and popular science films. Childrens' programmes, which are transmitted daily, included 20 plays. Experimental transmissions in colour were to be organized in Moscow during 1958. Television programmes were being transmitted regularly in 1956 from Moscow, Leningrad, Kiev and 27 other cities throughout the Union, and new stations in a number of other centres were nearing completion. The broadcasting authorities of the U.S.S.R. expressed the opinion, however, that the rapid expansion of television 'cannot limit the further development of (radio) broadcasting networks'.[2]

The Realm of Radio

It follows that if television can do the better job in fields in which the visual element plays an important part, 'radio is best in those areas where sound is the major element'.[3] The two main fields for radio, according to the Canadian Royal Commission, are music and (probably) the news. 'There seems to be little doubt, as noted by the Toronto Royal Conservatory of Music, the Vancouver Symphony Society and many others, that radio is a better medium than television for the transmission of fine music. There were others who felt that, up to the present at least, radio had provided better, more complete and more satisfying newscasts than television.'[4]

The contention that news is primarily a matter for radio is supported by Gerhart D. Wiebe, a Columbia Broadcasting System research psychologist who maintains that: 'News is among the most robust departments of radio. The immediacy of radio news is without equal, and this characteristic is unchallenged by television, although smaller cameras and video-tape will reduce radio's advantage somewhat.'[5] In another tribute to the immediacy of radio news reporting, a United States radio news director recently stated that this factor 'caused the press to abolish extra-edition newspapers'.[6] Similar trends can be noted throughout the United States where the majority of radio stations are turning to news and music as their main fields of activity.[7]

It should be noted, however, that competent voices have been raised against letting radio supply only news and music where there is a choice between radio

1. *Japan Broadcasting Corporation (NHK) through Charts and Diagrams*, Tokyo, 1957.
2. Communication from the chairman of the National Commission of the U.S.S.R. for Unesco, Moscow, 14 November 1957.
3. Canadian Royal Commission on Broadcasting, op. cit., p. 205.
4. ibid. Not many, however, would perhaps agree with J. A. Westrup when he states: 'The person who says he prefers a televised performance of an orchestral concert is not really interested in music at all: he is interested only in the means by which it is executed.' —*The Times Radio and Television Supplement*, 22 August 1956, pp. vii–ix.
5. 'Radio and Television: Looking Ahead 20 Years', *Journalism Quarterly*, Vol. 32, No. 1, Winter, 1955, p. 29.
6. Jim Borman, 'How Durable is Radio?' *Journalism Quarterly*, Vol. 34, No. 3, Summer, 1957, p. 313.
7. See, for example, Jack Gould, 'The Survival of Sound Broadcasting in the United States', *BBC Quarterly*, Vol. IX, No. 2, Summer 1954, pp. 70–3; and Harvey J. Levin,, 'Competition among Mass Media and the Public Interest', *The Public Opinion Quarterly*, Vol. XVIII, No. 1, Spring 1954, pp. 62–79. See also above, Chapter 2.

and television. In the British publication, *Unsound Broadcasting*, for example, a distinguished group of persons in the fields of literature and entertainment supports the case for a continued well-rounded radio output. Sir Laurence Olivier, a member of the group, affirms that 'plays that depend more on the quality of their dialogue than on their spectacular qualities are more suited to sound broadcasting'.[1]

So far we have been concerned primarily with situations where the listener can make a choice between radio and television. But we cannot overlook the many millions of people who have no choice and for whom radio must continue to be the sole medium. First there are the people of the underdeveloped countries where economic factors may delay television saturation for many years to come. Next are the inhabitants of more advanced countries, such as Norway, Finland and New Zealand, where geographical and population difficulties delay expansion and the final achievement of television coverage can be measured not in years, but in decades.

The Director-General of Norwegian Telecommunications, in a communication to the European Broadcasting Union, stated that 'we are still in the experimental stage and a draft plan in schematic form of the future television network will not be ready for about a year. Even were priority given to television, to the detriment of all development in sound broadcasting, it would, with ordinary credits, take us several decades to obtain satisfactory coverage for the majority of the population. It is therefore only in the fairly distant future that television might perhaps supplant sound broadcasting throughout the whole of our territory. Meanwhile, it is absolutely necessary to continue our efforts to create a sound broadcasting service which may satisfy the need of the entire population.'[2]

Within such countries, there are also areas which may be completely outside television coverage, from an economic and technical point of view. 'The Finnish Broadcasting Company is of the opinion that sound broadcasting will continuously keep its position (in Finland). Television cannot decrease the importance of sound broadcasting in a country of such large area but of sparse settlement as is Finland.'[3] Even in the United Kingdom, competent observers hold that when television has reached its 'feasible maximum', there will still be '2 million homes without television but with sound'.[4] Limitations in Africa, Asia and other underdeveloped regions are manifestly much greater.

Lastly, one should not overlook the many persons who cannot view television because of the conditions of their work, and the hardy devotees who will continue to prefer radio to television despite the growing availability of the new medium.

To conclude, we could hardly do better than note this summary of views of the Canadian Royal Commission on Broadcasting: '(a) television notwithstanding, radio is here to stay; (b) good radio service must continue to be provided to the several million Canadians who either cannot or do not wish to watch television; (c) somewhat improved service ought to be provided to the hundreds of thousands of Canadians who live in the more sparsely settled parts

1. The Sound Broadcasting Society, *Unsound Broadcasting*, London, 1957, p. 24. See also L. MacNeice, 'A Plea for Sound', *BBC Quarterly*, Vol. VIII, No. 3, Autumn 1953, pp. 129–35, and the reply by Moore Goffrey, 'The Word and the Picture in Broadcasting', ibid., Vol. IX, No. 1, Spring 1954, pp. 25–31. For a discussion on the importance of sound broadcasting to poetry, see P. H. Newby, 'New Literature on the Air', ibid., Vol. IX, No. 3, Autumn 1954, pp. 156–61.
2. EBU, Technical Centre, *The Present Position and Perspectives of VHF Sound Broadcasting in Europe*, Vol. II, Norwegian reply, pp. 1–2. Although experimental television in Norway was begun in January 1954, the decision to start a regular service was made only in June 1957. Regular television is due to start in 1960.
3. ibid., Vol. II, Finland's reply, p. 2.
4. Sir William Emrys Williams, 'Seven Decisive Years for Sound and Vision', *The Times Radio and Television Supplement*, Wednesday, 28 August 1957, p. iii.

of the country and who have little hope of being reached by television in the next several years; (d) the broadcasters as well as the listeners and viewers will benefit from the intelligent and deliberate counter-programming of radio and television broadcasts; (e) in radio and television, neither medium is subservient to the other but both are complementary to one another; (f) radio can excel television in those types of programmes where the aural elements are more important; (g) radio cannot usually compete successfully with television in the production of spectacular programmes and should therefore undertake such production only infrequently; and (h) above all, radio broadcasters should, with the imagination, resourcefulness and inventiveness they have so amply demonstrated in the past, continually seek new techniques, new ways of effectively reaching the audience that is still there, and thus make of radio, in some of its aspects at least, an even better and more satisfying instrument than it was prior to the advent of television.'[1]

1. Canadian Royal Commission on Broadcasting, op. cit., pp. 207–8.

the future of broadcasting 9

Radio broadcasting, as this survey has demonstrated, is an ideal means of mass communication. Unsurpassed in speed, range and economy, it is eminently suited to fulfil modern man's need for information, enlightenment and entertainment, and to promote the free flow of ideas between countries. Radio is the most powerful and pervasive media yet devised by man.

Broadcasting has shown tremendous vitality in its relatively short life. Just four decades ago it was but a whisper, raucous at that, available only to the few devoted amateurs who were so interested in listening to sounds coming over the air that they were willing to spend time and money building their own crude receivers. As the pioneers of broadcasting improved the technical quality of transmissions and the content of programmes, a widespread public demand arose for access to the new medium. In the United States, as we have seen, over 700 stations were operating only seven years after the first regular broadcasts began. Today radio commands a vast world-wide audience of hundreds of millions, attracted by the immediacy of the spoken word.

Radio is also outstanding in its adaptability. It is a rapid and efficient means of keeping people informed of important world events, wherever they may occur, and is an inexpensive way of bringing music, plays and talks to a widely scattered and heterogeneous audience. It is also used by many people to receive broadcasts directly from other countries. With a normal medium-wave set, for example, European listeners can pick up broadcasts from several neighbouring countries. With slight modification, most sets can also receive short-wave broadcasts from the far corners of the globe. It is not surprising, therefore, that almost from the beginning of broadcasting, national authorities have sought to reach audiences in other lands as well as those at home.

As we have seen, broadcasting is particularly well suited to the less advanced areas where difficulties of terrain, economic limitations and widespread illiteracy have hindered the development of other media. While inadequate transport facilities may hamper the distribution of newspapers and films from urban centres to outlying areas, radio can communicate over long distances regardless of jungle or mountain barriers. Second, there are considerations of economy. While film, newsprint and other basic materials must often be purchased from abroad in the currencies of major producing countries, a broadcasting service is relatively inexpensive to establish and maintain. The third advantage of radio is that it can fulfil its task although the audience may be largely illiterate; indeed, radio can be used to attack illiteracy itself.

It is equally apparent from the present study that the potentialities of broadcasting are far from being fully realized. Many obstacles, economic, technical and political, impede its effective use. The development of broadcasting in the various regions of the world has been markedly disparate; broadcasting organizations and industries have not always kept pace with the possibilities offered by technical progress or with the changing requirements of public interest; insufficient effort has been made to promote the international exchange of programmes, or to develop acceptable programmes for exchange; and finally, the failure to agree on the rational use of the frequency spectrum space available to broadcasting has seriously impaired listener reception and hindered expansion in advanced as well as in less advanced countries.

Broadcasting for All

It was inevitable that the wealthier, technically developed countries should have been the first to organize broadcasting facilities adequate to their needs. The result is that today the number of receivers in some of these countries is calculated on the basis not of families per receiver, but of receivers per family. Sets are installed in various rooms of the house and in the family car as well. Choice of programmes is large and varied, and many stations broadcast around the clock. But over the greater part of the world, adequate services are lacking. We have seen that in more than a hundred countries, most of them in Africa, Asia and Latin America, there are less than five receivers per 100 inhabitants (or less than one set to every five families). Broadcasts can be received for only a few hours a day, and reception is often technically poor. Such paucity of facilities is a deprivation affecting some 60 per cent of the world's population.

An immediate task confronting broadcasting organizations and industries is, therefore, to ensure transmission and reception facilities for those who need them most. In less advanced countries, the provision of transmission services calls for the planning of a medium-, high- or very high-frequency transmission system that will ensure reliable coverage for the areas concerned and the purchase, installation and proper maintenance of the necessary transmitting facilities. In addition, trained technical and programming staff are needed to operate the services and furnish programmes suited to the listener's needs.

Fortunately, in most less advanced countries, general programmes of economic and social development now make provision for the establishment of transmitting facilities. Governments have in fact recognized that the economic considerations involved in appropriating public funds for the development of transmitting services lose much of their importance when weighed against the possible advantages offered by broadcasting as a medium of information and education. With regard to the procuring of expert technical help to advise on installation and to train local staffs, some countries have made arrangements with more technically advanced countries and others have turned to the United Nations and its appropriate Specialized Agencies, such as the ITU and Unesco. Although these organizations have responded within the limits of their resources, there is little doubt that the extent of the need calls for more assistance than present credits seem to allow.

The installation of facilities is only one difficulty, however. Many problems of language, choice of material and technical presentation attend the production of programmes which are meaningful to local audiences. The experience of France, the United Kingdom and other nations administering non-self-governing territories emphasizes the need for well-trained programme staffs and thorough preparation and research to make broadcasting in underdeveloped areas effective. That radio can play a vital role in basic education is likewise shown by the success of the farm forum techniques which such diverse countries as Canada, India and Colombia have used to help rural audiences understand and

overcome new economic, social and political problems. Here, as in other fields of broadcasting, the rich fund of knowledge and techniques now available can be used to enable the underdeveloped countries to achieve, in a few years, a level which other countries took decades to reach.

The most pressing problem for underdeveloped areas, however, is the provision of good receivers at a price within the reach of the average householder. Even the most up-to-date transmitting facilities will have little meaning if there is no receiver in the home. Further, as has been noted, the lack of proper receivers can even force administrations to adopt less than the best transmitter system. The objective in the underdeveloped countries, as in the advanced areas, should be to reach a point where there is one good receiver per family. To meet the requirements of the underdeveloped countries alone, this would necessitate the provision of some 350 million additional sets.

Unfortunately, in many of the less advanced countries efficient receivers are still a luxury, owing to their high original price and cost of upkeep and the imposition of import duties and internal taxes. Some 85 countries, many of them underdeveloped, levy duties on receivers which often represent 50 per cent or more of their value. An additional 40 countries apply internal taxes. Governments, particularly those of the underdeveloped countries, should seriously consider abolishing these charges, or greatly reducing them. The loss of revenue would be more than compensated by the benefits to be derived from popular access to broadcasting.

It seems clear that if the target of 350 million additional receivers for the underdeveloped countries is to be reached, further action must be taken to encourage the mass production of efficient, low-cost sets. Various administrations in Africa and Latin America have worked individually to promote the manufacture of inexpensive sets adapted to domestic requirements. The experience acquired by these administrations, and by receiver manufacturers, might well be pooled for the design of a robust, wide-band, low-cost receiver, with standardized parts, which could be put into mass production. The experience is available and the potential market is known.

Broadcasting's Responsibility

While the most pressing world problem is to provide broadcasting facilities in those areas which have so far been deprived of them, one must never overlook the fact that a good start in the field of broadcasting is no guarantee that radio will always continue to be used to its best advantage. What happens to broadcasting after it becomes available to the general public is a problem that will always face developed and underdeveloped countries alike.

The pervasiveness, immediacy and intimacy of radio place a heavy burden on those who control its use throughout the world. By design broadcasting can be turned into a propaganda machine, or it can be used to present unbiased news and to help the listener understand his neighbour's problems. It may be transformed into a mere outlet for 'popular' music and commercials, at best just another irritant of modern civilization, or it can be used to widen cultural horizons and aid in educational advancement. Constant vigilance is necessary on the part of all concerned to keep broadcasting from sliding into either of these undesirable extremes. It does not of course follow that the listener will always take advantage of the best in broadcasting. If, however, he does not have access to radio, and to a choice of good programmes, he is deprived of a highly potent instrument of enlightenment.

International Broadcasts

 The problems involved in the transmission of radio broadcasts across frontiers

are no less serious than those encountered in domestic broadcasting. Ideally, the purposes of international broadcasting are to present the best of the culture and the ideas of the transmitting country; to report world news objectively; and to explain the broadcasting country's viewpoint on important world problems. But the picture that emerges from an examination of the facts is far from reassuring.

The three methods of sending programmes across national frontiers—transmission relays, programme exchanges and direct international broadcasts—are all important. Relays and exchanges have been used almost from the beginning of broadcasting. Through the efforts of broadcasters, national administrations and international organizations, these two methods have been widely employed to enlarge popular horizons by making people aware of the daily life and culture of other nations. A basic disadvantage, however, is that only the authorities in the receiving country may decide whether programmes thus offered are to be used on local stations. Problems of timing and programming further limit the amount of material that can be broadcast.

Logically, the best instrument for the free exchange of programmes between countries is international broadcasting on long-range high frequencies. Under this system the listener himself chooses programmes for reception at times convenient to him.

That high-frequency broadcasting has failed to fulfil its function is evident in the growing discrepancy between the volume of international broadcasting and the size of the international audience. The great majority of States now consider it necessary to conduct international services, even if broadcasting is limited to only a few hours a week. Hundreds of hours of programmes are being beamed daily to all parts of the world. Theoretically, a listener with an efficient short-wave set could tune in to broadcasts from abroad at almost any hour of the day or night. In some areas he could choose between dozens of different programmes. Yet despite the vast expenditure of money and effort, the international audience is actually small. Although the average domestic broadcaster would consider his work a failure if he had such a limited audience, many external broadcasters are satisfied if their audiences number only thousands or even hundreds of listeners.

There are many reasons for the limited size of international audiences. One of the more important, but less known, is that political factors often govern the scheduling of programmes directed abroad, with the result that insufficient attention is given to technical factors which determine whether programmes will be heard by the maximum audience. There is also the deliberate jamming of international broadcasts and unintentional interference between stations resulting from the chaos that exists in the high-frequency broadcasting band. The latter problem will be considered later in this chapter.

Deliberate interference, in the form of jamming of incoming broadcasts, has been an almost permanent feature of international broadcasting since World War II, despite the formal condemnation of the practice by the United Nations General Assembly as being a denial of the right of all persons to be fully informed, and despite a resolution of the General Conference of Unesco affirming the individual's right to listen freely to broadcasts from other countries. In addition, jamming is a sterile activity, enormously expensive and wasteful of scarce frequencies and material resources. It should also be noted that the General Assembly's condemnation of jamming attempted to answer the accusations of the administrations which practice jamming by inviting governments to refrain from broadcasts containing hostile propaganda and to report facts 'truthfully and objectively'.

The Problem of Frequencies

Of fundamental importance to the future of broadcasting, domestic or inter-

national, is the situation arising from the natural limitation of the frequency spectrum. Broadcasting is only one of the many radio services that use the spectrum, and new services requiring space are being introduced. No service can appropriate additional spectrum space without affecting other services. Broadcasting cannot, therefore, always choose the frequencies it considers best suited for its purposes, or the number it believes necessary to diffuse its message.

The ITU, which over the years has carried out the task of apportioning the spectrum among the various services, sought to allocate frequencies on the basis of international co-operation. The radio services alone, with their apparently insatiable appetite for frequencies, could not be expected to determine objectively how much of the spectrum was necessary for their needs.

So long as the total amount of space available for distribution among the various services was flexible, expanding requirements were equitably met. Difficulties arose, however, when no more desirable frequency bands remained to be allocated and the needs of all services continued to increase. Attempts to operate more and more transmitters in the limited space allocated to radio services by the ITU soon resulted in interference between stations performing the same service. The practical solution found was to assign the available frequencies to the countries operating a particular service on the basis of their individual needs.

The first such remedial effort was the Geneva Plan (1926), drawn up by broadcasting organizations, which assigned specific frequencies to European low- and medium-wave transmitters. The Geneva Plan has been periodically revised in an attempt to keep up with the ever-increasing demand for frequencies. Other radio services (including high-frequency broadcasting) continued for a long time simply to notify their requirements to the ITU, where they were recorded in the International Frequency List. The list was a convenient reference work for countries planning new services but lacked the order and authority of an assignment plan.

By World War II, interference had become common throughout the frequency spectrum, resulting in virtual chaos especially in the high-frequency bands. In 1947 the ITU decided to borrow from the experience of the European broadcasters and to prepare a definite assignment plan covering all the desirable frequencies in the spectrum, based on national needs, and in the form of a comprehensive new International Frequency List. In addition, an International Frequency Board was to be established to make certain that new frequency changes would cause no interference to the stations already in operation according to the new list. As we have seen, the board was created, but no general agreement was reached on the assignment plan.

The establishment of a world-wide assignment plan for all services was thwarted principally because the total frequency requirements submitted by countries greatly exceeded the available spectrum space. Too many countries met subsequent requests for a reduction in their demands with the argument that they could best judge their requirements. In high-frequency broadcasting, a complicating factor is that the areas to be covered, the languages to be used and the times of transmission are frequently decided not by telecommunication or broadcasting administrations, but by government departments which are non-technical and fundamentally political. Consequently, an administration may often, on the insistence of a higher executive organ, be obliged to maintain a requirement for a circuit which it knows will provide a poor service.

The political considerations involved in creating a workable frequency assignment plan are doubtless important; but the listener's right to enjoy the benefits of radio has an equal claim to attention. The ability of future radio conferences of the ITU to reach an agreement on the rational use of the frequency spectrum will have a profound effect on the future of radio in general, and on broadcasting in particular.

There is another approach which alone cannot solve the fundamental problem of political co-operation, but which can perhaps aid the quest for a political solution: frequency spectrum conservation. If the limits of the desirable allocation bands cannot be enlarged, the frequencies should always be used in the most effective manner. As we have seen, many radio services have conscientiously sought to discover some means of reducing the frequency space used by transmissions so as to permit a greater volume of traffic in their allocated bands. Many techniques thus developed have been successfully adopted for current use.

Of all the services, broadcasting has perhaps done the least in this respect. Even if it is conceded that the special nature of broadcasting has prevented such action in the past, the perfection of frequency modulation (FM) broadcasting in the very high frequencies opens the door to an effective contribution to frequency spectrum conservation. In 1947 the ITU assigned an additional band to broadcasting in the very high-frequency area. Subsequent experience in a number of countries in Europe and North America has shown that high-frequency FM broadcasting is an excellent means of local coverage and, in addition, provides the listener with a high quality signal, relatively free from interference.

The most important advantage offered by such FM broadcasting is that if adopted universally for local coverage, it will permit allocations in the medium- and low-frequency bands to be used only for national and regional international broadcasting. The high-frequency bands could thus be reserved almost exclusively for long-distance international broadcasting. The saving that could result from such an arrangement would relieve much of the pressure on the medium- and high-frequency bands, thus contributing materially to solving the frequency problem as a whole.

Radio and Television

Radio is no longer the only electronic means of mass communication. Television, with its added emphasis on the visual, has grown with astonishing speed. In some countries television coverage now equals that of radio and the television audience is rapidly reaching that of radio. Many other countries have started television services and an additional number are preparing to follow suit.

If television had not expanded so rapidly, the task of the world's broadcasters would be simpler: first, to bring the benefits of radio to all who have so far been deprived of it, with the ultimate aim of ensuring at least one receiver per family; and, second, to improve broadcasting continuously, both in respect of reception and programming, in communities where it is already an established institution, and pass on these improvements to the underdeveloped countries. The rise of television has added a new problem: to determine what role radio broadcasting should fill in view of the challenge of television, and to adapt broadcasting to that role.

Experience in the United States, Canada and certain other countries indicates that television is having a profound influence on listening habits. In areas where both media are available throughout the day, television's greatest impact is during the traditional leisure hours of early and late evening. In these countries, the evening radio audience is only a fraction of what it was during the peak reached by sound broadcasting a few years ago, and the total time devoted to listening is also steadily declining even though there is no decrease in the number of listeners.

Radio is still important, however, in the mornings and early afternoons and its total audience remains fairly constant. The apparent reason for this phenomenon is that television demands a degree of concentration which is not compatible with many occupations and activities. This conclusion is supported by the fact that the purchase of new radio receivers is continuing with no

noticeable decline, and that new sets are being used in various parts of the home. In communities where there is an absolute choice between television and radio, the same number of people are listening, but they spend less time doing so.

In addition to those who choose radio because they can enjoy its advantages while engaged in other activities, there are numerous groups of persons who cannot benefit from television because they remain outside the area of practical television coverage, or lack funds to buy the more expensive television sets. In Canada, for instance, with its areas of scattered population and difficult terrain, the former category is quite large. Although statistics are lacking, it also seems that many persons continue to prefer radio because they believe it can do better job in such fields as news and music, or find that television is not compatible with other leisure pursuits such as reading.

What do these preliminary indications of the impact of television mean to the world's broadcasting authorities? First, it appears that even in areas where broadcasters can provide television coverage as extensive as that of radio, and where the same number of families have television sets, there will remain an audience sufficiently large to justify a continuing and extensive radio service. True, there must be some adjustment of programmes and changes in emphasis; but radio will continue to be an important medium of information and entertainment.

Second, the high cost of programming and operating television services will prevent most countries from attaining ideal television coverage for many years to come. A number of administrations maintain that it will take decades to attain maximum television coverage, and few believe that 24-hour programming, or even 12-hour programming daily will then be possible. It seems likely that in most areas where commercial television is not adopted, the authorities will restrict television to the evening, leisure hours, with perhaps a few minutes of 'telecasting' in the morning or at noon. In these countries radio must continue to be an all-round medium of communication. In short, present indications point to a long and active future for radio broadcasting.

Opportunity for Action

As has been emphasized in this study, there is no easy solution to the varied problems that confront broadcasting. If broadcasting is to have a future worthy of its potentialities, positive action must be taken by all of those concerned, from listener to international organization.

The listener must criticize and suggest. Broadcasters must make every effort to supply the best possible broadcasting facilities and make certain that the listener is given a choice of programmes which are of the highest possible quality from both the technical and programming point of view. On the national level there must be the closest possible co-operation between all the authorities, whether private or governmental, to make certain that broadcasting facilities are properly used. On the international level, there must be constant effort on the part of the member countries of the ITU to co-operate in solving the frequency problem. There must also be co-operation between all the international organizations with any interest whatsoever in broadcasting to tackle the other problems of radio that cannot be solved on a national basis.

Every opportunity should be taken to improve radio as a means of communication between peoples. If this study serves even in some small way to further that aim, its purpose will have been fully achieved.

appendix

Distribution of radio receivers in 140 countries

Country	Number of receivers or licences		Population (in thousands)	Number of receivers or licences per 1,000 population		Year
	Total	Wired[2]		Total	Wired[2]	
Africa						
Algeria (Fr.)	406 771		10 143	40		1957
Angola (Port.)	32 682		4 355	8		1957
Basutoland (U.K.)	500		620	1		1954
Bechuanaland (U.K.)	2 000		327	6		1956
Belgian Congo	16 330		12 533	1		1955
Cape Verde Islands (Port.)	1 299		182	7		1957
Ethiopia (incl. Eritrea)	16 000		20 000	1		1956
French Equatorial Africa	10 000		4 544[3]	2		1953
French West Africa	50 000		18 350[3]	3		1953
Gambia (U.K.)	600		290	2		1953
Ghana	31 170	(26 310)	4 691	7	(6)	1956
Kenya	23 902	(225)	6 150	4	(0.04)	1956
Liberia	2 500		1 250	2		1954
Libya	17 498		1 105	16		1955
Mauritius (U.K.)	24 646		587	42		1957
Morocco						
Former French Zone	431 350		8 675[3]	50		1957
Former Spanish Zone	...	...	...	...	...	...
Tangier	20 000		183	109		1955
Mozambique (Port.)	24 167		6 170	4		1957
Nigeria (incl. Brit. Cameroons)	64 305	(57 448)	33 368	2	(2)	1956
Portuguese Guinea	1 444		554	3		1957
Reunion (Fr.)	6 255		295	21		1956
Rhodesia and Nyasaland (U.K.)						
Northern Rhodesia	10 350	(200)	2 130	5	(0.9)	1955
Nyasaland	2 890		2 600	1		1956
Southern Rhodesia	...	...	...	...	...	...
Ruanda Urundi (Belg.)	1 150		4 321	0.3		1955
Sierra Leone (U.K.)	6 100	(4 020)	2 100	3	(2)	1956
Somaliland (U.K.)	620[3]		640	1		1953
Spanish Guinea	1 000		205	5		1954
Tanganyika (U.K.)	18 314[3]		8 760	2		1957
Togoland (Fr.)	520		1 052	0.5		1953
Tunisia	107 706		3 800	28		1957
Uganda (U.K.)	100		5 593	0.02		1956

1. The geographical nomenclature used here, as elsewhere in this study, has been adopted for convenience of presentation and does not imply official endorsement or acceptance by Unesco of the status of States and territories as set forth in the text or illustrations.
2. Included in 'Total' column.
3. Estimate.

Country	Number of receivers or licences		Population (in thousands)	Number of receivers or licences per 1,000 population		Year
	Total	Wired[2]		Total	Wired[2]	
Union of South Africa	793 589	(14 161)	13 915	57	(1)	1956
United Arab Republic						
Province of Egypt	850 000		23 516	36		1956
(see also under Asia, United Arab Republic, Province of Syria)						
Zanzibar and Pemba	3 225		280	12		1956
America, North						
Bahamas (U.K.)	10 000[3]		94	106		1955
Bermuda (U.K.)	16 000		42	381		1957
British Honduras	3 345		82	41		1956
Canada	9 660 000		16 589	562		1957
Costa Rica	50 000[3]		915	55		1954
Cuba	1 100 000		6 261	176		1956
El Salvador	24 000		2 268	11		1956
Greenland (Den.)	3 200		27	119		1956
Guadeloupe (Fr.)	2 800		229	12		1954
Guatemala	36 030		3 159	11		1954
Haiti	19 000		3 344	6		1956
Honduras	30 000		1 711	18		1956
Martinique	8 000		253[3]	32		1956
Mexico	2 500 000		29 679	84		1955
Nicaragua	30 000		1 204	25		1954
Panama	95 000		863	110		1953
Puerto Rico	200 000		2 267	88		1956
St. Pierre and Miquelon (Fr.)	1 000		5	200		1953
United States	150 000 000		171 229	876		1957
West Indies Federation						
Barbados	26 000	(18 000)	230	113	(78)	1957
Jamaica	...	(17 000)	1 564	...	(11)	1956
Leeward Is.: Antigua	1 114		53	21		1956
Trinidad and Tobago	42 628	(19 000)	765	56	(25)	1957
Windward Is.	5 000[3]		308	16		1955
America, South						
Argentina	2 900 000		18 400	158		1953
Bolivia	200 000		3 235	62		1956
Brazil	3 500 000		57 098	61		1954
British Guiana	32 898		516	64		1957
Chile	650 000		6 597	99		1954
Ecuador	100 000		3 796	26		1956
Falkland Islands (U.K.)	771	(441)	2	386	(221)	1957
French Guiana	120		28	4		1954
Paraguay	80 000		1 496	53		1953
Surinam	10 000		221	45		1956
Uruguay	500 000		2 650	189		1956
Venezuela	230 000		5 953	39		1956
Asia						
Aden (U.K.)	10 000		802	12		1957
Afghanistan	12 000		12 000	1		1956
Brunei (U.K.)	1 300		55[3]	24		1954

 1, 2, 3. See page 147.

Country	Number of receivers or licences		Population (in thousands)	Number of receivers or licences per 1,000 population		Year
	Total	Wired[2]		Total	Wired[2]	
Burma	25 597[3]		19 856	1		1956
Cambodia	6 300		4 100[3]	1.5		1954
Ceylon	163 923	(18 362)	8 929	18	(2)	1956
China (Republic of)	215 000		9 240	23		1956
China (People's Republic of)	1 500 000		581 390	3		1953
Cyprus	92 000		536	172		1957
Hong Kong (U.K.)	116 599	(53 000)	2 583	45	(21)	1957
India	1 075 909		387 350	3		1956
Indonesia	500 000		82 600	6		1955
Iran	500 000		18 945	26		1956
Iraq	100 000[3]		4 842	21		1956
Israel	354 489		1 924	184		1957
Japan	14 591 082		90 900	161		1957
Jordan	53 142		1 538	35		1957
Korea (Republic of)	300 000[3]		21 526	14		1955
Lebanon	71 000		1 450	49		1956
Macao (Port.)	4 949		207[3]	24		1957
Malaya (Federation of)	195 970	(20 259)	6 277	31	(3)	1957
North Borneo (U.K.)	7 960		397	20		1957
Pakistan	100 696		83 603	1		1956
Philippines	216 693		21 440	10		1954
Portuguese India	4 345		647	7		1957
Portuguese Timor	301		484	0.6		1957
Sarawak (including Brunei) (U.K.)	30 000[3]		692	43		1956
Saudi Arabia	16 000		6 036	3		1956
Singapore	99 373	(37 472)	1 474	67	(25)	1957
Thailand	108 469		19 925	5		1954
United Arab Republic Province of Syria	100 000		3 970	25		1956
(see also, under Africa, United Arab Republic, Province of Egypt)						
Europe						
Andorra	1 800		6[3]	300		1955
Austria	1 838 855	(11 672)	6 992[2]	263	(2)	1957
Belgium	2 307 184	(132 353)	8 989	257	(15)	1957
Bulgaria	400 000		7 601	53		1956
Czechoslovakia	3 323 208		13 353	249		1957
Denmark	1 550 861		4 500	345		1957
Finland	1 121 493		4 333	259		1957
France	10 881 235		44 000	247		1957
Germany Democratic Republic	5 396 847		16 380[3]	329		1957
Federal Republic and West Berlin	14 400 244	(133 629)	53 692	268	(2)	1957
Saar	233 894		1 012[3]	231		1957
Gibraltar (U.K.)	5 350	(600)	25	214	(24)	1957
Greece	545 366		8 096[3]	67		1957
Hungary	1 774 300[3]		9 815	181		1957
Iceland	44 500		161	276		1956
Ireland	477 129		2 885	165		1957

1, 2, 3. See page 147.

Country	Number of receivers or licences		Population (in thousands)	Number of receivers or licences per 1,000 population		Year
	Total	Wired[2]		Total	Wired[2]	
Italy	6 758 824		48 353	149		1957
Liechtenstein	3 175	(329)	15	212	(22)	1957
Luxembourg	88 893		315[3]	282		1957
Malta and Gozo (U.K.)	59 435	(45 144)	319	186	(142)	1957
Monaco	4 500		20[3]	225		1956
Netherlands	3 127 637	(526 145)	11 009	284	(48)	1957
Norway	984 713		3 496	282		1957
Poland	4 027 503	(1 572 022)	28 180	143	(56)	1957
Portugal	595 521		8 909	67		1957
Rumania	1 499 484	(614 690)	17 829	84	(34)	1957
San Marino	1 910		14	136		1957
Spain	2 104 827		29 431	72		1957
Sweden	2 695 029		7 369	366		1957
Switzerland	1 308 341	(309 258)	5 117	256	(60)	1957
Turkey	1 097 965		25 500	43		1957
United Kingdom	14 653 777	(1 024 033)	51 455	285	(20)	1957
Yugoslavia	890 168		18 005	49		1957
Oceania						
Australia	2 308 399		9 643	239		1957
British Solomon Islands	371		104	4		1957
Fiji (U.K.)	18 000[3]		354	51		1957
Gilbert and Ellice Islands (U.K.)	206		40	5		1957
Guam (U.S.)	2 500		35	71		1954
New Caledonia (Fr.)	4 000		65	62		1954
New Hebrides (Fr., U.K.)	200		55[3]	4		1956
New Zealand	531 000		2 229	238		1957
Pacific Islands (U.S.)	1 626		64	25		1955
Tonga (U.K.)	100		52	2		1954
Western Samoa (N.Z.)	1 397		93	15		1954
U.S.S.R.						
U.S.S.R.	33 121 000	(24 773 000)	200 200	165	(124)	1957

1, 2, 3. See page 147.

glossary

Following are explanations of various technical terms used in this study.

Frequency. The quality which characterizes electromagnetic radiation (and therefore radio transmissions) in a way similar to that in which colour characterizes light. Both the radio frequency spectrum and the light spectrum are in fact different parts of the general electromagnetic radiation spectrum. The basic unit in which frequency is measured is 'cycles per second'. However, since radio frequencies are usually of the order of thousands and millions of cycles per second, the units of kilocycles and megacycles (1,000 and 1,000,000 cycles per second respectively) are more generally used.

Wavelength. Another parameter by which electromagnetic radiation is characterized. It is a measure of the distance between successive cycles of electromagnetic radiation as it propagates through space. Wavelength, which is usually expressed in meters, was the common method of describing the position of radio stations in the frequency spectrum in the early days of radio; it is now being replaced by 'frequency' as a measure (see above).

There is a fixed relationship between frequency and wavelength, due to the fact that radio waves travel through space with the fixed speed of light (300,000 kilometres or 186,000 miles per second). This relationship is illustrated by the following example. If a station starts transmitting, the signal it sends out will be 300,000 kilometres distant one second later. If the station transmits with a frequency of 300,000 cycles per second, there will be 300,000 cycles in the space between the transmitter and the point 300,000 kilometres distant.

There is thus one cycle for each kilometre. The term 'wavelength' is used for the length of one cycle when a signal is being propagated in a medium. Consequently, a 300,000 cycle per second transmission would have a wavelength of 1 kilometre; or, in the terminology commonly used, 300 kilocycles equals 1,000 metres.

As already stated, radio frequency signals travel with a fixed speed, independent of the nature of the signals or waves. Consequently, if the frequency is doubled, twice as many cycles will be in the space between the transmitter and the imaginary point 300,000 kilometres distant. Since the wavelength is now only half as long, a frequency of 600 kilocycles must equal a wavelength of 500 metres. Hence, as the wavelength shortens, the frequency goes up; inversely, as the wavelength lengthens, the frequency goes down.

Wavelength was the measure originally used in radio (especially in Europe) and the frequency bands in which broadcasting stations operate thus became known as the 'medium', 'long' or 'short' wave bands.

Medium-wave band. Most important of the broadcast bands, it is used throughout the world for regional and national broadcasting. The first broadcasting stations started operating in this band and today the vast majority of the world's broadcasting stations transmit within it. In the Atlantic City Frequency Allocation Table this band

extends on a world-wide basis from 535 to 1605 kc/s, which corresponds roughly to the wave band between 185 and 560 metres. Radio waves of these frequencies travel only a short distance (about 100 to 200 km) during the day whereas at night their range may increase up to three or four times this distance.

Long-wave band. Used for broadcasting only in Europe. Radio waves of wavelengths falling in this band cover greater distances than those of the medium-wave band. Distances up to and over 500 kilometres can be covered and, in addition, the range covered is relatively independent of the time of day. Use of this band has enabled administrations to cover the whole of their territories with one high-power transmitter and thus provide a national programme from a single station. However, there is room for only a few transmitters in the long-wave band since it extends, with certain reservations, only from 150 to 285 kc/s. In terms of wavelength, it is approximately the wave band from 1,050 to 2,000 metres.

Short wave. A group of bands used mainly for long distance (1,000 to 20,000 km) transmissions, as well as short range transmissions (up to 2,000 km) which cannot be practically conducted with medium or long waves.

Short wave bands are now commonly called 'high-frequency broadcasting bands'. Nevertheless they are often referred to by the wavelength on which they are centred. Those more generally used are the 13, 16, 19, 25, 31, 41 and 49 metre bands, which become in terms of frequency the 21, 17, 15, 11, 9, 7 and 6 megacycle bands respectively.

Very high-frequency band. This has only come into large-scale use for broadcasting within the last 10 years. All frequency modulation stations, and most television stations operate within this band.

Hertzian waves. Another name for radio waves, so named after Heinrich Hertz (1857–94) who first demonstrated their use.

Modulation. The process whereby the basic radio signal is altered, before being sent out, so that it can carry a message (music, speech, etc.).

The process of 'modulation' can be carried out in several ways. The two following methods are important to broadcasting.

Amplitude modulation (AM). The method most widely used in broadcasting, AM operates on the principle that the strength of a radio transmission is varied in accordance with the volume of the sound to be transmitted.

Frequency modulation (FM). A comparatively new type of modulation, the reception of which requires a slightly more complicated, and therefore more expensive, receiver than amplitude modulation. FM is nevertheless fast finding favour in Europe and North America because it makes possible transmissions with much greater clarity of sound. It is the frequency of the transmission and not its strength which is varied with the volume of the transmitted sound.

The following example illustrates the difference between AM and FM. If a person wished to use a light to show whether a sound was loud or soft, he could do this either by showing a strong or a weak light (which would stimulate amplitude modulation); or he could represent the loud sound by a red light and the soft one by a blue light (which would simulate frequency modulation).

Single side-band transmissions. A special modification of amplitude modulation used mainly by commercial radio-telephone transmissions. Through special processes, it is possible to eliminate certain not strictly necessary signals before a transmission is sent out, and thus save frequency spectrum space. Those signals which have been suppressed are then replaced at the receiver so as to make reception possible.

Wired broadcasting. A system of broadcasting whereby a listener has a programme supplied to his home by wire, instead of from the air. Since the signal is transmitted along wires to the listener's loudspeaker, interference from other stations and any static which the normal receiver might pick up are eliminated.

Scatter transmissions. A method of transmitting radio signals over distances between 300 and 1,000 or more kilometres by means of very high-power radio beams and very sensitive receiving equipment. This type of transmission is made possible by the use of hitherto little-known properties of the earth's atmosphere. Frequencies which would ordinarily be of little value in covering such distances can be thus employed.

Scatter transmission therefore opens up additional frequency spectrum space for medium-distance communications.

Electronic tube or radio valve. A basic component of electronic and radio amplifying circuits. In this valve a minute electric signal can be used to modify a much larger

flow of electric current and thus cause signal amplification. Until recently the electronic tube or radio valve was the only practical amplifier in use. Now, however, the transistor is being increasingly employed and other types of amplifier are being developed or are already used in industry.

High-frequency alternator. An electrical generator resembling the generators used in electric power stations, except that its output is an electric signal which can be connected to an antenna for transmission. For some time, before the development of high-power transmitting tubes, the high-frequency alternator was the principal means of generating Hertzian waves with high power.

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index[1]

1. Items pertain to radio broadcasting unless otherwise stated. See also Appendix, pp. 147-50.